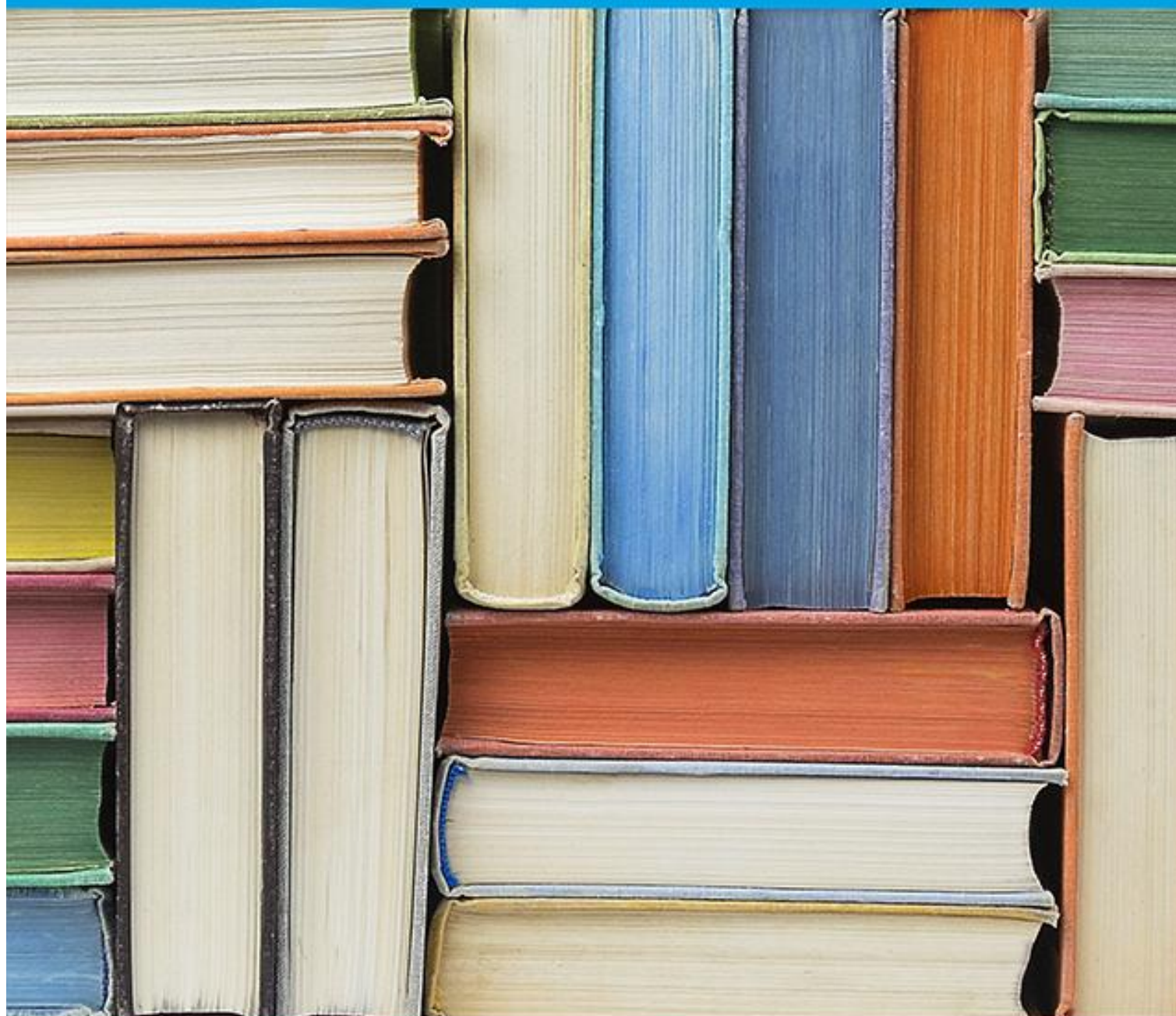# Perspectives in
Public Health

- Paramedics and health promotion
- The two-child limit for benefits in the Supreme Court: implications for public health
- Strategic planning in oral health improvement
- Implementing a mandatory COVID-19 vaccine: ethical challenges

Editorial

Matt Hobbs
Joint Deputy Editor, Perspectives in Public Health

A warm welcome to this rousing issue of *Perspectives in Public Health*. It is a little over two years since the first COVID-19 lockdown in the United Kingdom. A lot has changed since that first lockdown for many of us and while the emphasis has often been on COVID-19, other public health issues have remained pressing topics of focus. As such, this issue of *Perspectives in Public Health* maintains this much needed broad focus, with a good blend of different topics including, but not limited to, health equity, oral health, green space, ethics and food hygiene.

First, Schofield eloquently outlines the emerging role of health promotion in paramedicine and describes how the paramedic's role in promoting health and wellbeing is starting to receive significantly more attention. We also have a thought-provoking piece around some of the most significant changes in welfare provision since the inception of the welfare state and what the consequences could be for public health. Following on from this, Payán outlines several important considerations for how we can advance community-engaged research to promote health equity. Inequity is such an important topic that has been increasingly highlighted, and perhaps exacerbated, by the COVID-19 pandemic.

Patel and Stanhope raise two public health issues close to my heart and areas of research. First, Patel provides a balanced and logical dialogue on how strategic planning can benefit oral health. Oral health remains a significant public health issue, and while oral diseases are among the most prevalent diseases globally, these are still largely preventable. Stanhope then shifts the focus from oral health to the importance of green spaces for public health, especially for vulnerable populations during the COVID-19 pandemic. I am sure many of us can relate to the importance of getting fresh air in green spaces, such as parks, during our lockdown periods. Finally, in a piece that needs no introduction in terms of its importance, Arora tackles the important ethical issues that surround the implementation of mandatory COVID-19 vaccination.

Peer-reviewed material includes a review from Fairbrass, who appraises human responses to nature- and culture-based non-clinical interventions. Non-clinical health interventions are those which use activities rather than clinical services for the prevention or treatment of chronic conditions and diseases. This important area can prevent conditions from worsening and reduce demand for acute healthcare services. Lawrence and colleagues focus on the UK Government's prevention agenda and National Health Service long-term plan. They developed the 'Healthy Conversation Skills' training and present results from a pilot study that assesses the feasibility of primary care practitioners adopting Healthy Conversation Skills in their routine practice.

Other papers include a study by Flint, which explored adults' thoughts and behaviours in response to the COVID-19 outbreak. This study provides insights into adults' perceptions and behaviours in response to the COVID-19 pandemic and associated lockdowns and aims to help improve the effectiveness of communication during the COVID-19 pandemic. Finally, Eley focuses on the important issue of foodborne illnesses; an issue that continues to cause a significant global burden. This study across four European countries aimed to improve consumers' food safety behaviour and explored school educators' attitudes, behaviours and knowledge towards food hygiene, safety and education.

In my role as Deputy Editor for *Perspectives in Public Health*, it is a real privilege to see the breadth and quality of work that is submitted to the journal. Behind the scenes, there is a huge amount of work that goes into publishing each issue therefore, I would like to extend our thanks to our team, to the peer reviewers and authors who make the work published in this journal possible. In this issue, there is an impressive array of cutting-edge content across numerous important public health topics and I hope you enjoy indulging in it.

Paramedics and health promotion

In this opinion piece, Schofield and McClean report on the rationale for the potential for a change in scope of practice for paramedics to provide health promotion. The authors outline how this needs to be supported by further research to support the acceptability of this expansion to their traditional role both by the profession and by patients.

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The NHS continues to face rises in the demand for urgent and emergency care. Paramedics provide out-of-hospital urgent and emergency care, often in the most difficult and unpredictable circumstances. There is a need for more ambulances and more personnel to staff these units. The College of Paramedics describes paramedics as 'registered healthcare professionals who have a unique role that crosses healthcare, public health, social care and public safety, they work autonomously providing care in a range of situations'.[1] In the UK, paramedics are best known for working within Ambulance Services providing immediate and emergency care in response to 999 calls made by the public.

Although health promotion is in its early days in paramedicine, gradually the paramedic's role in promoting health and wellbeing is starting to receive

> **Although health promotion is in its early days in paramedicine, gradually the paramedic's role in promoting health and wellbeing is starting to receive more attention**

more attention. The College of Paramedics is including health promotion as part of the scope of practice.[2] The ambulance services are acknowledging the importance of using patient contact time with patients for this purpose.[3] Public Health England, NHS England and Health Education England have produced a consensus statement describing the commitment of their organisations to work together to maximise support for population behaviour change and help individuals and communities significantly reduce their risk of disease.[4] This statement recommends the evidence-based approach to healthcare of Making Every Contact Count (MECC), which encourages all those who have contact with the public to talk about their health and wellbeing and should be applied across all health and social care organisations.[5] Paramedics have the opportunity to support positive behavioural changes through MECC.

The Ottawa Charter, one of the cornerstones of health promotion, identifies three primary mechanisms for promoting health:

- Advocacy for health and for a holistic view of health;
- Enabling people by creating equity in terms of access, opportunities, resource availability and life skills;
- Mediation among governmental, industrial, health, community and other sectors of society which recognises the interdependent and intersectoral nature of health and wellbeing.[6]

Paramedics offer universal and equitable resource availability (by providing the same equipment and personnel to anyone calling for an ambulance at any time for any reason), are knowledgeable and they have high levels of trust among the public. They are well placed to advocate for their patients and well-positioned to mediate among and between the many agencies and organisations. Every year 10 million 999 calls are made, and 30% of these patients are treated and discharged at scene by the attending paramedic.[7] These interactions often

> **Every year 10 million 999 calls are made, and 30% of these patients are treated and discharged at scene by the attending paramedic**

at the patient's home provide a unique opportunity for paramedics to identify people with risk factors, and opportunities to provide information, brief interventions and signpost people to locally provided services.

Paramedics today fill broader roles than those encompassed within traditional models of prehospital care, in part due to ageing populations and the prevalence of chronic conditions. An expanded role may help address

health workforce sustainability and shortages.

There is very limited evidence about if or how health promotion is delivered by paramedics and its acceptability to patients, their family and the profession. Future research should explore the perceptions, views and experiences of staff regarding barriers and facilitators to health promotion in the urgent and emergency care setting, alongside an assessment of patient acceptability.

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The two-child limit for benefits in the Supreme Court: implications for public health

In this article, Machin demonstrates how welfare provision is a key determinant of population health and the clear evidence to demonstrate that welfare reform has led to income insecurity and a wide range of health issues. This article considers the impact of the two-child limit on health and well-being, the consequences of the Supreme Court decision and emphasises the importance of social security as a significant public health concern.

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The last 10 years has been a remarkable period for the UK social security system. The most significant changes in welfare provision since the inception of the welfare state have resulted in a reduction in social security spending of over £30 billion. One of the most controversial elements of the government's programme of welfare reform is the two-child limit. This policy has returned to the fore following a recent Supreme Court judgement,[1] where the Court was asked to decide if the financial restrictions imposed by the two-child limit are compatible with rights under the European Convention on Human Rights. This commentary analyses the impact of the two-child limit, the consequences of the Supreme Court decision, and the ways in which social security is a significant public health concern.

The two-child limit was introduced from April 2017, and the child elements of Universal Credit and Child Tax Credit are no longer paid for the third or subsequent child in a family born after this date. The latest government figures[2] show that 250,000 households and 911,000 children are affected by this policy and the numbers are increasing. The Institute for Fiscal Studies[3] estimates that by the mid-2030s, 700,000 families will be impacted by the policy with an average reduction in income of £3000 per year; child poverty is projected to increase by 300,000. The government maintains that the two-child limit creates equity between working families and welfare recipients, although 57% of claimants affected by the policy are classified as being in-work.

> **250,000 households and 911,000 children are affected by this policy and the numbers are increasing**

The two-child limit creates a significant number of health and wellbeing concerns including an increase in mental health problems, strained relationships, social isolation, and guilt about an inability to support children in a family.[4] The impact on children is stark; the social and educational development of younger children can be impeded, and older children can be excluded from social activities. There are a number of exceptions to the policy, including when a third child is born as part of a multiple birth, or adopted. The most controversial exception is based on 'non-consensual conception'. Concerns have been expressed around the trauma of disclosing sexual violence, and the need to demonstrate that the claimant is no longer living with the perpetrator.[5] Health and social care professionals can find themselves in the unwelcome position of acting as a 'gate-keeper' as third-party evidence must be provided to the Department for Work and Pensions confirming that a claimant's circumstances are consistent with this exception. The British Pregnancy Advisory Service (BPAS)[6] reports that the two-child limit was a key factor in many women deciding to terminate a pregnancy during the pandemic. It has been highlighted that the policy has a disproportionate impact on women, refugees, and families with larger families due to religious conviction or cultural norms.[7] No other European welfare state has adopted a policy of the same nature as the two-child limit, and there have been calls for its abolition from the Children's Commissioners of the devolved nations,[8] and prominent public health professionals.[9]

The two-child limit for benefits in the Supreme Court: implications for public health

A decision in the Supreme Court case, *SC and Ors v SSWP* UKSC 2019/0135, was handed down on 9 July 2021. The first claimant has a range of health problems which make the use of the contraceptive pill problematic; her third child was unplanned. The second mother fell pregnant with her third child after leaving an abusive relationship. Both women objected to abortion on moral grounds. The case, brought by Child Poverty Action Group, argued that women, large families, people with a moral or religious objection to birth control, children, and children with multiple siblings are unlawfully discriminated against as a result of the two-child limit. It was contended that this is a breach of Article 8 of the European Convention on Human Rights (right to respect for private and family life), Article 14 (prohibition of discrimination), and Protocol 1 of Article 1 (peaceful enjoyment of possessions). In a decision which disappointed many charities and social welfare lawyers, the Supreme Court held that the policy does not discriminate against women who are disproportionately affected by any policy linked to the raising of the children. It was judged that the government is entitled to administer a policy which it believes maintains economic wellbeing. In relation to larger families, the Court maintained that it should not interfere with government policy which seeks to balance state support provided to families and parental responsibility. The Court rejected that the two-child policy discriminates against children stating that the benefits system continues to support third or subsequent children through schemes such as child benefit and free school meals, and that children have no direct entitlement to welfare benefits as Universal Credit and Child Tax Credit are paid to adult carers.

The decision of the Supreme Court to approve the underlying principles of the two-child limit is not welcome news for low-income families or for public health. We know that as the gaps in the welfare safety net become wider, income and health inequalities increase. Craig and Katikireddi emphasise that welfare provision is a key determinant of population health.[10] The Marmot Review 10 Years On[11]

> The Marmot Review 10 Years On highlighted that welfare reform has led to an increase in the number of families experiencing income insecurity

highlighted that welfare reform has led to an increase in the number of families experiencing income insecurity; this is linked with adverse childhood experiences, poor long-term physical and mental health, and low life expectancy. Families experiencing financial insecurity have been more severely exposed to the health and economic impacts of COVID-19.[12] The British Medical Association[13] recognises that poverty alleviation should not be a marginal concern for health professionals. As the number of families affected by the two-child limit increases in the years ahead, it will be important for public health professionals to monitor how this policy undermines attempts to 'level up' inequalities.

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Advancing community-engaged research to promote health equity: considerations to improve the field

In this article the authors provide an overview of the different types of community-engaged research (CER), key insight on the utility of leveraging CER to promote health equity, and practical steps to operationalize CER principles in public health research. The content also emphasizes the importance of diversifying academia and the field of public health—an issue that is not only critical to health equity, but a timely concern that is being actively debated.

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The COVID-19 pandemic rapidly increased attention and concern over health inequities that have historically plagued communities of color. Lack of quality healthcare access, housing instability, discrimination, and economic deprivation are among the numerous inequities encountered by marginalized individuals and groups with devastating interacting and cumulative impacts on their health and wellbeing.

Community-engaged research (CER) has long held promise in public health as an orientation to research[1] to help address health disparities and inequities.[2] CER is an asset-based approach that shifts away from a deficit model to emphasize existing community assets, resources, and knowledge.[3] This approach can strengthen community capacity – taking into account unique historical, structural, sociopolitical, and cultural factors influencing community health.

CER comes in many forms and names, including community-participatory partnered research, community-academic research partnerships, and community-based participatory research (CBPR).[4] CBPR is a gold standard in CER as a collaborative approach based on principles that include fostering co-learning and capacity building for all members.[1,5] Ideally, it equitably involves community partners and researchers in the entire research process from question identification to dissemination.[4,6]

CER is a paradigm shift to conducting science that can integrate minoritized voices and communities of color as equal collaborators – a step in the right direction to achieve health equity for all people that can be a challenging exercise in humility and openness.[5] Across all CER forms is the premise that community members and/or organizations contribute to the formation and design of research questions, approaches, and solutions.

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Theoretical community engagement models focus on patient/consumer involvement in developing an intervention, peer/lay-delivered interventions, and community empowerment.[2] Examples of strategies include building partnerships and coalitions to reflect diverse perspectives,[7,8] convening a community advisory board for input,[9] and reviewing data with community members to identify interventions.[10]

A wide breadth of research can benefit from a CER approach, including translational research to increase the relevance of research for communities and bridge the gap between research findings and actionable practice and policy.[7,11] A CBPR policy approach that spans context, CBPR processes, and policy strategies can lead to equitable

Advancing community-engaged research to promote health equity: considerations to improve the field

policy changes and improve health outcomes.[12]

A concern around growing interest in CER is the 'dangers of co-optation as this label is loosely applied to include research and intervention efforts in search of funding that do not truly meet the criteria for this approach'.[6] Some of these criteria are process focused since CER relies on relationships, communication, and trust.

There are several important challenges to consider before undertaking this type of work. First, it is a time consuming process[4] that entails developing and maintaining relationships between entities that may be unequal in power and social status. Another barrier is the misalignment between the time and effort needed to establish and maintain authentic partnerships and academic expectations for researchers to accumulate data for grant proposals or to publish peer-reviewed articles. The current climate may inadvertently promote research that treats community engagement as a transactional process for recruitment – *further sowing distrust against research institutions and science in marginalized communities*. For instance, relying on community partners as volunteers can be exploitive and unethical, particularly if there are stark differences in economic and social status between partners. These actions can further add to the long history of mistreating disenfranchised groups in the name of science.

CER that is *community-based* is the best opportunity for the field to mitigate previous insensitivities and damage. How might we, as a field, reverse course and encourage transformative research that is critical and long in coming? A start is to be more intentional in how we describe communities. Language is powerful and can reinforce existing frameworks. Too often, the narrative in health disparities is to consider communities as 'vulnerable', which implicitly confers the quality of defenselessness or passivity and conceals the factors that led to vulnerability. We encourage shifting away from terms connoting inherent deficits and, instead, adopting language such as historically marginalized or medically underserved, which emphasize inequities due to institutional neglect and exploitation.

Another step is to consider the role of CER in diversifying the research field. In addition to investing in and supporting initiatives to promote a diverse research pipeline with representation from marginalized communities, academic and research institutions need to invest and train investigators to conduct CER using published texts[1,5,11] and should offer fellowships and training programs for early career scholars and graduate students.

Next, researchers and funders should pay careful attention to descriptions of partnerships and their collaborative processes in proposals. How will the research study involve and be of benefit to the community? Is the study aligned with the broader needs of the community? Are individuals or organizations being compensated for their time and effort (or are there clear agreements with an employer if the responsibilities are being integrated into an individual's scope of work)? What are the power and social dynamics and how do these change over the course of a project? Did partners agree to a communication plan that reflects each person's preferences? These are all fundamental questions for authentic CER that is community-based.

Finally, institutions should incentivize and reward the use of CER approaches. For instance, institutions should value CER efforts as contributions to scholarship in merit and review processes. These contributions may include translational research products (e.g. policy or research briefs) or efforts to disseminate findings to a community audience. Funders and journals can expand their aims to mention CER, solicit products focused on CER, and invite experts with CER experience to serve on editorial and review boards to signal interest and build this expertise within the scientific community.

Involving the very individuals and organizations negatively impacted by inequities and health disparities in research is necessary to promote health equity. As logical as this may seem, achieving this goal requires a paradigm shift in the incentive structure and process of conducting public health research.

> **Involving the very individuals and organizations negatively impacted by inequities and health disparities in research is necessary to promote health equity**

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Strategic planning in oral health improvement

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Strategic planning in oral health improvement

This article seeks to raise the profile of oral health within the health and social care system, as an important aspect of general health and wellbeing. Patel and Witton aim to highlight the importance of strategic planning in such times of uncertainty and flux, so that organisations are able to clearly articulate their role, remit and priorities, and how they are best placed to deliver upon these.

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Oral health is an important aspect of general health and wellbeing. Following the abolition of Public Health England (PHE), it is fundamental that oral health improvement remains embedded across the health and social care system. Emerging Integrated Care Systems (ICSs) will also offer opportunities to integrate dental services and oral health promotion activities to support the broader healthcare commissioning agenda. This article highlights tools and processes to support system partners in informing the development of their strategic plans so that they are able to adapt to the changing and increasingly challenging demands of the health and social care sector while maximising opportunities to include oral health in their health improvement strategies.

THE ABOLITION OF PHE AND IMPLICATIONS FOR ORAL HEALTH IMPROVEMENT

In August 2020, the Secretary of State for Health and Social Care announced that PHE was being abolished.[1] The new Office for Health Promotion will now be leading on national efforts to improve population health, alongside the UK Health Security Agency delivering public health protection functions.[2] There have been ongoing concerns about how these plans will address health inequalities.[3,4]

For oral health improvement in particular, PHE is the principal source of dental public health expertise and its abolition could potentially impact system progress in improving population oral health and reducing oral health inequalities.

CURRENT SYSTEM CHALLENGES

Oral health is an important aspect of general health and wellbeing and impacts of oral diseases are multiple, affecting both physical and psychological wellbeing and quality of life.[5] Alongside general health, the impact of COVID-19 on oral health and oral health inequalities is significant as the steepest inequalities have been exacerbated within more vulnerable, disadvantaged and socially excluded groups, who already bear the greatest burden of oral disease.[6] This situation is further compounded by limited provision of dental services throughout the pandemic.[7–9]

To deliver real change, a focus on the wider determinants of health is going to be necessary to achieve sustainable

> **As we look to the future, it is fundamental that oral health improvement remains embedded across the health and social care system**

improvements in oral health.[10] However, this will be challenging in light of the large-scale cuts to local authority public health grants over the years since the Health and Social Care Act was introduced in 2012.[11] As we look to the future, it is fundamental that oral health improvement remains embedded across the health and social care system.

WHAT IS STRATEGIC PLANNING AND WHY IS IT IMPORTANT?

Strategic planning is the process of developing an organisation's purpose, aim and objectives. It includes the allocation of resources and responsibilities, drawing on robust evidence and setting feasible timescales for achieving goals.[12] This article highlights tools and processes to support system partners in informing the development of their strategic plans so that they are able to adapt to the abolition of PHE and system re-configuration.

Documents such as the PHE Strategy 2020 to 2025[13] and the Faculty of Public Health 2020–2025[14] clearly set out the role, remit and strategic priorities of each respective organisation. What is required now, as we transition, is a scaled-down tangible process through which any

organisation can work through. Monitor have proposed a seven-stage framework as the basis of developing a strategy for Foundation Trusts and other provider organisations.[12] These stages are also relevant to strategic planning in public health and are described next.

FRAME

This establishes a transparent framework for the development and implementation of the strategy with input from internal and external stakeholders and partners. Strategic planning should be a continual process to deal with changing priorities and uncertainties.[15]

DIAGNOSE

This establishes challenges and opportunities in the context of a local health and social care system. It involves an internal assessment of the organisation's current performance, including quality, operational, financial and workforce. Externally, this would involve assessing how well it is responding to the needs, challenges and priorities of the populations and organisations it serves.

FORECAST

This stage involves creating a clear view of the future in which the organisation might operate within. Scenario planning is a highly relevant tool given the level of uncertainty we are currently faced with as it explores more experimental or innovative opportunities.[16]

GENERATE OPTIONS

This involves developing, exploring and evaluating strategic ideas and options for change. It might consider alternative strategic priorities to focus upon, whether a current priority should be de-prioritised or whether to collaborate with other organisations to meet partners' needs better.

PRIORITISE

This involves choosing which strategic initiatives to pursue and building them into a coherent strategy. This requires an understanding of national public health priorities and drivers, the future hosting-organisation's role and remit and balancing this against the needs of the local population. The potential additionality of the organisation will need to be considered, that is, if it is well-placed (i.e. has the resources, capacity and capability) to make a significant contribution.

DELIVER

This involves creating and publicising the implementation plan, and allocating resources to achieve the strategy. This requires setting out the activities, milestones, measurements and key performance indicators and being clear about who will deliver what, by when.

EVOLVE: HOW TO FUTURE-PROOF THE STRATEGY?

This stage is about monitoring the impact of the strategy to ensure it continues to be effective. Substantial changes in the external environment, such as significant restructuring in across the health and social care sector, would trigger an automatic review of part or all of the strategy.

> **Across business and health sectors, evidence demonstrates how strong strategic planning delivers significant benefits for organisations, their partners, their staff and the local populations they serve**

NOW WHAT?

Across business and health sectors, evidence demonstrates how strong strategic planning delivers significant benefits for organisations, their partners, their staff and the local populations they serve. This is now particularly important given the ongoing transformation within health and social care. Dealing with uncertainty is core to strategy development and thus a reconsideration of our strategic approach is perhaps now very timely. For oral health, this might involve facilitating the development of a more integrated approach to primary care dental services and oral health improvement. We will all need to work together to maintain the profile of oral health, ensuring it is entered onto the agenda in these new partnerships and systems.

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Implementing a mandatory COVID-19 vaccine: ethical challenges

This article will explore the topical issue of whether the COVID-19 vaccine should be implemented as mandatory for access to certain facilities and events in the UK, and whether it is ethically justifiable to do so against the two main ethical challenges of autonomy and justice.

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With new variants of the COVID-19 virus emerging and spreading, many politicians and scientists, including the chief of the EU, Ursula von der Leyen, have advocated for a mandatory vaccination policy to be implemented.[1] Already, Austria has announced the requirement for all citizens to be vaccinated against COVID-19 from February 2021, with other countries, such as Greece, introducing monetary fines to those who are unvaccinated. The UK has introduced COVID-19 passports, whereby one must be fully vaccinated or provide proof of a negative lateral flow result in order to access certain venues and facilities.[2] This move has reignited a long-standing debate over whether one should be under compulsion to be vaccinated. This article will discuss whether implementing a mandatory COVID-19 vaccine, for

those without medical exemptions, is ethically justifiable against the two main objections: autonomy and justice.

One can consider that implementing a mandatory COVID-19 vaccine falls under the remit of governmental responsibility to protect public health. Giubilini and Savulescu[3] have likened this argument to the implementation of a seatbelt. Wearing a seatbelt protects an individual performing an everyday action (driving) from serious injuries or death if they are involved in a car accident. Equally, the COVID-19 vaccine protects an individual in their everyday life from severe illness or death if they are exposed to coronavirus.[4] Neither are 100% effective, nor 100% risk-free. The actual level of risk imposed by wearing a seatbelt is analogous to that of a vaccine, and while both may be perceived to be a minor inconvenience, they both hold considerable benefits in protecting oneself. In some scenarios, wearing a seatbelt can be counterproductive and lead to injuries that would not have occurred if a seatbelt was not worn, known as 'seatbelt syndrome'.[5] Equally, vaccines do pose a minor risk of side effects, and there is no guarantee that one will ever be exposed to COVID-19; however, one can approximate the likelihood of being exposed as roughly

> **The actual level of risk imposed by wearing a seatbelt is analogous to that of a vaccine, and while both may be perceived to be a minor inconvenience, they both hold considerable benefits in protecting oneself**

the same as a passenger being in a car accident once in their life. Equally, the government has implemented a number of other laws regulating the internal consumptions of goods in the interests of public health (e.g. fluoridation of water, regulating food standards, and sugar tax).[6] It is important to note that while these laws initially faced great public resistance, they are now widely accepted.[7]

OBJECTION: AUTONOMY

However, this argument could be contested on the grounds that it infringes each individual's right to autonomy. It is in this scenario that the COVID-19 passport system currently being used circumvents this issue by offering the option of a lateral flow test to those who wish not to be vaccinated. Equally, the implementation of a mandatory vaccine policy could be termed such that it is required for access to events or facilities, similar to the mandatory measles, mumps and rubella (MMR) vaccine required for school-children in America. Here, parents are offered the choice of public education for vaccinated children, or accessing alternate forms of education for those who wish to not vaccinate their child.[8] This offers protection in the form of either physical shielding (by preventing those who are unvaccinated to access

Implementing a mandatory COVID-19 vaccine: ethical challenges

high-risk areas) or through vaccination. Thus, a similar system in regards to COVID-19 could be implemented, whereby autonomy is maintained by providing a choice of accessing high-risk areas with protection from the vaccine or physical protection away from these areas.

OBJECTION: JUSTICE

The secondary objection towards the implementation of a mandatory COVID-19 vaccine is the issue of justice, whereby those following certain religions or philosophical beliefs may refuse vaccination on the basis of their beliefs, and thus could be considered discriminated against by a mandatory vaccination policy. Here, one can raise Flanigan's[9] gun-shooting analogy in response to mandatory vaccinations. Flanigan argues that the act of refusing a vaccine constitutes harm to not only oneself but also to those around them. This argument draws the analogy that a shooter could fire a gun in a public space, with no intention to harm anyone, but seriously injure or kill his neighbours. In a similar sense, a nonvaccinated individual could transmit a contagious (but preventable) disease within society,

unintentionally causing harm to those around them. Critics argue that this is not a fair argument, as each person has the freedom to decide whether to carry a gun, or equally, to not be vaccinated. However, this criticism serves to strengthen the argument in favour of a mandatory policy: while it is legal to carry a licenced gun, it is not legal to randomly fire a gun in a public space or accidentally shoot someone. Similarly, while one has the autonomy to choose not to be vaccinated, they do not have the right to harm the vulnerable with a preventable disease. Hence, by restricting access of unvaccinated individuals to high-risk areas, they are prevented from transmitting diseases within certain areas. Flanigan argues that people should not be allowed to act as biological weapons just because their religion or philosophical beliefs permit them to. This utilises John Stuart Mills'[10] 'harm principle', whereby an individual's actions can be limited to prevent harm to others. Thus, while religious and philosophical beliefs can permit one to cause harm to oneself, this privilege does not extend to harming others.

As seen across the globe with the COVID-19 pandemic, when public health is at risk, measures must be implemented to protect the safety of each individual and each society. Implementing a mandatory vaccination policy is a preventive measure that aims to reduce the occurrence of outbreaks and protect those who choose not to be vaccinated from unnecessary exposure. While it is clear that a mandatory policy is beneficial in disease control, the reality of implementation is complex, but achievable, illustrated by the countries already utilising these policies. The crux of this argument is not to enforce vaccination, rather, a mandatory policy will encourage citizens to utilise their autonomy to choose between vaccination or physical protection to reduce their risk of contracting disease.

> **While it is clear that a mandatory policy is beneficial in disease control, the reality of implementation is complex, but achievable**

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Human responses to nature- and culture-based non-clinical interventions: a systematised review

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Abstract

Aims: A wide range of non-clinical nature- and culture-based interventions for the treatment of health issues have been evaluated in evidence and systematic reviews. However, common outcomes of these interventions have not been identified and neuro-bio-psychosocial mechanisms underlying how these interventions impact health are not well understood. We conducted a systematised review and compared the evidence for human responses to nature- and culture-based non-clinical interventions for a range of health issues and assessed the proposed mechanisms and conceptual frameworks underlying these interventions.

Methods: Comprehensive searches were conducted up to May 2018 in six bibliographic databases: Campbell Collaboration, Cochrane Library, Embase, Medline, Scopus and Web of Science. Studies included were evidence reviews or systematic reviews on any nature- or culture-based non-clinical intervention to improve the health of individuals.

Results: A total of 60 reviews were included (33 of nature, 26 of culture, 1 of both) covering 1480 individual studies and trials. The most common review types were systematic (32), literature (22) and meta-analyses (6). Positive effects on mental health were reported for the majority of interventions, while other health outcomes such as immunity were not well represented in the review literature. A range of secondary outcomes were common to both nature- and culture-based interventions including psychological and emotional impacts, social interaction and relationship development, skills development, physical health benefits, and positive impact of the intervention environment. Only two reviews proposed conceptual frameworks, and the neuro-bio-psychosocial mechanisms that underpin the health changes were not clarified.

Conclusion: Future research should focus on reviewing the evidence gaps for non-clinical nature- and culture-based interventions with an emphasis on implementing larger sample sizes, cohort and longitudinal studies, which deploy a wider range of mixed-methods, quasi-experimental and randomised control trials. There should also be agreement on terminology and developing conceptual frameworks to better understand the neuro-bio-psychosocial mechanisms underlying interventions.

INTRODUCTION

Chronic non-communicable diseases are the leading cause of death globally.[1] The costs of treating these diseases are high; in England, the treatment of long-term conditions now accounts for 70% of total health and social care spending.[2] Non-clinical health interventions use activities rather than clinical services for prevention or treatment of chronic conditions and disease. They are formally delivered through partnerships between community-based organisations and health and social care providers, whereby healthcare professionals refer patients to non-clinical sources of support in the community to improve their health and wellbeing.[3] As the demand on health and social care increases, non-clinical health interventions are being increasingly included in prevention and treatment plans of chronic health conditions.[3,4]

Nature- and culture-based non-clinical interventions are two broad categories of interventions that specifically use natural and cultural assets to deliver health and social care support. Nature-based interventions involve activities that change the environment in which people live, work, learn, recreate or heal to promote nature interactions. Alternatively, they change people's behaviour through programmes or other means that involve engagement with nature.[5] Culture-based interventions involve creative arts programmes (including visual and performing arts) and other cultural participation activities including engagement in festivals, museums, libraries, historic buildings and heritage sites.[4,6] Examples of activities include care farming, environmental conservation, forest bathing (i.e. walking in, sitting in and/or viewing the forest),[7] art therapies, book lending schemes and museum visits.

Multiple physical and mental health benefits are derived from engagement with nature- and culture-based activities, which lead to cost and efficiency savings for healthcare providers through avoided healthcare and medical costs.[3,4,6,8,9] For example, economic analysis suggests that social prescribing provides a return on investment of £1.20–£11.55 for every £1 spent via mechanisms such as mitigating the negative impacts of social inequality and reducing the costly treatment needs of dementia.[4] In terms of both nature- and culture-based interventions, the activity conducted provides participants with secondary health and wellbeing benefits, including increased physical activity; social interaction with therapists, carers and other participants; improved communication with caregivers; a sense of worth and purpose from contributing to a task; and skills development.[10,11] In addition, the environment alone is proposed to provide added benefits such as a connection with natural and cultural heritage on top of the benefits derived from conducting the activity.[7,10,11] Many of the outcomes identified for nature- and culture-based activities are shared across the two seemingly varied types of activities.[12] These benefits contribute to a number of determinants of health such

as social support and cohesion, personal growth and purpose in life,[13–15] which may also link to the physiological mechanisms that support health.[16]

Increasing evidence suggests that non-clinical health interventions, including interventions using natural and cultural assets, are a valuable addition to treatment plans and relieve the burden of care from emergency and primary care services. These 'upstream' interventions have been shown to prevent conditions worsening and reduce demand for acute healthcare services.[3,4] But efforts to mainstream these interventions in health service, social care or community support settings are held back by the lack of (1) theoretical or conceptual frameworks beyond those based on the wider determinants of health[13,14] and (2) understanding of the mechanisms by which these interventions bring about benefit. It is likely that gaining an enhanced understanding of how different forms of engagement, and types of interventions or activities, bring about similar health outcomes will aid in the wider acceptance of such initiatives within society.[12]

Here we provide a systematised review of the field to examine how the existing evidence could help inform frameworks or mechanisms. To do this, we examined two classes of interventions (those involving activities based on nature or culture) and looked for commonalities in human responses to interventions, secondary outcomes and the proposed underlying mechanisms. We chose these classes of interventions as they have an extensive evidence base associated with them and share similar health outcomes from seemingly varied types of activities. Due to the increasing volume of review literature on this topic,[4,11] we used a systematised review methodology to comprehensively compile the evidence from multiple reviews into one accessible and usable document.[17]

METHODS
Search strategy
Comprehensive searches of the scientific literature were conducted in six electronic databases up to May 2018, including Campbell Collaboration, Cochrane Library, Embase, Medline, Scopus and

Web of Science, and were restricted to English language publications that reported a review of primary studies. The search strategy consisted of the names of specific types of nature- and culture-based interventions such as 'forest bathing' and 'art therapy', as well as the broader terms 'community referral' and 'social prescribing', combined with the term 'health'. Details of the Medline search strategy, which was adapted for all other electronic database searches, are provided in the Supplementary Information.

Non-clinical nature- and culture-based health interventions are typically delivered either by a professionally qualified therapist or by a professional trained in the intervention activity such as an artist, environmental conservationist or actor who may have no formal therapeutic qualification. To maximise the number of reviews that we included in this study, we did not limit our criteria of an eligible intervention to those delivered by a professional with a formal therapeutic qualification, although we acknowledge that this is a broader definition than is used by others.

Study selection
All reviews of primary studies were eligible, including systematic reviews, meta-analyses, literature reviews, scoping and critical reviews, as defined by Grant and Booth.[18] For a review to be included, the authors must have attempted to quantitatively or qualitatively synthesise the data from at least two primary studies. Both reviews with results pooled statistically in a meta-analysis and those with qualitative analyses were eligible for inclusion. Reviews must have addressed the impact on health of a nature- or culture-based intervention, excluded were reviews that addressed interventions defined as spiritual or sensory. For an intervention to be defined as nature-based, it had to involve changing the environment in which people live, work, learn, recreate or heal to promote nature interactions, and/or changing people's behaviour through programmes or other means that involve engagement with nature.[5] Interventions that used a typically outdoor activity such

as running, but in an indoor environment such as a gym, were excluded. For an intervention to be defined as culture-based, we included any programme involving creative arts (including visual and performing arts) and other cultural participation activities including engagement in festivals, museums, libraries, historic buildings and heritage sites.[4] Our list of eligible interventions was compiled by reviewing a number of recent reviews on this topic.[3,4,6,19] The studies identified in the search were initially screened for relevance on the basis of their titles and abstracts. Subsequently, the full text of potentially relevant studies was assessed and studies were selected that satisfied the eligibility criteria. To summarise the exclusion criteria, reviews were excluded that did not synthesise results from at least two primary studies; did not report on a health outcome; and did not report on a nature- or culture-based intervention. Also excluded were studies that reviewed treatment programmes or methods of intervention implementation (rather than primary studies reporting on health outcomes) and/or that cited evidence without reference to primary studies (see the Supplementary Information for the Study Exclusion Criteria).

Quality assessment and data extraction
The methodological quality of the reviews satisfying the eligibility criteria (see the Supplementary Information for the Study Exclusion Criteria) was assessed using the National Institute for Health and Care Excellence (NICE) guidelines for assessing systematic reviews and meta-analyses,[20] as this method allows a consistent approach to assessing a broad range of review literature. Due to the nature of the review literature on nature- and culture-based non-clinical interventions, that is, the body of review literature is small and composed mainly of qualitative reviews or quantitative studies with small sample sizes, it was necessary to include reviews that scored poorly on the NICE quality assessment in order to draw more nuanced conclusions about the impact of nature- and culture-based interventions.

The NICE guidelines consist of seven criteria, five of which are rated as 'yes', 'no' or 'unclear', covering review characteristics such as literature search rigour, study quality assessment and reporting, and appropriateness and reporting of the review methods. We limited our use to these five criteria as their answers could be synthesised to produce an overall quality score for each review study. We considered that reviews following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method satisfied the NICE criteria on appropriateness and reporting of methods. As an additional measure of methodological quality, we recorded whether the review protocol had been preregistered on a public repository such as the Cochrane Library. Criteria 1 (the review addresses an appropriate and clearly focused question that is relevant to the review question) and criteria 2 (the review collects the type of studies you consider relevant to the guidance review question) were retrospectively removed from our quality assessment as our exclusion criteria ensured that all included reviews satisfied these criteria.

Descriptive data were extracted using a standard form. Data collection included the following: general characteristics of the review (year of publication and type of review); clinical characteristics (age group, diagnosis of participants and type of intervention); methodological features (assessment methods used by the primary studies included in the review); results (number of primary studies included, review findings); suggested mechanisms of intervention actions; proposed theoretical or conceptual frameworks; research gaps; conclusions and recommendations for practice.

Presentation of results
Evidence tables were produced to summarise the characteristics of the reviews and to synthesise the reported health and wellbeing outcomes. Health and wellbeing outcomes were classified following the International Statistical Classification of Diseases and Related Health Problems (ICD) 11th Revision.[21]

Patient and public involvement
We did not involve patients or the public in this work.

RESULTS
Literature searches up to May 2018 produced 751 studies of which 60 were included in this review (nature = 33, culture = 26, both = 1) reporting evidence from 1480 primary studies (see Table S1 and Supplementary Information). Figure 1 shows the flow of studies throughout the selection process. Twenty-three studies were excluded for the following reasons: eight reviewed only a single primary study; seven did not report on any health outcomes of the intervention; four did not report on an eligible intervention; one did not report on either a health outcome or an eligible intervention; one reviewed the implementation of interventions rather than health outcomes; one reported on treatment programmes rather than peer-reviewed studies; and one failed to cite references for statements made about health outcomes of interventions. A list of the 23 excluded studies and reasons for exclusion are available in the Supplementary Information.

Description of the reviews
The reviews were published between 2005 and 2018, with more than half of the reviews (n = 36) published in 2014 or later. More than a quarter of the reviews (n = 17) were focused on populations of children and younger adults. General characteristics of the reviews are summarised in Table 1. Over 100 different measures representing the health status of participants were used in the studies covered (Tables S2 and S3).

METHODOLOGICAL QUALITY
Overall, the methodological quality of the reviews was moderate. The median quality score was 2 (interquartile range = 1.75–3) on a scale of 0 to 3. Thirteen reviews (22%) had major methodological flaws (a score of zero), while 22 reviews (37%) satisfied all the components of the quality appraisal (see Table S1 for the review ratings on the individual quality components). The most common flaw identified by the NICE quality appraisal was failure to assess and report the

Human responses to nature- and culture-based non-clinical interventions: a systematised review

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Figure 1

Study flow diagram

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┌─────────────────────────────┐
│ # of records identified      │
│ through database             │
│ searching: 1239              │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐          ┌─────────────────────────────┐
│ # of records screened        │─────────▶│ # of records excluded: 670   │
│ after duplicate removal: 751 │          └─────────────────────────────┘
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐          ┌─────────────────────────────────────┐
│ # of full-text articles      │─────────▶│ # of full-text articles excluded     │
│ assessed for eligibility: 83 │          │ with reasons: 23                     │
└─────────────────────────────┘          │ One or less studies reviewed         │
              │                            │ for eligible intervention: 8         │
              ▼                            │ No health outcome: 7                 │
┌─────────────────────────────┐          │ No eligible intervention: 4          │
│ # of studies included in     │          │ No health outcome or eligible        │
│ overview: 60                 │          │ intervention: 1                      │
└─────────────────────────────┘          │ Review of intervention               │
                                           │ implementation rather than           │
                                           │ health outcomes: 1                   │
                                           │ Review of treatment programmes       │
                                           │ rather than studies: 1               │
                                           │ Lack of appropriate referencing: 1   │
                                           └─────────────────────────────────────┘
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quality of studies included in the reviews (63% of reviews). In addition, 15 reviews (25%) either did not conduct a rigorous search or did not provide enough information to assess the rigour of the search strategy used. Thirteen reviews (22%) failed to provide an adequate description of the methodology used or the methods used were inappropriate to the review question. Eleven reviews (18%) preregistered their study protocol on a public repository.

EFFECTIVENESS OF NATURE- AND CULTURE-BASED NON-CLINICAL INTERVENTIONS

Overall, the reviews tended to report positively on the effectiveness of nature- or culture-based non-clinical interventions, whereas only a small number of negative or unclear findings were reported (Figure 2, Table S4). Positive effects are those reported as improved health and wellbeing or reduced symptoms, whereas negative effects are those reported as worse health and wellbeing or increased symptoms. For example, the reduction of blood pressure by forest bathing[7] is considered a positive effect, while the

increase in psychosis symptoms by arts-based therapy[22] is considered a negative effect. Outcomes related to mental, behavioural or neurodevelopmental diseases and disorders, symptoms or signs were reported for the majority of interventions. The least commonly investigated outcomes were related to immunity, the nervous system and ear health. Some specific health outcomes were more frequently associated with particular types of interventions in the review literature. For example, psychosis was only reviewed in relation to culture-based interventions, while stress was only reviewed in relation to nature-based interventions (Table S4). The majority of interventions investigated were focused on treatment rather than prevention of chronic conditions and disease. Only findings from high-quality reviews (≥2 quality score, Table S1) are reported in Figure 2 to allow greater confidence in the results and conclusions.

SECONDARY HEALTH AND WELLBEING OUTCOMES

Secondary health and wellbeing outcomes are effects that are hypothesised to play a role in achieving

the primary outcome and include factors such as physical activity, social interaction and learning. A range of secondary health and wellbeing outcomes that may influence the effect of interventions were proposed in half of the reviews ($n = 30$), the majority of which were common across both nature- and culture-based interventions (Figure 3, Table S4). The most diverse group of secondary outcomes was of psychological or emotional nature, such as enjoyment and pleasure from taking part in the intervention and improved confidence. Outcomes related to social interaction and relationships were also commonly cited such as the development of relationships with carers and intervention providers. Physical health outcomes proposed included engagement in physical activity through the intervention and increased consumption of healthy food. The impact of the intervention environment was cited more commonly for nature-based interventions. Learning, including the development of knowledge and skills through the intervention activity, was also proposed for a number of intervention types.

Table 1	
Descriptive characteristics of reviews of nature- and culture-based non-clinical interventions for health included in this review (*n* = 60)	
	No. of studies
Group classification	
Children (<12 years)	8
Adolescents (13–18 years)	9
Adults (>18 years)	18
Undefined	35
Type of review	
Systematic review	28
Literature review	23
Meta-analysis	6
Cochrane systematic review	4
Scoping review	3
Critical review	1
Type of intervention	
Culture	
Visual arts	22
Music	6
Dance	3
Drama	2
Writing (including poetry, story-telling and journaling)	2
Nature	
Garden use	13
Horticulture	6
Care farming	5
Forest bathing	4
Outdoor exercise	3
Ecotherapy	2
Environmental conservation	1
Nature-assisted therapy	1

MECHANISMS

Mechanisms are the underlying biological, physiological, psychological and neurological processes which explain how and why an intervention works, such as which neural pathways are involved when participants in music-based therapy are singing. These are in contrast to the outcomes of interventions, be they primary or secondary outcomes, which are the resultant effect(s) or impact(s) of the intervention, which are themselves the results of mechanisms. Two reviews proposed conceptual frameworks, including a review of the health impacts of environmental conservation activities[11] and a review of the health and wellbeing impacts of gardening activities in schools.[10] The model presented by Husk et al.[11] includes a range of potential 'mechanisms': spirituality, change in personal/social identity, achievement/ contribution, knowledge acquisition, social contact, being away from stressors, restoration/recuperation, enjoyment/pleasure, going into nature, self-confidence and physical activity. However, we refer to these as secondary outcomes (Figure 3, Table S4) rather than mechanisms which are the neuro-bio-psychosocial processes in the body that bring about health outcomes. The conceptual model proposed by Ohly et al.[10] is composed of a suite of outcomes common to the other reviews in this study (Table S4), which are organised into the following categories: (1) physical and social aspects of school gardening, (2) factors influencing success and sustainability, and (3) intermediate to long-term final outcomes. Mechanisms are not proposed in this model, but in the text of the paper, the authors cite the Attention Restoration Theory as a potential mechanism which suggests that contact with nature can restore depleted ability to concentrate.

DISCUSSION
Principal findings

In this review, we synthesised the evidence provided by the review literature about the efficacy of nature- and culture-based non-clinical health interventions for health and wellbeing. This topic has received increasing attention in recent years with over half of the reviews having been published after 2013. The earliest review that we identified was published in 2005, with the numbers increasing rapidly from 2014. This trend suggests that there is a need for regular reviews of this growing literature field to ensure that new evidence is synthesised frequently to inform health and social care policy and practice. We found a wide range of types of nature- and culture-based non-clinical health interventions that have been examined using a review approach, and reporting on their efficacy was predominantly positive. However, the neuro-bio-psychosocial mechanisms underlying the association between interventions and outcomes were not well-articulated in the review literature. Two reviews proposed conceptual models but these focused on outcomes rather than mechanisms, which highlights the need to better understand mechanisms. The quality of the included reviews was moderate with 15 reviews (25%) scoring poorly on the NICE quality appraisal and a substantial number of reviews (63%) failing to appraise and report the quality of their primary studies. The lexicon of non-clinical interventions is very complex and it is clear there is no agreed terminological or methodological framework. This makes evaluation difficult as each study tends to stand alone. It also makes learning and synthesis challenging. Nevertheless, some common health and wellbeing outcomes emerged, including psychological and emotional impacts, social interaction and relationship development, skills development, physical health benefits and positive impact of the intervention environment.

Strengths and weaknesses of this study

Here we present the results of a systematised review by qualitatively compiling evidence from multiple reviews to provide an overview of what is currently known about the efficacy of nature- and culture-based non-clinical health interventions, the proposed outcomes elicited by these interventions and the existing knowledge gaps. This is the first time that the nature- and culture-based non-clinical health intervention

Figure 2

Findings in reviews of efficacy of culture-based (left-hand panel) and nature-based (right-hand panel) non-clinical interventions for health and wellbeing

Results are limited to those reported by high-quality reviews (≥2 quality score, Table S1). Significant results reported by meta-analyses are reported as the lower and upper confidence intervals of the effect size(s) and coloured to indicate the direction of effect reported (green = positive, red = negative). Health outcomes are grouped following the International Statistical Classification of Diseases and Related Health Problems (ICD) 11th Revision. See Table S4 for full results, including those reported in medium- and low-quality reviews (<2 quality score, Table S1), and Table S5 for mapping between health outcomes reported in reviews with the ICD classification system. 'Env. conserv.' refers to 'Environmental conservation' interventions.

Legend Positive effect + No effect ⊘ Negative effect − Unclear effect ?

Figure 3

Potential secondary health and wellbeing outcomes proposed by reviews of culture-based (left-hand panel) and nature-based (right-hand panel) non-clinical interventions for health and wellbeing

Only outcomes proposed by high-quality reviews (≥2 quality score, Table S1) are reported. See Table S4 for full results, including those reported in medium- and low-quality reviews (<2 quality score, Table S1), and Table S6 for grouping of secondary health and wellbeing outcomes reported in reviews. 'Env. conserv.' refers to 'Environmental conservation' interventions.

Secondary health and wellbeing outcomes	Visual arts	Music	Dance	Drama	Forest bathing	Horti-culture	Eco-therapy	Garden use	Care farming	Outdoor exercise	Env. conserv.
Psychological or emotional	●	●	●		●	●	●	●	●	●	●
Environmental		●				●		●	●		●
Physical health		●	●			●	●	●		●	●
Social and relationships	●	●	●			●	●		●	●	●
Learning		●						●	●		●

review literature has been evaluated in this way. We restricted our search strategy to using scientific literature databases which will have restricted our included reviews to peer-reviewed publications. This potentially will have introduced publication bias to our results, particularly as grey literature dominates the field of non-clinical health interventions. For example, a recent UK government report on culture-based non-clinical health interventions has over 1000 citations, comprising a range of peer-reviewed intervention studies and grey literature.[4] Due to the qualitative nature of most of the reviews included, we were unable to assess the risk of publication bias in this study. Publication bias is difficult to evaluate among reviews of non-randomised studies, and quantitative methods for assessing publication bias are not suitable with sample sizes of less than 10,[23] of which our study includes only 6 reviews reporting quantitative meta-analyses. Eleven reviews had preregistered protocols which should have reduced the risk of publication bias for these reviews. We used strict inclusion criteria to ensure that the quality of evidence included in our review was high, demonstrated by three quarters of reviews scoring moderate to high on the NICE quality appraisal. This approach will have reduced the number of reviews included in this study. Our search strategy used the names for specific types of interventions chosen by reviewing recent reviews of the field;[3,4,6,19] this approach will have limited our search terms to well-established types of interventions while more novel interventions were potentially missed. However, it is less likely that novel interventions would have amassed enough primary studies to have been examined using a review methodology. We made subjective choices about what constitutes a 'nature'- and 'culture'-based intervention which will have impacted the breadth of interventions satisfying our inclusion criteria; interventions classified as spiritual or sensory were excluded.

Strengths and weaknesses in relation to other studies
Evidence on the efficacy of nature- and culture-based non-clinical health

interventions has tended to be reviewed separately, for example, the role of nature-based interventions for mental health[3] and the arts for health and wellbeing,[4] highlighting the silos that exist in this research field. We are not aware of any studies to date that have specifically compared the review literature for nature- and culture-based non-clinical health interventions. By conducting this systematised review, we highlight trends in the review literature of specific intervention/health outcome combinations. For example, the majority of outcomes reported were related to mental health and there are a number of areas of physical health that have not been tackled by high-quality review studies. A surprising finding is the lack of high-quality review studies investigating the impact of nature-based interventions on diseases and disorders of the immune system given the evidence for links between exposure to natural environments and immunity.[24] The application of statistical methods recently developed for quantitatively synthesising evidence of multiple reviews[25] would be a useful avenue to develop the research presented here in the future.

The meaning of the study: possible explanations and implications for clinicians and policymakers
In general, the vast majority of reviews reported positive health impacts of nature- and culture-based non-clinical health interventions, while a small number of meta-analyses reported significant positive effect sizes for some interventions, suggesting that these interventions may be an effective addition to patient treatment plans. These findings are particularly pertinent given recent policy shifts from the UK's National Health Service (NHS) to incorporate social prescribing within their Universal Personalised Care model of healthcare delivery, as outlined in the NHS Long Term Plan.[26,27] The recent rapid increase in the review literature suggests that there is increasing interest in the use of nature- and culture-based non-clinical health interventions in practice. However, the conceptual and theoretical frameworks underlying this research are not well developed and the underlying

neuro-bio-psychosocial mechanisms are not well understood. This makes integrating these interventions into mainstream health and social care challenging. In concordance with previous reviews,[4] our findings highlight a knowledge gap in relation to the use of non-clinical interventions for improving health through prevention as the majority of reviews covered treatment interventions. However, natural and cultural assets have been shown to be highly economically valuable in terms of their preventive health effects. For example, in England, it is estimated that access to greenspace could save £2.1 billion per year in health costs due to increased physical activity alone,[28] while the arts, museums and heritage sites save the NHS around £700 million per year through reduced general practitioner (GP) visits and use of mental health services.[29] Unfortunately, both natural and cultural public assets are under threat in the UK due to government underfunding.[9,30,31] The degradation and loss of these assets will have considerable economic costs due to the lost preventive health services they provide.[32] Several review authors highlighted the need to investigate the the role of intervention characteristics[33–35] and dose–response relationships[36] on intervention efficacy to inform design guidelines and programmes for the delivery of interventions and this is an area of much needed research.

Unanswered questions and future research
Future research of this kind should focus on reviewing the evidence gaps for non-clinical nature- and culture-based interventions with an emphasis on implementing larger sample sizes, cohort and longitudinal studies, deploying a wider range of mixed-methods, quasi-experimental and, finally, randomised control trials – but only when this later approach is appropriate in the more controlled circumstances. There must be a focus on improving the rigour of studies, and more use of quantitative as opposed to self-report measures (see Table S2 for the methods/outcome measures used by the primary studies reviewed). There should also be

agreement on (1) methodological terminology, and (2) the need to develop conceptual frameworks so that a better understanding can be developed of the neuro-bio-psychosocial mechanisms underlying interventions. There are already well-tested models of health and wellbeing[13,14] that can form the basis of this research. Without this mechanistic appreciation, it will be more difficult to design effective interventions that practitioners can apply with confidence and, consequently, more difficult for commissioning bodies to mainstream these kinds of interventions.

CONCLUSION

Here we present the first systematised review of the health outcomes of nature- and culture-based non-clinical interventions. The evidence from the review literature suggests that these interventions deliver a wide range of positive health outcomes, and that inclusion of nature- and culture-based non-clinical health interventions in health and social care plans may be effective at improving the lives of sufferers of chronic health conditions. However, there is a lack of understanding of the neuro-bio-psychosocial mechanisms underlying the

associations between interventions and human health, which impedes the quality of studies, evidence and uptake by health and social care providers. There are a number of health issues and interventions which are currently understudied in the review literature, which may reveal additional health benefits in the future. The use of nature- and culture-based interventions as preventive public health measures would be economically effective, but requires government commitment to maintain high-quality natural and cultural public assets. As the global prevalence of chronic health conditions increases, the maintenance of natural and cultural assets for public health must be an international priority.

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AUTHOR CONTRIBUTIONS

A.J.F. performed the searches and selection, data extraction, quality assessment and synthesis, and drafted the manuscript. All authors reviewed and edited the manuscript, and all approved the final draft.

CONFLICT OF INTEREST

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Supplemental material for this article is available online.

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PEER REVIEW

Meeting the UK Government's prevention agenda: primary care practitioners can be trained in skills to prevent disease and support self-management

Meeting the UK Government's prevention agenda: primary care practitioners can be trained in skills to prevent disease and support self-management

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Abstract

Aims: The NHS Long Term Plan has a prevention focus and ambition to support patients to self-manage disease through improving health behaviours. An essential requirement of self-management is behaviour change, but many practitioners have not been trained in skills to support behaviour change. 'Healthy Conversation Skills' (HCS) training was developed at the University of Southampton for this purpose. This article reports on a pilot study that aimed to assess the feasibility of primary care practitioners adopting HCS in their routine practice. It describes their experiences and level of competence post-training.

Methods: Health Education England (Wessex) commissioned HCS training for 18 primary care practitioners. Fifteen of these practitioners were subsequently observed in their consultations at one or two time points; face-to-face semi-structured, reflective feedback interviews were conducted immediately following the observations. Practitioners' HCS competence was assessed from the observations and interviews using a previously developed and published coding rubric. The interview data were analysed thematically to understand practitioners' experiences of using the new skills.

Results: Practitioners demonstrated competence in embedding the skills into their routine practice following HCS training. They reflected on how patients liked being asked questions, the usefulness of setting SMARTER (Specific, Measured, Action-oriented, Realistic, Timed, Evaluated and Reviewed) goals and the power of listening. They could also identify facilitators of skill use and ways to overcome challenges such as patients with competing priorities and organisational constraints. They found the skills valuable as a way of empowering patients to make changes to manage their own health.

Conclusions: HCS are acceptable to primary care practitioners, can be readily adopted into their routine consultations and are a helpful strategy for supporting patients to make changes. HCS training has the potential to be a sustainable, scalable and effective way of contributing to the prevention agenda by supporting disease self-management, and hence of addressing today's epidemic of lifestyle-related conditions.

Meeting the UK Government's prevention agenda: primary care practitioners can be trained in skills to prevent disease and support self-management

INTRODUCTION

The recently announced NHS Long Term Plan describes ambitions to give patients more control over their health and treatment, and prevent non-communicable diseases, such as cardiovascular and chronic respiratory diseases, most cancers and diabetes, through improving health behaviours.[1] Disappointingly, it offers no detailed plan for how these ambitions will be realised and appears to place responsibility for this on individual NHS trusts and local authorities. Previous NHS plans were more specific in that they suggested an approach to disease prevention that involved frontline staff in 'Making Every Contact Count' (MECC), but it was left to individual trusts and local authorities to decide how best to equip their staff to do this.[2,3] Taking up this challenge, all regions of England have now established mechanisms for MECC, facilitating health improvement and disease prevention through the development of the wider healthcare workforce. MECC as a principle takes advantage of the fact that everyday more than a million people in the UK have contact with healthcare and social care practitioners. These contacts represent opportunities to support members of the public to adopt healthier behaviours and in so doing 'make every contact count'.[4] The MECC agenda provides one way of delivering the UK Government's growing disease prevention agenda and recognises the opportunity that the workforce has to influence health behaviour and in so doing prevent disease.

Over the last 5 years, National Health Service (NHS) commissioners have included a commitment to MECC principles in standard NHS contracts and linked it directly to CQUINs (Commissioning for QUality and INnovation) relating to self-management.[5] More recently, the role of the primary care workforce in supporting secondary prevention has been given focus by the announcement of a UK Government emphasis on prevention with the NHS Long Term Plan.[1]

Developing Integrated Care Systems and Primary Care Networks, which are expected to be key in delivering many of the commitments in the Long Term Plan, will place new demands on the workforce for skills in disease prevention.[6,7] Training the primary care workforce in skills to support healthier behaviours and disease self-management offers one way of meeting these demands.

Recent evaluations of methods used to deliver MECC have concluded that it is acceptable to, and valued by, a range of practitioners and that training in behaviour change skills can benefit patients.[8,9] Concerns have been raised, however, about the feasibility of implementing the MECC agenda in organisations with varying cultures and structures. Organisations that view themselves as responsible for prevention rather than treatment and have strong relationships between departments demonstrate greater implementation.[9] Others with organisational and financial constraints have needed strong leadership and commitment to the training of staff and highly engaging and effective training to justify release of staff time.[10,11] Outside the MECC context, many frontline practitioners do not routinely receive training in skills to support behaviour change. Many report lacking confidence in initiating conversations about diet and exercise, for example.[12,13]

Health Education England is responsible for the training and development of the healthcare workforce. In 2013, the Wessex region proposed using Healthy Conversation Skills (HCS) as the mechanism for delivering MECC. In a range of evaluations, HCS-trained health and social care practitioners had shown improved confidence and competence in supporting behaviour changes, demonstrating continued use of the skills up to one year post-training.[14–16] HCS training adopts an empowering, person-centred approach to changing behaviour. It equips frontline practitioners with skills to maximise the benefit from conversations with patients that support them to find their own solutions and identify first steps to change.[17] HCS are practical, simple to learn and can be used opportunistically by practitioners working in any setting, with any population, in any time frame. Box 1 outlines the training philosophy and programme; further details have been published elsewhere.[17]

The aim of this study was to evaluate the feasibility of training primary care practitioners from Wessex in HCS and to assess how they embed the skills into routine practice. Such practitioners play a key role in preventing disease in local communities and in delivering the UK Government's commitment to 'putting prevention at the heart of our nation's health'[18] (p. 4). Staff working within primary care settings have opportunities to discuss a wide range of health behaviours, including diet, physical activity, smoking, alcohol consumption and medication management.

This article addresses the following research questions:

1. How well do HCS trainees demonstrate sustained use of the skills post-training?
2. What are primary care practitioners' experiences of HCS training?
3. How do primary care practitioners implement the skills in routine practice?

METHODS
Setting and participants

In 2013, Health Education Wessex contacted general practitioner (GP) practices in Hampshire and Buckinghamshire inviting them to pilot the HCS training. An information sheet and booking form were emailed to all GP practice managers via the local clinical commissioning group. GP practices that expressed willingness to take part were asked to release two of their practice staff to attend training. These practitioners were offered HCS training as part of their continuing professional development (CPD) and were sent the training information sheet. Reasons for non-participation included time constraints, too far to travel and insufficient notice. Participants were therefore self-selected. The training was conducted by two HCS trainers with support from another team member; all are experienced in group work and behaviour change. The pilot study was

PEER REVIEW

Meeting the UK Government's prevention agenda: primary care practitioners can be trained in skills to prevent disease and support self-management

part of the feasibility stage for Health Education Wessex, with the ambition to upscale the training to practitioners across the region.

Ethics

As HCS training and follow-up were considered service provision and workforce development, the study met the criteria for service improvement and did not, therefore, require approval from the local research ethics committee. However, universal ethical principles were followed throughout the study, and participants were asked for consent to participate at each stage.

Procedures, materials and data analysis

This longitudinal pilot study is based on data derived from pre- and post-training evaluations, observations and reflective feedback interviews; the latter two activities were undertaken at two time points: 1–2 months and 11–13 months post-training.

Pre- and post-training evaluations

All trainees completed an evaluation sheet at the start of Session 1 and end of Session 2 to measure change in use of Open Discovery Questions (ODQs, beginning with How or What) by responding to four statements about diet, exercise, alcohol and smoking. Responses were coded using a previously developed coding matrix.[14] Changes in confidence, importance and usefulness in relation to supporting change were also measured at these two times on a published 10-point Likert-type scale.[15]

Observations

Practitioners were observed during one of their routine clinics at their general practice to assess how they used HCS. Observers recorded the use of three of the four HCS (ODQs, Listening and SMARTER (Specific, Measured, Action-oriented, Realistic, Timed, Evaluated and Reviewed) goal-setting) using a standard proforma. Immediately following each observation, observers recorded a competency score for the participant for use of the three HCS using a published

competency-rating rubric.[14,15] Each HCS was scored from 0 to 4, where 4 demonstrated the highest competency. Given the small sample size, formal statistical tests were considered inappropriate and only descriptive statistics were calculated.

Reflective interviews

Once all the observations had been completed, the observer conducted a face-to-face reflective feedback interview with the practitioner using a semi-structured discussion guide. Consent was sought from each participant to audio-record the interview. Immediately following the interview, the researcher recorded a competency score for the final HCS (Reflection) based on the interview data, using the coding rubric described above.

The audio-recordings were transcribed verbatim. Using deductive coding and a constant comparative approach,[19] themes and sub-themes were generated and used to produce a coding framework. Stages in the analysis included (1) review of the transcripts; (2) development of a coding framework to represent emergent themes, illuminated with verbatim quotations; (3) thematic coding of the transcripts using the coding framework; and (4) repeating stages 1—3 until the coding framework was fit-for-purpose. The research team met to discuss any minor disagreements, and a proportion of the transcripts was double-coded to inform the final coding framework.

RESULTS

Data were collected from clinics covering a range of conditions including sexual health, chronic obstructive pulmonary disease (COPD), cardiac health, overweight, smoking, diabetes, and NHS health checks. Eighteen participants completed the HCS training, ranging in age from 20 to 60 years, with a mean of 10 years' relevant work experience. Three participants had previously received brief motivational interviewing training. Each reflective interview lasted 15–50 min in length. Data included in the analysis are derived from 15 participants who attended both HCS training

sessions and were observed post-training during at least one clinic session and one follow-up reflective interview.

How well do HCS trainees demonstrate sustained use of the skills post-training?

Table 1 presents measures of HCS competence for individual trainees assessed using three methods: (1) pre- and post-training evaluation sheets; (2) observations of one or two clinic sessions following training; and (3) during reflective interviews carried out after each clinic session.

From pre- to post-training, participants' use of ODQs (rising from 12 to 55 ODQs), measures of confidence (median score rising from 7 (range: 3–10) to 8 (range: 6–10, out of 10)) and usefulness (median score rising from 8 (range: 6–10) to 10 (range: 8–10, out of 10)) in using the skills to support change, all increased post-training.

Clinic sessions observed at follow-up lasted 1–3 h. The levels of competency for asking ODQs and Reflection were high among participants at both follow-ups (median scores of 4 out of 4 for each at both follow-ups), while Listening (median scores of 2 out of 4 at both follow-ups) and Goal-Setting (median scores of 2 out of 4 at both follow-ups) were moderate.

Table 1 shows the scores for individual trainees as they progressed through training and into using the skills in practice. Their scores illustrate the variation in skills at baseline and in competencies after training and over time as they are implemented. Overall, the data show that competencies stayed relatively stable at most time points for almost everyone.

What are primary care practitioners' experiences of HCS training?

In the reflective interviews, practitioners were generally positive as to how the training had affected their skill development. They appreciated the training structure, activities, interactive/participatory style of delivery (no PowerPoint slides), resources and the opportunity to learn with other health professionals:

Meeting the UK Government's prevention agenda: primary care practitioners can be trained in skills to prevent disease and support self-management

Table 1.

Participants' individual Healthy Conversation Skills (HCS) confidence, importance, usefulness and competence scores ($n=15$ at FU1; $n=9$ at FU2)

ID no.	Job role	No. of Open Discovery Question (ODQ) responses		Confidence		Importance		Usefulness		Observation: HCS competence						Reflective interview	
										ODQs		Listening		SMARTER		Reflection	
		Pre-training	Post-training	Pre-training	Post-training	Pre-training	Post-training	Pre-training	Post-training	FU1	FU2	FU1	FU2	FU1	FU2	FU1	FU2
002	Practice Nurse Manager	1	4	7	7	10	10	7	10	4	2	2	2	2	2	4	3
003	Healthcare Assistant	1	4	10	10	10	10	8	10	4	3	2	2	2	1	4	3
004	Healthcare Assistant	0	4	4	10	6	10	8	10	2	3	2	2	1	1	4	4
005	Practice Nurse	3	4	7	10	10	10	8	10	4	4	4	4	4	4	4	4
006	Practice Nurse	0	4	7	9	10	5	10	10	3	4	2	2	2	3	4	4
008	Triage Nurse	0	4	3	8	10	10	10	10	3	4	2	3	1	3	4	4
020	Practice Nurse	1	4	8	9	10	10	8	10	4	4	4	3	4	3	4	4
022	Practice Nurse	0	4	8	7	10	10	8	10	4	4	4	3	2	2	4	4
025	Healthcare Assistant	0	3	7	7.5	10	10	9	10	2	2	2	2	1	2	4	2
009	Practice Nurse	2	4	7	7	9	9	8	8	4	–	2	–	2	–	4	–
011	Dietitian	0	4	9	9	10	9	9	9	4	–	3.5	–	2	–	4	–
021	Practice Nurse	1	4	6	9	8	10	7	10	4	–	4	–	2	–	4	–
024	Occupational Health Nurse	3	–	7	6	9	9	7	9	4	–	4	–	1	–	4	–
026	Sexual Health Nurse	0	4	7	8	10	10	7	8	4	–	1	–	2	–	4	–
027	Occupational Health Nurse	0	4	6	8	8	10	6	8	3	–	2	-	1	–	4	–
Total ODQs		12 ($n=15$)	55 ($n=14$)														
Median				7	8	10	10	8	10	4	4	2	2	2	2	4	4

FU1: follow-up 1–2 months post-training; FU2: follow-up 11–13months post-training. SMARTER: Specific, Measured, Action-oriented, Realistic, Timed, Evaluated and Reviewed.

PEER REVIEW

Meeting the UK Government's prevention agenda: primary care practitioners can be trained in skills to prevent disease and support self-management

I liked, although it was horrible, listening to it back. It was quite nice to do the recording and see where you go wrong and how to change that, sort of reflecting back on yourself. (ID004_FU1)

I liked meeting people from other surgeries and having to work with someone you wouldn't necessarily have ever met before ... (ID004_FU1)

The practitioners considered the training valuable in providing new learning. It was stimulating and useful, encouraging them to reflect on key principles of their practice and how effective the skills were in enabling them to empower patients to identify their own solutions and goals. The value afforded to the skills learnt in the training, in turn led to the perception that the time allocated to post-training, follow-up was important and useful if they were to effectively support their patients to make health changes:

It's really cool to have that feedback from you as well, because you're kind of seeing what I'm not seeing ... so that's pretty cool to have that kind of follow-up. (ID005_FU2)

How do primary care practitioners implement the skills in routine practice?

Thematic analysis identified three themes that answer this question. These were (1) how practitioners implemented HCS; (2) what challenges to implementation were experienced; and (3) recognising the impact of having healthy conversations.

How practitioners implemented HCS

Practitioners described ways in which they were using HCS and successes they had experienced. They talked about their use of goal-setting and SMARTER techniques in supporting patients to make plans for change:

I felt it went pretty well and patients have been able to give me some feedback on how their goals went. (ID005_FU1)

I will use that SMARTER plan that you gave us ... you know Specific and

Timed and everything, and try and build a plan with them, especially about weight loss. (ID004_FU1)

Practitioners reflected on how they were asking ODQs to empower people to find their own solutions and on the effect this had of opening up conversations with patients in a way that revealed more about the patient's life and context in which they were managing their health condition:

We talked about his life, what he was doing ... what his employment was, what he wanted to do and things ... (ID002_FU2)

I'm surprised how open people are really ... they even say thank you for asking the question. (ID008_FU2)

There were discussions about listening rather than telling or giving information and reflecting on having healthy conversations. Some spoke of their increased awareness of behaviour change techniques and the impact of HCS overall on their practice:

I'm doing less talking which is quite good, and trying to do more listening. (ID020_FU1)

I think probably I was quite reflective, and I think that I handed the responsibility back to him. (ID008_FU2)

Practitioners reported, and were observed to be, spending a significant amount of time using and reflecting on all four HCS. The reflective feedback interviews offered practitioners an opportunity to plan further development of their skills, particularly when they recognised occasional use of their previous communication style:

... maybe sometimes I don't always listen as much as I should do ... I tend to like stepping in for the patient. (ID006_FU1)

Practitioners reflected on the challenges to using HCS in practice. With guidance and support from the interviewer, practitioners identified ways to practise the skills in order to increase their use:

Because I do a lot with COPD patients. For me it's [about] smoking cessation, and I just want to continue practising what I am doing [with the skills] actually. (ID002_FU2)

Even if it was only a more open conversation, you know ... perhaps might be the aim. (ID008_FU2)

Practitioners' commitment to embed these skills in their work is evidenced by their willingness to plan ways in which they could improve.

What challenges to implementation were experienced?

Practitioners discussed challenges created by the nature of the job they do, specifically patient attributes and systemic constraints in their workplace and the wider NHS context.

A patient's medical condition was seen to sometimes preclude the practitioner from having a healthy conversation:

She wasn't wearing her hearing aids ... if she wasn't hard of hearing, she would have been a hard patient because she was ... not forthcoming. (ID003_FU2)

Sometimes the habitual nature of a patient's behaviour was perceived to get in the way:

It's her choice ... She's drawing the line and saying to me 'no, I'm not going to alter that, that's not negotiable'. I'm not sure that there's anything else that I can do. (ID008_FU1)

A patient's circumstances or general attitude towards health or changing behaviour emerged as a barrier to the practitioner being able to support them effectively:

I think she's hesitant because she's in a bad place. She's stressed, she's not coping, and I'm trying to help her, but her finance . . . (ID003_FU1)

Practitioners responded to patients' reactions within the clinic when deciding how far they could pursue a healthy

PEER REVIEW

Meeting the UK Government's prevention agenda: primary care practitioners can be trained in skills to prevent disease and support self-management

conversation with them. How the patient was feeling physically or mentally, and any habitual behaviour affected practitioners' use of HCS, particularly when patients were considered resistant.

Practitioners were also impeded by the nature of their job role or the wider work context, including mandatory reporting requirements. These included time pressures, the culture of information-giving and the expectation to signpost patients onto other professionals or organisations:

> I get 10 minutes per patient, unless it's for hearing or ECG, in which I get 20 minutes. But basically it's in and out ... you need to be good at time-keeping. (ID004_FU2)

> I think nurses are great at kinda telling patients what to do. (ID006_FU1)

> By the same token, I still have to follow what the NHS wants. (ID003_FU2)

Expectations remain on professionals to inform patients via leaflet provision or service signposting, sometimes hindering opportunities for having healthy conversations.

Impact of having healthy conversations
There was much discussion on how using HCS in consultations had a positive impact on both the patient and the practitioner. HCS were commonly used to build rapport with patients, leading them to be more likely to open up. Engagement in the conversations initiated by the practitioner subsequently led to patients achieving their behaviour change goals:

> It encourages us to be more open with the patient asking them open-ended questions, asking the patients to talk. ... I think it's also building up that relationship with them. (ID00_FU2)

> This week I saw him, and he came up to me and he put his arm around me and said 'thank you so much. I haven't smoked since that morning'. (ID002_FU1)

Using HCS in both their professional and personal life increased practitioners'

confidence to make changes to their own behaviours and to support patients' or friends' health changes:

> Speaking to patients, I've got more confident and as I'm progressing in my job role it's definitely helping me more. (ID004_FU2)

> My best friend is getting married in 2015 and she wants to be at least two dress sizes smaller, so that's her goal. I would like to be a dress size smaller, so we're starting early, so that we can do it properly and slowly, with exercise and everything. (ID004_FU2)

Recognition of the benefits of using HCS in their practice also prompted many to identify ways that HCS could or should be more widely available to their colleagues:

> I shared the literature you gave us ... several of my colleagues have taken it and I know they would be really keen to do it. (ID002_FU1)

DISCUSSION
The aims of this study were to explore the experiences and competency levels of primary care practitioners using HCS in their practice following HCS training and to evaluate whether it is feasible for other practitioners to be trained and to embed these skills into routine practice. Findings are discussed below as they answer each study question.

How well do HCS trainees demonstrate sustained use of the skills post-training?
As seen in previous evaluation of HCS training, primary care practitioners were better able to use some HCS than others.[14] Observations of patient interactions in clinic at two time points post-training indicated that practitioners were skilled at asking ODQs and reflecting on their practice. But while they had incorporated listening and supporting their patients to set SMARTER goals to some extent, they found these skills more challenging to implement. Reflective interviews suggested that some practitioners felt a healthy conversation

was too time-consuming to carry out in addition to completing the required routine tasks. However, all practitioners demonstrated at least moderate competency for each HCS, which indicates that they were able to embed the new skills to some extent into their practice. Thus, HCS can be considered to be acceptable, practical and sustainable up to one year post-training in a primary care setting.

What are primary care practitioners' experiences of HCS training?
Practitioners valued the training and described how it enhanced their motivation to use HCS. They felt supported to reflect on how they were using them in their practice and enjoyed the follow-up observations and reflective feedback interviews because they reinforced the value of the skills. They also remarked on the benefits they gained from training together with practitioners from other GP practices. This pilot study suggests that healthcare practitioners with different levels of experience acquire HCS readily and value the way the training encourages them to share good practice.

How do primary care practitioners implement the skills in routine practice?
All practitioners who were interviewed reflected on how they were using HCS with their patients and the resultant positive impact. Some practitioners still found it difficult not to revert to telling their patients what to do although they understood that this might not be the most effective strategy. The follow-up interview gave practitioners the opportunity to recognise and reflect on this, to make plans to practise and build confidence in using HCS. There were certain types of patients, particularly those with significant competing priorities in life, with whom practitioners found it more challenging to use the skills. Short appointment times were cited as an additional challenge; however, if the NHS Long Term Plan to make every part of the country an integrated care system by 2021 is actioned, it will likely facilitate

PEER REVIEW

Meeting the UK Government's prevention agenda: primary care practitioners can be trained in skills to prevent disease and support self-management

time for having healthy conversations to support MECC.[20] Previous research identified systemic barriers to implementing training in skills to support behaviour change. For example, public health practitioners valued the MECC training they were given but were prevented from making best use of their skills because they lacked management support and resources.[10] Others suggest that 'the (MECC) service is only as effective as the system in which it operates'[9] (p. 660).

Practitioners noted that the training had impacted their patients, themselves, and their family, friends and colleagues. They spoke about enjoying their new-found rapport with chronically ill patients, who were more likely to open up about their physical and emotional wellbeing and make plans to manage their health. They saw some improved health outcomes at their follow-up appointments. Barrecheguren and Bourbeau[21] describe the use of self-management programmes by those with COPD, highlighting the key role that plans and goals play in the success of self-management. Others have reported a 70% increase in uptake of smoking cessation services among patients who had support from practitioners using a MECC approach.[9] These findings suggest that training in accessible behaviour change skills could have benefits for patients and the broader public if widely implemented. Practitioners spoke of their increased confidence in using HCS with friends and family, suggesting that HCS training could have an impact on the quality of life of practitioners and their social network. Though only hinted at in these data, this presents the intriguing possibility that adopting these skills might have a generalised impact on health and wellbeing.

IMPLICATIONS FOR POLICY AND PRACTICE
How does HCS represent a means of delivering on the NHS Long Term Plan?
These study findings have implications for disease prevention and exacerbation through encouraging patient self-management in primary care. Using HCS does not require extensive training or familiarisation with complex concepts. The authors would also propose that as practitioners' confidence and competence in using the skills increase, they should be able to adopt this approach within the time they have available. Practitioners can use the skills in any primary care context and do so over the long term. These attributes suggest that it is likely to be cost-effective. Nelson et al.[9] said of MECC training, 'its strength is its simplicity', observing that this simplicity encouraged organisation and stakeholder commitment.

In order to realise the ambition of the NHS Long Term Plan, health and social care practitioners of all types need skills to support health behaviour change. There is a substantial body of evidence to suggest that practitioners across the NHS currently feel they lack confidence and skills to have effective conversations with patients and clients about weight, diet and other health behaviours.[12,13,22] The study reported in this article suggests that HCS training could provide primary care practitioners with accessible and easy-to-use skills to empower patients to maintain health and prevent disease exacerbations.

The NHS Long Term Plan assigns responsibility for delivering its preventive agenda to individual NHS trusts and local authorities. While this is, on the one hand, a heavy responsibility, it also presents an opportunity to adopt a trust-wide or local authority-wide approach to prevention, on the other. The colleagues of practitioners trained in the study reported here, expressed a desire to also have training in HCS. There was clearly a willingness in these GP practices to acquire the skills needed to have conversations to support health. Training of all health and social care practitioners across a trust or local authority would create an environment where patients and the public were offered opportunities to reflect on their health needs, make plans and set goals in every meeting with every type of practitioner – truly 'Making Every Contact Count'.[3]

Strengths and limitations
This study collected data from a small, self-selected convenience sample of GP practices in Hampshire and Buckinghamshire, thus limiting the generalisability of the findings. As a feasibility study, however, it allowed an exploration of the acceptability and usefulness of the skills in routine primary care practice. It may be that these practitioners are no different in any systematic way to other practitioners in similar roles, but further research is needed to confirm this. Evidence of generalisability comes from consistency with previous data on use of HCS training with larger numbers of health and social care practitioners.[14,15]

Practitioners may have behaved differently while being observed, thus producing observer bias. Equally, the training team interviewing practitioners may have, by nature of their role as a trainer, caused them to overstate evidence of HCS use. However, from the outset, the research team was aware of areas for potential bias and used a wide range of methods in an attempt to address these, including using a variety of evaluation tools, assessing practitioners at multiple time points and collecting several sources of data from each trainee. While evaluation tools were not validated against other instruments, they have been extensively piloted by the research team and found to be fit-for-purpose.[14,15]

CONCLUSION
This article indicates that HCS training is a good investment, valued by staff who use the skills in the long term. We propose that HCS are readily adopted by practitioners because the training design and skills match practitioners' own perceptions of their needs. Having 'healthy conversations' does not add to their burden.

Although there has been a delay in publishing these data from the 2013 pilot programme, the findings seem as relevant today as they were then. There are important reasons for publishing now the development work that underpins current HCS training and evaluation activities.

PEER REVIEW

Meeting the UK Government's prevention agenda: primary care practitioners can be trained in skills to prevent disease and support self-management

First, a 2019 sandpit activity convened by Health Education England to develop a plan for assessing the national impact of MECC (and attended by two of the authors) highlighted the limited evaluation of very brief interventions such as MECC. This lack of evidence indicates a need for studies such as the one we report in this article in order to inform practitioners, service commissioners and policy makers as to the value of a MECC approach.

Second, this pilot study informed the development and large-scale roll-out of the Wessex MECC programme across three of the five English regions as the method of training health and social care staff to make every contact count.[3] Since 2014, over 5000 staff have been trained in HCS using a Train-the-Trainer model, and the training is now accredited by the Royal Society for Public Health. A large-scale evaluation is planned, but the pilot data reported in this article are important for establishing the early credibility and usefulness of HCS and to explain why the roll-out was commissioned.

Finally, HCS have proved to be particularly important to practitioners working during the COVID-19 pandemic. Aspects of the face-to-face training described in this article have been adapted for delivery online to support those working with the most vulnerable at this time. To date, the 90-min online 'Supportive Conversations' training has been delivered to nearly 300 frontline workers from across England.

In the same way that HCS training is valued by trainees because it is designed to fill a skills gap that they identify for themselves, HCS have been taken up at an organisational level because they meet the requirement in many NHS contracts to deliver on the MECC agenda. There is potential for this training to be fundamental to delivering the preventive ambition of the current NHS Long Term Plan, as well as supporting the UK's COVID-19 response and recovery, demonstrating the versatility and broad applicability of HCS.

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AUTHORS' CONTRIBUTIONS

E.R. commissioned the training; W.T.L. and C.V. undertook delivery of the HCS training and development of evaluation materials, supported by T.T.; and W.T.L and T.T. conducted the observations and reflective interviews. W.T.L., D.W. and H.B. coded and analysed the data. All authors contributed to early versions of the manuscript. W.T.L. and M.B. produced the final draft. All authors provided input to the final manuscript.

CONFLICT OF INTEREST

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PEER REVIEW

Meeting the UK Government's prevention agenda: primary care practitioners can be trained in skills to prevent disease and support self-management

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APPENDIX 1
Healthy Conversation Skills training outline

Communication is enhanced through practitioners developing the skill of asking open-ended, or open discovery, questions – those that begin with 'how' and 'what'. Such healthy conversations allow a patient or client to explore an issue, identify barriers and generate solutions that can be reviewed with the practitioner at their next encounter. Experiential training aims to increase self-efficacy and sense of control of both practitioners and their patients and clients.

The four core skills are the following:

1. To use Open Discovery Questions (those that specifically support exploring of issues, barriers and priorities; problem-solving; and goal-setting).
2. To reflect on practice.
3. To listen rather than provide information.
4. To support goal-setting through SMARTER (Specific, Measurable, Action-oriented, Realistic, Timed, Evaluated, Reviewed) planning.

Healthy Conversation Skills training typically consists of two 3- to 4-h group sessions over 1 week to allow time for practising and reflecting on skills. Training is delivered by one or two facilitators experienced in group work and behaviour change to a group of around 6–16 trainees. This is followed by a period of on-going support, which may include a phone call or visit from one of the trainers to find out how skills are being implemented in practice. The phone call/visit allows trainees to reflect on the training, how they have implemented their new skills, any barriers to their implementation and plans for continued or increased use, including embedding self-reflection and peer reflection as part of normal practice. All follow-up activities are also opportunities to collect evaluation data to assess the effectiveness of the training. Undertaking these activities from 1 month post-training is based on an assumption that staff would have opportunities to practise their new skills, and if they were finding this challenging, it would be a good time to reflect on this and make plans for progress. Further follow-ups can be undertaken at later stages to assess long-term use of the skills in practice.

Use of Artificial Intelligence to understand adults' thoughts and behaviours relating to COVID-19

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COVID-19; lockdown; attitudes; behaviours; Artificial Intelligence

Abstract

Aims: The outbreak of severe acute respiratory syndrome coronavirus 2 (COVID-19) is a global pandemic that has had substantial impact across societies. An attempt to reduce infection and spread of the disease, for most nations, has led to a lockdown period, where people's movement has been restricted resulting in a consequential impact on employment, lifestyle behaviours and wellbeing. As such, this study aimed to explore adults' thoughts and behaviours in response to the outbreak and resulting lockdown measures.

Methods: Using an online survey, 1126 adults responded to invitations to participate in the study. Participants, all aged 18 years or older, were recruited using social media, email distribution lists, website advertisement and word of mouth. Sentiment and personality features extracted from free-text responses using Artificial Intelligence methods were used to cluster participants.

Results: Findings demonstrated that there was varied knowledge of the symptoms of COVID-19 and high concern about infection, severe illness and death, spread to others, the impact on the health service and on the economy. Higher concerns about infection, illness and death were reported by people identified at high risk of severe illness from COVID-19. Behavioural clusters, identified using Artificial Intelligence methods, differed significantly in sentiment and personality traits, as well as concerns about COVID-19, actions, lifestyle behaviours and wellbeing during the COVID-19 lockdown.

Conclusions: This time-sensitive study provides important insights into adults' perceptions and behaviours in response to the COVID-19 pandemic and associated lockdown. The use of Artificial Intelligence has identified that there are two behavioural clusters that can predict people's responses during the COVID-19 pandemic, which goes beyond simple demographic groupings. Considering these insights may improve the effectiveness of communication, actions to reduce the direct and indirect impact of the COVID-19 pandemic and to support community recovery.

INTRODUCTION

On 11 March 2020, the World Health Organization (WHO) announced that coronavirus disease 2019 (COVID-19) was a global pandemic.[1] The disease is caused by a virus called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The actual and estimated infection rate suggests that for many people the disease is not life-threatening. However, the severity of illness and mortality risk varies between countries, regions and population subgroups. For instance, in May 2020, it was reported that age, male sex, obesity and underlying illness had emerged as risk factors for severe COVID-19 or death.[2]

Governments across the world have taken a range of actions to reduce the risk of infection and spread including the introduction of new legislation and policy, as well as public health messages, and the closing of their borders. In many countries, governments have enforced a period of lockdown that has typically included a requirement for people to stay at home unless they are key workers or have other essential reasons for leaving their home.[3,4]

Understanding the attitudinal and behavioural responses to COVID-19 and the associated lockdown is critical in building evidence to inform current and future communication and messaging, public policy, and the development of interventions to support risk mitigation efforts. This evidence can also provide insights to identify and support subgroups of a population who may be at greater risk of infection, and the unintended consequences of COVID-19 lockdown. As such, we have delivered a time-sensitive study of adults' thoughts and behaviours relating to COVID-19 to better understand the response and potential impact of the pandemic.

METHODS
Participants
The original sample comprised of 1126 respondents from the general population. Twenty participants were removed for either reporting an age < 18 years or an infeasible age. Of the remaining sample, there were 845 females, 249 males, 8 reported other for gender and 4 preferred not to say.

Measures
An online survey was developed to explore adults' thoughts and behaviours relating to COVID-19. The survey comprised eight sections utilising a combination of closed and open questions: (1) demographics; (2) thoughts and behaviours relating to COVID-19 including knowledge of symptoms, actions to reduce infection and spread; (3) impact on employment such as working from home and the perceived impact on work productivity; (4) impact of home schooling on work and health; (5) impact on health and lifestyle behaviours such as sleep, alcohol, diet, physical activity; (6) wellbeing, which was measured using the Warwick-Edinburgh Wellbeing Measure;[5] (7) sources of information about COVID-19; and (8) additional comments. Please see Supplementary Table 1 for an overview of the online survey. Prior to launching the survey, a pilot study was conducted with a diverse sample of adults.

Procedure
Between 8 April and 15 May, the survey was disseminated using social media, email distribution lists, website advertisement and word of mouth. The survey was hosted by Qualtrics LLC; a third-party online survey administration platform. Inclusion criterion was age ≥ 18 years.

The study was granted ethical approval by the School of Psychology Research Ethics Committee at University of Leeds (REC number PSYC-20).

Statistical analysis
Due to the insufficient number of participants reporting 'other' or 'prefer not to say' when asked about their gender, these participants were removed. Thus, the final sample included in the statistical analysis was 1094 of which 72.6% (794) were from the United Kingdom and 27.4% (300) from the rest of the world; 77.2% (845) were female, the average age was 39.4 ± 12.7 and 29.6% (324) reported having children 18 years of age or younger. The average age of participants was 39.4 years; for men the average was 40.8 and for women 38.9. Eighty-six percent of respondents reported having at least one risk factor.

We fit generalised linear models with main effects for all statistical analysis described in the results section. Statistical analyses were performed using R[6] (version 3.6.2) and the tidyverse (version 1.3.0),[7] and VGAM (version 1.1-2) packages.[8] Wellbeing was treated as a continuous outcome. Risk mitigation was defined as the sum of the number of measures a respondent indicated taking and treated as a Poisson random variable; this assumption appears reasonable in our data. Knowledge of symptoms of COVID-19 and concerns about COVID-19 were modelled using logistic regression. Because 'none of the above' was not a possible option, failing to select any choice on these questions was treated as a negative response for that option. Likert-type scale questions regarding the impact of COVID-19 were modelled with Adjacent Category Logit models assuming proportional odds. Statistical significance was defined as a $p < .05$.

All responses were modelled as a function of age as a numeric covariate, gender (male or female), Index of Multiple Deprivation (IMD; numeric: 1–10 as identified using the English Indices of Deprivation,[9] whether the person had children aged 0–4, 5–11, and 12–18 years (three separate binary variables), whether respondents were in the high risk categories for severe illness from COVID-19 infection as identified by the UK Government,[3] and reported income. Income was treated as a numeric variable with the highest income in the selected bracket (see Supplementary Table 1).

RESULTS
Descriptive statistics
Table 1 provides an overview of participants' demographic characteristics and Supplementary Table 2 provides an overview of participants' income, perceptions of the impact of COVID-19 on finance, change in employment due to COVID-19 and, where parents are home schooling, the impact it has on job productivity, ability to perform their job role, and on sleep and relaxation.

We found that concerns about infection, illness or death, spreading COVID-19 to others, the impact on health services, the economy and employment were high, with significantly higher concerns for subgroups including people identified as at high risk from COVID-19 infection and people reporting a lower income (see supplementary materials).

Impact of COVID-19 on lifestyle behaviours
Figure 1 displays the impact of COVID-19 on lifestyle behaviours. People who are older were more likely to report a more negative impact of COVID-19 on their ability to make financial ends meet (OR = 0.985, $p = .0022$), whereas people with a higher income were more likely to report a more positive impact (OR = 1.21, $p < .0001$). People with a higher income were less likely to indicate that they are cutting back on their spending (OR = 0.9201, $p = .0037$).

People who are older were less likely to report more change in their diet compared to pre-COVID-19 (OR =

Table 1

Demographics summary of participant age, gender, country, pregnancy status, parents with children under 18 years, parents with children aged 0–4, 5–11, 12–18 years, and high risk group

Participant characteristics

Age[a,b]	39.4 ± 12.7
Gender	
Male	22.8% (249)
Female	77.2% (845)
Country	
United Kingdom	72.6% (794)
Other	27.4% (300)
Pregnant ($n = 834$)	
Yes	0.7% (8)
No	75.5% (826)
Children ($n = 1082$)	
Yes	29.6% (324)
No	69.3% (758)
Children 0–4 years	
No	92.0% (1006)
Yes	8.0% (88)
Children 5–11 years	
No	86.2% (943)
Yes	13.8% (151)
Children 12–18 years	
No	87.6% (958)
Yes	12.4% (136)
High risk group[c]	
None listed	78.6% (860)
At least one	21.4% (234)

[a]Mean and standard deviation.
[b]$n = 1094$ except where otherwise specified.
[c]High Risk Group = people identified as at high risk of severe illness from COVID-19 by UK Government.

0.991, $p = .013$); people with risk factors were more likely to report more change in their diet and a change in their sleep compared to pre-COVID-19 (OR = 1.39 and 1.31, $p = .00051$ and .00035, respectively). People who are older, women, and people with children aged 5–11 years were more likely to report an increase in alcohol consumption (OR = 1.013, 1.25 and 1.47; $p = .0017$, .041 and .0091, respectively). There was no discernible difference among groups regarding change to the amount or type of physical activity that they are engaging in compared to pre-COVID-19.

Impact of COVID-19 on wellbeing

Supplementary Table 4 shows the percentage and participant counts for each of the items of the Warwick-Edinburgh Wellbeing Measure. The mean aggregate wellness score was 40.46; the standard deviation was 15.22. Across the items in the scale, large numbers of participants responded with 'not at all' or 'rarely'.

Although people who are older and people with children aged 12–18 years reported statistically higher wellbeing scores, the actual difference was small. Per additional year of age, people saw an average increase of 0.0800 ($p = .0134$); people with children aged 12–18 years reported an average wellbeing score 2.58 points higher than those without ($p = .027$), whereas the standard deviation of wellbeing was 15.2.

EXPLORATION AND PREDICTION USING TEXT-DERIVED FEATURES
Text data

Free text was collected across 14 questions which were distributed throughout the survey sections. As a pre-processing step all responses were concatenated for each participant and tokenised using spaCy's large English web model.[i] Tokenisation is the process of separating text into character sequences (words, numbers, punctuation). The length of the concatenated responses (i.e. the number of tokens) varied from 1 to 1934 (mean = 228, median = 173.5). The histogram of token counts is presented in Supplementary Figure 2.

The concatenated text for each participant was further processed to extract sentiment scores and personality scores. Sentiment scores were obtained using VADER Sentiment Analysis tool.[10] All scores returned by the tool (positive, neutral, negative, compound sentiment) were used in the analysis. Personality scores were obtained using proprietary software by Scaled Insights. The software takes as input a language sample and produces 114 personality features. The machine learning models which underpin the software have been trained and evaluated on large samples of annotated text.

The 118 (114 personality, 4 sentiment) described previously were used as input in a number of machine learning models described below. Because the reliability of the personality modelling software depends on the number of words provided in the language sample, the following analysis was restricted to participants ($N = 803$) whose combined text response consisted of at least 100 tokens.

Machine learning was used in two settings: unsupervised (clustering) and supervised (classification or regression).

Clustering

The unsupervised setting used a clustering algorithm (k-means) to separate participants into groups based on their personality and sentiment scores. Since the k-means algorithm requires that the number of clusters be specified, we first experimented with different values of k. We used two heuristics (sum of squared distance and an elbow plot, and degree of separation between clusters and a silhouette plot) to check which k from a range between 2 and 10 resulted in most coherent and disparate clusters. Both heuristics indicated that two clusters was the optimal number. Subsequently, we applied the k-means algorithms with $k = 2$ to the personality and sentiment scores data. This resulted in two clusters of fairly equal size (Cluster_1: 436, Cluster_2: 367; see Figure 2 for a visualisation of the clusters). Table 2 lists the ten most differentiating features and the cluster centroid values. Cluster_1

Use of Artificial Intelligence to understand adults' thoughts and behaviours relating to COVID-19
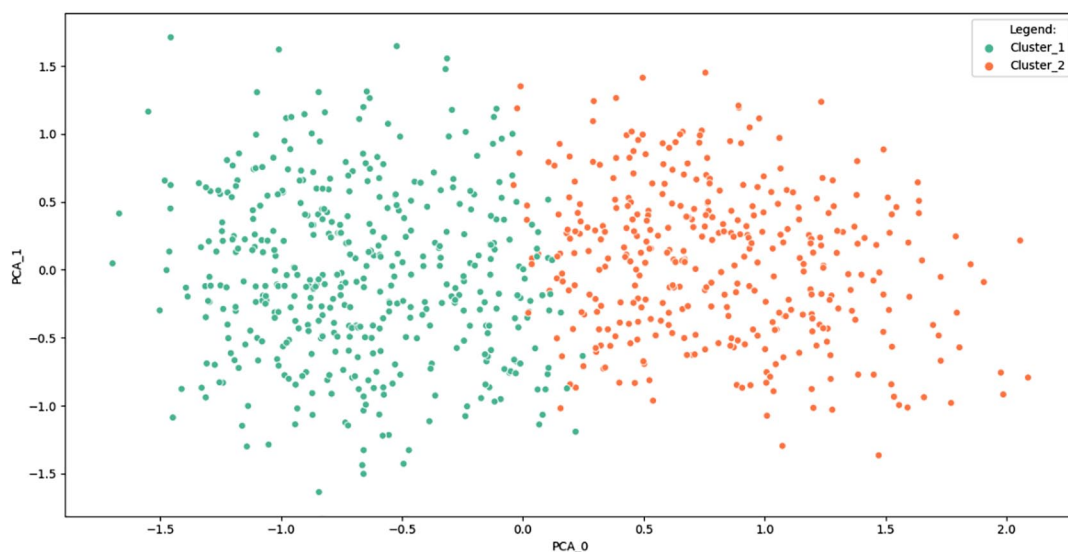

Figure 1

Change in diet (panel a), alcohol (panel b), amount of physical activity (panel c), type of physical activity (panel d), and amount and quality of sleep (panel e), compared to pre-COVID-19

Figure 2

Visualisation of clusters using principal component analysis (PCA)

Table 2

Ten features with largest scores differences between clusters (centroid values for each cluster given)

Feature	Cluster_1	Cluster_2
Compound sentiment	0.60	−0.70
Neurotic	0.56	0.79
Insecure	0.38	0.61
Trust	0.55	0.41
Adventurous	0.44	0.30
Dutiful	0.76	0.63
Stressed	0.64	0.76
Happy	0.32	0.20
Depressed	0.59	0.70
Aggressive	0.41	0.53

has positive compound sentiment and higher values for trust, adventurousness, dutifulness and happiness, while Cluster_2 has higher values for neuroticism, insecurity, stress, depression, aggression, and negative compound sentiment.

The responses of the two clusters was compared for concerns, mitigating actions, impact on lifestyle behaviours and wellbeing (Table 3). Three out of four lifestyle behaviours (diet, physical activity, sleep) and the wellbeing score had all statistically significant ($p < .05$) differences between the two clusters. Three out of six concerns (becoming infected, severe illness, and impact on employment) had a weaker result at $p < .1$. Participants in Cluster 2 (with more negative sentiment, more neurotic and insecure) have higher scores for concerns and impact on lifestyle behaviours. They also have a lower wellbeing score. A possible contributing factor to these findings might be the fact that the number of people identified as at high risk of severe illness from COVID-19 was significantly greater in Cluster_2 ($N = 126$) than Cluster_1 ($N = 96$) (two proportion z-test, $p = .0001$).

Prediction models

In addition to clustering participants based on their personality and sentiment scores, we investigated to what extent these features can be used for predicting concerns, mitigating actions, impact on lifestyle behaviours, and wellbeing score in the context of COVID-19. A model which predicts these attitudes and behaviours and requires only a language sample could be potentially used within a digital environment to better identify people who might be more likely to be negatively impacted and offer them preventive support. The aim of the current study is to assess to what extent only these features (personality and sentiment) are predictive.

General prediction set-up

For each attitude or behaviour, we trained a separate binary or multi-class classifier. We first explored a range of different classifiers (logistic regression, support vector machine, stochastic gradient descent classifier, and random forest). Across all classifiers we found that Random Forest achieved the best results and was chosen for further tuning. The algorithm parameters were tuned on a training set (shuffled and stratified 75% of the original data). The tuned parameters

were then used to train the final classifiers using 10-fold cross-validation.

Concerns about COVID-19

The responses relating to concerns were all expressed on a 1–10 scale. To form classes, the values were split into 'low' (1–3), 'medium' (4–7) and 'high' (8–10). Area Under the Receiver Operating Characteristics (AUROC) is used to evaluate the multiclass problem.

Overall, the classifiers for COVID-19 related concerns are performing only slightly better than random (AUROC = 0.5). The highest performance is achieved when predicting the concern for spreading the virus (AUROC = 0.58); see Supplementary Table 5.

Mitigating COVID-19

The mitigating actions each formed a binary class (i.e. someone either used particular mitigation method or not). Accuracy score is used for evaluation.

The two highly skewed mitigating actions (social distancing and taking all possible actions) achieved the highest accuracy scores. The scores are expected due to highly skewed class distribution. Among the other actions, predicting the use of protective apparel and increased shopping achieved highest scores (Acc. = 0.65 and 0.69 respectively); see Supplementary Table 6.

Impact of COVID-19 on lifestyle behaviours

The responses on the impact of COVID-19 on lifestyle behaviours used scales which were converted to classes as follows. Scale -2—2 (used for alcohol consumption and physical activity) was converted to 'Decrease' (-2,-1), 'No Change' (0), 'Increase' (1,2). Scale 0—4 (used for diet and sleep) was converted to 'No or little impact' (0,1), 'Some impact' (2), 'Significant impact' (3,4). Area Under the Receiver Operating Characteristics (AUROC) is used to evaluate the multiclass problem.

Overall, the classifiers performed slightly better than random, with highest scores achieved by classifiers for alcohol consumption (AUROC = 0.61) and sleep (AUROC = 0.6); see Supplementary Table 7.

Table 3				
Differences between clusters in mean scores for concerns, mitigating, actions, impact on lifestyle, and wellbeing score				
	Cluster 1	**Cluster 2**	**Result**	***p*-value**
Concern: becoming infected	5.87	6.21	−1.91	.06
Concern: severe illness or death	5.44	5.8	−1.66	.1
Concern: spreading to others	7.9	7.88	0.15	.88
Concern: impact on the health service	8.03	8.1	−0.42	.68
Concern: impact on the economy	7.44	7.42	0.15	.88
Concern: impact on employment	5.43	5.82	−1.8	.07
Actions: social distancing	425	357	0.18	.86
Actions: self-isolation	185	192	−2.8	.01
Actions: wearing protective apparel	148	131	−0.52	.6
Actions: shopping online	212	201	−1.74	.08
Actions: increased shopping	139	114	0.25	.8
Actions: all above	22	20	−0.26	.8
Lifestyle: diet	1.47	1.66	−2.73	.01
Lifestyle: alcohol	0.1	0.03	1.06	.29
Lifestyle: physical activity	−0.2	−0.51	3.76	<.01
Lifestyle: sleep	1.58	2	−4.92	<.01
Wellbeing score	45.79	41.15	6.84	<.01

t-test used for numeric variables (concerns, lifestyle, wellbeing), two proportion *z*-test used for binary variables (actions). All results rounded to two decimal places.

Impact of COVID-19 on wellbeing

The numeric Warwick-Edinburgh Wellbeing Measure (with a range of possible scores between 14 and 70) was used directly as a target variable. Participants with incomplete responses were removed from analysis and $N = 794$ responses were used in the prediction model. Mean absolute error and explained variance were used for evaluation.

The best prediction model had a mean absolute error of 6.43 and explained variance score of 0.12.

DISCUSSION

This study aimed to explore adults' thoughts and behaviours about COVID-19, and in doing so, provide insights about how people have responded to the global pandemic. Our study findings demonstrate a relationship between concern about infection and illness and death, where concern of both increases as age increases. Likewise, people who identify within one of the high-risk groups for severe illness from COVID-19 reported greater concern about being infected, and severe illness and death. This may reflect the public health messages that younger people have a lower risk of severe illness and death from COVID-19, and the increased risk for people aged 70 years and above, and identified as at high risk.

Our findings demonstrate that adults' physical activity, diet, sleep and alcohol consumption have been impacted – for some more than others. Greater changes in diet and sleep were reported by people in the groups identified as at high risk of severe illness from COVID-19 which may reflect the greater restrictions on daily life compared to people without a high risk status. This greater restriction on daily life and thus, likely greater change for people in the high risk groups, may explain the increased change in sleep amount and quality among this group compared to people without a high risk status. As such, given the importance

of sleep and potential impact of a reduced amount and quality of sleep, it is likely that COVID-19 and the associated restrictive measures will have greater direct and indirect impact on people identified as at high risk of severe illness from COVID-19.

Our study also investigated the potential usefulness of features derived from participants' language sample to gain further insights about people's personality attributes and sentiment. Using those features, we were able to cluster participants based on their personality and sentiment – one of the clusters could be characterised as more neurotic and insecure, with more negative sentiment. That same cluster showed several higher scores for concerns about COVID-19, a greater impact on lifestyle, as well as a lower wellbeing score. The clustering approach is preferable, because it does not require that a categorisation is imposed ahead of analysis (as it would be with a classification approach). Instead, the grouping of individuals is derived from the data. Furthermore, cluster membership for any new individual can easily be determined by using similarity between the individual's inferred features and the cluster centroids.

This link between personality traits and concerns, and impact on lifestyle and wellbeing provides additional insights for public health institutions and other organisations that goes beyond demographic information. In particular, within the context of interventions delivered in digital environments, the use of personality modelling from text could enable the use of more personalised advice and support. As the second cluster shows higher scores for depression, stress, and anxiety, this approach could be especially helpful for identifying people who might benefit from extra support. Furthermore, communications tailored using personality traits have been shown to be perceived as more effective.[11] For example, someone who is dutiful (one of the characteristics of Cluster 1) can be motivated to follow social distancing by highlighting guidelines set by authorities. This opens the possibility of

using digital channels to personalise public health communications using readers' personality traits. Since personalised interventions and personality modelling from text remains an active research domain, it is key to carefully and thoroughly consider the appropriate design and implementation of such a system within the public health context.

This study is not without limitations. First, this article represents a cross-sectional analysis of the impact of COVID-19 on adults' thoughts and behaviours, and as such informs about a period that for most represents lockdown. The data do, however, provide much needed findings of the impact of lockdown resulting from COVID-19, and with further data collection through follow-up collections post-lockdown, the longer-term impact can be assessed. Second, the methods of dissemination meant that we were unable to control for a representative sample and as such we would suggest caution in suggesting that our findings provide a representative picture of how the general population have been impacted by the COVID-19 outbreak. This includes the high proportion of females who completed the survey compared to males, which is commonly reported in online survey-based research. Finally, for some of the survey questions relating to lifestyle behaviours, we have identified the extent of change during COVID-19 but have not indicated direction. Further exploration of the corresponding open-ended answers will provide details regarding the direction of change.

CONCLUSION

Our study provided insights into adults' thoughts and behaviours relating to the COVID-19 pandemic during a time period that was for most, a lockdown. Our findings demonstrate high concern relating to infection, severe illness or death, and in particular spreading infection to others. Across the board, lifestyle behaviours have changed compared to pre-COVID-19, in particular, the amount and quality of sleep.

People identified as at high risk of severe illness from COVID-19 were impacted the most. This, coupled with

the greater restrictions on daily life as directed by government guidance, may have a substantial impact on both mental and physical health of this subpopulation. National and local governments must consider the short- and longer-term direct and indirect impacts of the COVID-19 pandemic, where, as the current study findings demonstrate, restrictions such as national and local lockdowns have a substantial effect on population health. It is imperative that these impacts are considered within recovery strategies, and that every effort is made to learn from the unique challenges of a global pandemic so that these learnings can be implemented in the future. Our findings provide additional insights for stakeholders working in the area of population health, and efforts to support those most affected warrants attention. In particular, public health communication and risk mitigation planning that both addresses high concern and builds confidence given the current context of a gradual release from lockdown and the likely associated impact, is needed. Use of Artificial Intelligence such as the methods used in the current study could provide a mechanism of personalising communication which may, for instance, support public adherence to risk mitigating behaviours.

CONFLICT OF INTEREST
The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: SWF & AP are employed by Scaled Insights.

ETHICAL APPROVAL
Ethical approval was granted by the School of Psychology at the University of Leeds. Reference number: PSYC-20.

Use of Artificial Intelligence to understand adults' thoughts and behaviours relating to COVID-19

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NOTE
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PEER REVIEW

Teaching young consumers in Europe: a multicentre qualitative needs assessment with educators on food hygiene and food safety

Teaching young consumers in Europe: a multicentre qualitative needs assessment with educators on food hygiene and food safety

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Abstract

Aim: Foodborne illnesses have a significant global burden and can be life-threatening, with higher risk in vulnerable groups such as children. SafeConsume is an EU-funded, transdisciplinary project aiming to improve consumers' food safety behaviour. Developing educational resources on food safety for use in schools has potential to improve teaching of our young consumers. The aim of this study was to explore school educators' attitudes, behaviours and knowledge towards food hygiene, safety and education.

Methods: Focus groups and interviews in England, France, Portugal and Hungary explored educator knowledge, skills, intentions and beliefs around educating young people (11–18 years) about food safety. Data were analysed using NVivo and emerging themes were applied to the Theoretical Domains Framework.

Results: A total of 48 educators participated. Knowledge, confidence and skills to teach food safety to young people varied depending on background and training. Educators reported they had a role to teach food safety to young people, were positive about delivering education and optimistic they could improve students' food safety behaviour. Barriers to teaching included lack of national curriculum coverage, limited time and money, and lack of facilities. Educators reported that social influences (family, celebrity chefs, public health campaigns and social media) were important opportunities to improve young peoples' awareness of food safety and consequences of foodborne illness.

Conclusion: Educator food safety expertise varied; training could help to optimise educator knowledge, confidence and skills. Ministries of Health and Education need encouragement to get food safety incorporated further into school curricula across Europe, so schools will be motivated to prioritise these topics.

INTRODUCTION

Foodborne illnesses are a global burden and WHO Director General advised that '*food safety is a hidden, and often overlooked, problem*'. WHO[1] defines food hygiene as 'the conditions and measures necessary to ensure the safety of food from production to consumption' and food safety to include 'safe food handling'. Every year almost one in 10 people globally develop foodborne illnesses and 420,000 people die.[2] WHO[2] estimates that there are 23 million foodborne illnesses and 5000

PEER REVIEW

Teaching young consumers in Europe: a multicentre qualitative needs assessment with educators on food hygiene and food safety

deaths in Europe annually. Correct food handling and hygiene practice could prevent most foodborne illness.[2] Although anyone can get a foodborne illness, children are at a higher risk of developing infection and having serious consequences along with pregnant women, older adults and immunocompromised individuals.

SafeConsume is an EU-funded, transdisciplinary project involving 32 partners from 14 countries which aims to reduce foodborne illnesses. e-Bug, operated by Public Health England (PHE), lead on the SafeConsume educational work package. e-Bug with their European partners develop educational resources for children and young people to improve hygiene behaviours.[3] Educating children and young people on food hygiene and microbiological food safety is an opportunity to create food safety-conscious consumers for the future, therefore reducing the future burden of foodborne illness. This study is an outcome of the SafeConsume EU project.

Several studies have explored children and young peoples' knowledge and behaviours towards food hygiene and safety in the UK, Europe and USA,[4–9] but studies exploring educator views are limited. In a small study, UK teachers reported that the most effective method to teach food hygiene and to reinforce food safety messages was with demonstrations of good practice and practical activities involving young people preparing food.[10] Swedish educators believed food safety was an important part of the school, home and consumer studies (HCS).[11] Almost all countries have in their school curricular topics covering food hygiene and safety for students 11–18 years old.[12]

The aim of this study was to explore educators' needs in relation to teaching about food hygiene and food safety across four European countries to inform the development of educational resources to address any gaps in knowledge, skills, attitudes and beliefs. Findings from complementary research completed with young people and curriculum overview were reported by Syeda et al.[12]

METHODS
Research design
Qualitative interviews and focus groups with educators were conducted during November 2017 – June 2018 in four European countries: England, France, Hungary and Portugal. These four European countries were part of the SafeConsume EU project educational work package noted in the introduction. Standardised protocols for the research were developed, reviewed and agreed by the project team.

Study setting
Secondary or high schools that teach students aged 11–18 years were recruited; between four and nine schools were recruited per country (see Table 1). Recruitment aimed to represent schools with a mixture of high and low socioeconomic status; for example, a mixture of schools located in affluent and deprived areas (as defined by the specific country). Furthermore, recruitment also aimed to represent a mixture of geographical locations (rural and city) in each country. Rural located schools are generally smaller with a lower population density and located in towns, villages and fringe areas, whereas city schools are generally larger with a higher population density and located in larger cities. The research areas did not have any known foodborne illness outbreaks or product recalls during the study that could have affected the findings.

Participants
A minimum of eight educators in each country employed at a school that taught 11- to 18-year olds food, technology or science-related subjects. Educators were considered appropriate for the study if they were qualified and teaching food, technology or science-related subjects.

Recruitment
Each country stratified schools in two geographic locations into high and low socioeconomic groups, randomised the strata, and invited each school to participate by letter, email and telephone. If schools declined to participate, the next school in the randomised list was approached. Invitation continued until

data saturation was reached. Educators were given an incentive in each country except for Portugal; £20 vouchers in England; USB sticks in France; small gift packs in Hungary.

TOPIC GUIDES AND BEHAVIOURAL THEORY
Comprehensive topic guides were developed by the project team using the Theoretical Domains Framework (TDF)[13] to guide questions to explore knowledge, skills, beliefs and attitudes around food hygiene and food safety, motivation and opportunities. Questions also discussed what resources educators currently use or would like to use for teaching about food hygiene and food safety.

The TDF describes 14 factors from theories of behaviour change that fall under the categories of capability, opportunity and motivation as outlined in the Behaviour Change Wheel described by Michie et al.[13] The TDF was used as it can help explain the behaviours required for successful education of food hygiene and food safety. The TDF can also help draw conclusions on the need for future appropriate interventions, for example, developing educational resources, establishing practical experience or delivering training. The conclusions drawn from our qualitative study will help inform future interventions (not included in this study).

Researchers in England and France piloted the topic guide with a food technology and science educator, respectively, and minor modifications were made following educator comments. All researchers within their respective country commented on the topic guide to ensure relevance in their country; therefore, the topic guides were standardised across the four countries and translated into their respective language.

DATA COLLECTION
Semi-structured interviews and focus groups with educators were conducted and facilitated in a private classroom at the schools by researchers in each country; all researchers were trained in qualitative research methods (C.B., R.S. and C.H. in England; P.T.L. and V.L.H. in

Teaching young consumers in Europe: a multicentre qualitative needs assessment with educators on food hygiene and food safety

Table 1.

Number of participants (educators) per country

Country	Rural schools	City schools	Educator interview	Educator focus group (participants)	Total educators
England	3	3	5	1 (3)	8
France	4	5	10	0	10
Portugal	1	3	9	0	9
Hungary	2	2	0	4 (21)	21
Total	10	13	24	5 (24)	48

France; T.I. and A.K. in Hungary and M.T. and J.F. in Portugal). The interviewer(s) did not know any of the educators prior to the data collection and all facilitators except one were female. Educators were provided with a detailed information sheet, were aware of the aims of the study and the interviewing researcher's organisation. Second researchers were often present to observe. Interviews and focus groups lasted between 37 and 76 min and many had to be 40–50 min to adhere to the duration of a lesson. All researchers made reflective notes following each data collection to iteratively feedback on topic guide development. All data were recorded, encrypted, anonymised and transcribed verbatim and checked for accuracy; transcripts were not returned to the educators. Interviews and focus groups were conducted until data saturation was reached.
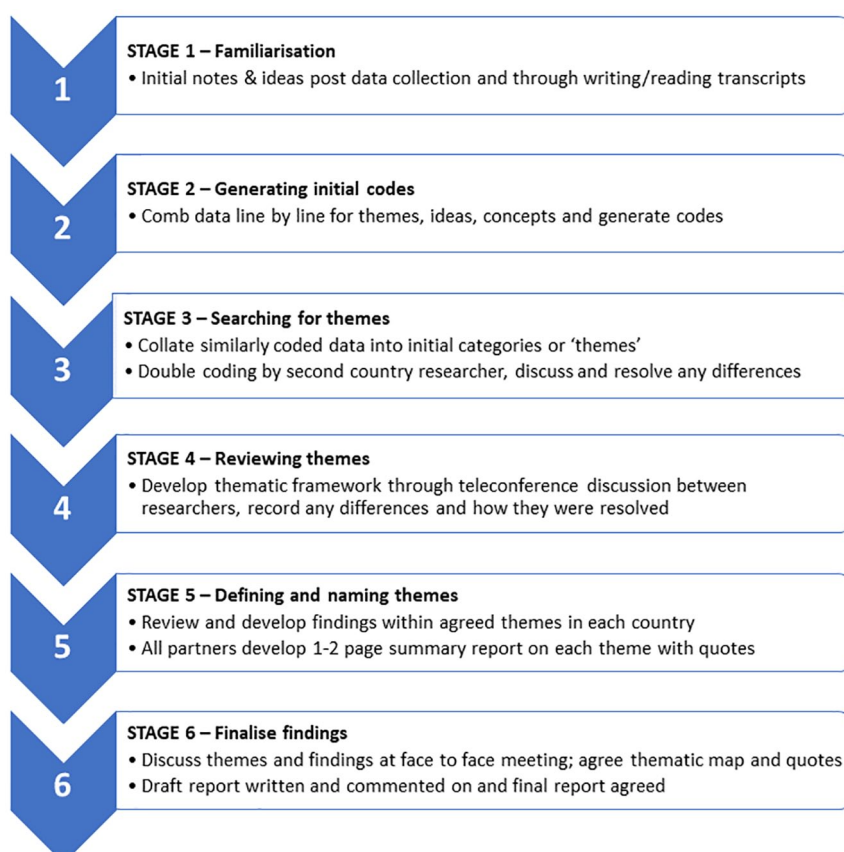
DATA ANALYSIS

Qualitative data was initially analysed individually by each country, using an agreed common six-stage thematic analysis[14] (Figure 1).

NVivo software version 11 (QSR International Pty Ltd. Version 11, 2015) was used as a tool to organise and code the data for thematic analysis. Initial thematic analysis was an inductive, iterative process running in parallel to data collection. One researcher from each country analysed all the country-specific data and a second researcher double coded 20% of their country data, agreeing the main emerging themes

Figure 1.

Six-staged thematic analysis

STAGE 1 – Familiarisation
• Initial notes & ideas post data collection and through writing/reading transcripts

STAGE 2 – Generating initial codes
• Comb data line by line for themes, ideas, concepts and generate codes

STAGE 3 – Searching for themes
• Collate similarly coded data into initial categories or 'themes'
• Double coding by second country researcher, discuss and resolve any differences

STAGE 4 – Reviewing themes
• Develop thematic framework through teleconference discussion between researchers, record any differences and how they were resolved

STAGE 5 – Defining and naming themes
• Review and develop findings within agreed themes in each country
• All partners develop 1-2 page summary report on each theme with quotes

STAGE 6 – Finalise findings
• Discuss themes and findings at face to face meeting; agree thematic map and quotes
• Draft report written and commented on and final report agreed

together. Main themes were then discussed between all countries and an agreed consensus for a coding framework was reached through discussions at two face-to-face meetings and monthly teleconferences. Once the main codes were agreed, an additional data analysis stage was conducted, and the findings were applied to the TDF. Data for each country was summarised in a matrix Excel document with each theoretical domain and relevant corresponding quotes from each country translated into English. Results were

PEER REVIEW

Teaching young consumers in Europe: a multicentre qualitative needs assessment with educators on food hygiene and food safety

again discussed leading to implications, including the needs and design of educator interventions. Each country provided a written report for educator findings based on the TDF with supporting quotes and educator needs to facilitate student education.

RESULTS

A total of 48 educators participated in 24 interviews and 5 focus groups from 10 rural and 13 city schools from the 4 countries (Table 1). Key themes are described within each domain of the TDF and in Table 2 with reflective quotes, other less prevalent themes are summarised but not included in Table 2.

KEY DOMAINS

Knowledge

Educator knowledge varied considerably across the four countries. Overall, most educators (except those in Portugal) had good knowledge on the risks and consequences of cross contamination, reheating foods and foodborne illness. Educators' understanding of 'food safety' varied, some educators discussed knowledge of 'farm to fork' and preventing foodborne infections and some educators discussed chemical hazards in food rather than microbiological hazards.

Few educators knew the types of foodborne microbes including *Salmonella enterica, Listeria monocytogenes* and *Escherichia coli*. Knowledge and perception of food hygiene varied: in England educators understood food hygiene to be about personal hygiene, that is, washing hands, yet in France and Portugal educators discussed food hygiene in terms of cooking precautions and cleaning the cooking environment. Some educators understood the link between food hygiene and food safety and the two were interrelated, but this was not consistent. Educator knowledge was dependent on their educational and teaching background: in general, most educators did not have any specialisation or qualifications in food subjects. In Portugal, most educators had a biology degree and in France a science degree. Educators in other countries had other

backgrounds, including working in industry.

Skills

Educators reported they have skills to be creative, to adapt and develop trustworthy and interactive resources including playing cards, posters, activities and PowerPoints. Some educators had taught scientific experiments in class including culture of yeast, culture from a door handle, microscope observations of yoghurt and experiments. Many educators reported skills to use online resources in class including videos, games, YouTube and so on. Educators in Hungary reported a lack of confidence to use smart technology, including projectors. A few educators in France reported feeling skilled to deliver lessons on microbes in general but not foodborne microbes. In Portugal, for this subject area, educator skills are outsourced when experts come in and talk about microbes.

Educators in all countries reported they have the skills in their personal life to check food has been cooked correctly and is safe to eat and share these skills with their students. They reported checking for doneness of meat through no pink bits and juices running clear. Skills in using cooking implements such as temperature probes to educate young people about food hygiene varied across countries. In England, educators would explain to older students how temperature probes were used, but in Portugal, educators did not use temperature probes; in France, educators do not deliver practical lessons, so probes are not used.

Social influences

Educators reported that the family has the biggest influence on students' initial behaviour as they grow up and take on parents' habits, attitudes and behaviours towards food hygiene learning. In all countries, educators reported that friends can also influence food hygiene behaviour and in France school nurses also play a role during health education classes.

Most educators reported that celebrity chefs on TV could have an impact on changing students' existing food hygiene behaviour. Real-life media stories about foodborne illness or friends/family having foodborne illness, public health campaigns and advertisements were considered by educators, to have the biggest capacity to change students' future behaviour. Social media such as Facebook and YouTube are popular methods of communication for students when searching for information on these topics. Educators perceive online recipes as the preferred media for students to learn about cooking, over physical recipe books.

Educators reported that they could have a certain influence on student behaviour through providing advice. Cultural differences in cooking and food hygiene were highlighted by educators, and they reported that making students aware of these differences would contribute to understanding around hygiene and food safety. Educators across countries reported that student knowledge about food hygiene and food safety was basic.

Beliefs about capabilities

Educators reported being capable of teaching the basics of food hygiene such as hand washing and personal hygiene; and food safety such as safe use of equipment and re-heating. However, cross contamination, food microbiology and foodborne illnesses were described as more difficult to explain to students. Educators reported that poor food hygiene may be difficult to improve in school as student behaviour is mostly influenced from habits they learn at home and from the media.

Level of educator confidence was influenced by lesson duration and prior experience of working with food. Many educators in France described themselves as 'at ease' to teach about microorganisms but less confident to teach about practical food hygiene; in France they do not have practical cooking lessons or school kitchens. In contrast, educators in England, where practical lessons are more common, did not feel capable of teaching about foodborne microbes especially if their

Teaching young consumers in Europe: a multicentre qualitative needs assessment with educators on food hygiene and food safety

Table 2.

Summary of main findings aligned to the TDF

TDF domain	Main themes	Key findings	Quotes
Knowledge	Food microbiology Food safety Food hygiene Cross contamination Foodborne illness Reheating foods Qualifications & training	Educator knowledge varied considerably across the four countries and varied on their qualifications and backgrounds. Some educators understood the link between food hygiene and safety, but it was not consistent.	'Food safety means] I can read what food contains . . . And I pay attention to storage at home and the proper handling of foods'. (Hungary) 'Food hygiene is about cross contamination where you're leaving, maybe if you've got raw meat and salad, or raw meat and cooked meat, and if you're crossing over with a knife, so if you're chopping the raw meat and then you're chopping the salad'. (England) 'Personally, healthy lifestyle it's what I mean by "food hygiene"' (France) 'Cross-contamination transmission, is where a food that could be good, can be contaminated with this kind of micro-organisms'. (Portugal)
Skills	Ability to adapt/develop resources Ability to cook Cooking temperature skills Making food safe to eat	Educators have skills to be creative, to adapt and develop trustworthy and interactive resources. Educators generally have basic cooking skills and the skills to check food is heated correctly and safe to eat.	'I've been teaching for a while now, so I have my "tricks". Most of the time I tell stories to motivate them'. (France) 'For example, during a biology lesson, somebody has a bag of chips, and we read up the ingredients. And they didn't know it. They didn't look at it at home. So, there are many things that we talk about'. (Hungary) 'We brought two experts from Ricardo Jorge Institute to do some experiences with kids about the microbes we have in our hands and the importance of washing hands'. (Portugal) 'The juices must run clear. I always say, put a knife in the thickest bit and then take the knife out . . . It's got to be hot hot . . . That's what I always say or piping hot right through'. (England)
Social influences	Family/Culture Media influence Curriculum Educator role to teach about food hygiene/safety	Family and cultural influences can impact student's behaviour as this is where educators believe students learn most of their food hygiene attitudes and behaviours. Educators perceive students to learn using the Internet and that is where students get a lot of their information from. The role of the teacher and curriculum influences were also reported by educators as a social effect.	'It could be useful learn more at school because some students, especially the younger ones, are very strict and they pass to their parents and want to do what they have learned at school, so I think it's important'. (Portugal) 'It's easier to approach the children from the angle of the internet. Today's students, including my children, are living in the world of the internet and cell phones. And perhaps, if we show them with it, they might look for it. Because I'm not sure, that if I tell them (without internet), they will do it at home'. (Hungary) 'I try to the extent of curriculum, I try not to deviate'. (France) 'It's definitely our responsibility to teach students about food hygiene and food safety'. (England)
Beliefs about capabilities	Ability to teach Ability to change behaviour Level of confidence	Educators feel capable of teaching certain elements of food hygiene, that is, hand washing and personal hygiene, but cross contamination and food microbiology was described as more difficult to deliver. Educator confidence depended on factors like lesson duration and prior food experience.	'I feel like I'm one step ahead of the students when I'm teaching it . . . I'm learning it myself to be able to teach it the following couple of days so, and then after that it's gone from my head as well'. (England) 'We teach them, but then we can't control whether they really wash their hands or wash the egg. It's very hard to verify if they apply the knowledge at home that we've taught them' (Hungary) 'I feel at ease to talk about immunology and microorganisms. Maybe I'm not extremely competent . . . for food hygiene and food born infections'. (France) 'These are not subjects that I usually teach with a lot of development'. (Portugal)
Beliefs about consequences	Personal experiences Student risky behaviours High-risk foods versus low-risk foods Educator perception of their teaching influence	Educators believe that school teaching can influence student's daily life and can be transferred to the home life. Educators felt that students have risky behaviours including missing critical hygiene points and lack concern about the consequences.	'I've been food poisoned three times . . . the first time was when I got my own house and I didn't cook salmon properly . . . then twice I've been poisoned from [name of fast food restaurant], with the salad bar'. (England) 'Sometimes I go to the girls' bathroom and I have already noticed that they do not wash their hands . . . They probably leave the bathroom and go to the bar to have their breakfast. They do not wash their hands because they have no wash habits, or they forget, or because they want to go to classroom . . . If they are my students, I tell: "don't you wash your hands?"'. (Portugal) 'It depends on home education. Because if they grow up in such an environment, that it is an important issue, then obviously it will be important for them. But if they don't grow up in such an environment, they will not care about it'. (Hungary) 'It's a domain where we manage to catch students attention'. (France)

(Continued)

PEER REVIEW

Teaching young consumers in Europe: a multicentre qualitative needs assessment with educators on food hygiene and food safety

Table 2.

Summary of main findings aligned to the TDF

TDF domain	Main themes	Key findings	Quotes
Environment, context and resources	Barriers to education / School facilities / Future resources	Barriers to teaching food hygiene and food safety include time, cost, lack of cooking/kitchen facilities, poor equipment, lack of content in the curriculum, different exam specifications, teacher training challenges, poor school hand hygiene facilities, socioeconomic differences between schools. Facilitators include new resources that are interactive and engaging.	'Curriculum time is cut all the time to give more time to English and Maths. So, you don't have very long [to teach food hygiene]. I have them for one term, a lesson a week for a term'. (England) 'Time. We don't have enough time. This is the problem, time. It's a lot of subjects, a lot of students and only a few hours. We have to do a lot of projects and reports, a lot of requests and resource management but we never have money to buy anything, it is very difficult'. (Portugal) 'We don't have an educational kitchen'. (Hungary) 'Human experience is livelier than books'. (France)
Memory, attention and decision processes	What teachers remember/struggle to remember / Decision making / Online training	Educators lack knowledge and memory around foodborne microbe names and causes of foodborne illness. Online training for educators was discussed positively and interactive videos and examples of everyday life are required for any training.	'I cheat in the lessons . . . We can talk about the whole digestive system, and learn about anatomy, but I'd better save 15 minutes from that lesson and to talk about it [food safety]'. (Hungary) 'I think online training must start with everyday life examples and then explain them'. (France) 'If we have some interesting videos [in the online training], it would be great. In Portugal, we don't share a lot of information . . . In Brazil, they have a lot of movies about restaurants. There are many things that would be interesting for kids, we do not have anything here. Here we don't do anything. We do not have that kind of resources'. (Portugal)
Intentions	Intentions to teach / Intentions to prevent foodborne illness	Educators have good intentions to teach food hygiene and food safety and have the intentions to make learning about these topics interesting, interactive and relatable to everyday life. However, intentions are dictated by the curriculum.	'It's incredibly important [teaching on food poisoning] . . . because obviously it has such a big impact on our healthcare system'. (England) It is important to teach food hygiene and food safety 'The sooner the better'. (Hungary) 'The public need to be more aware. It's not just people in the profession, it's not just those caterers, it's not just the people that run the local café or the little sandwich shop or whatever. I think everybody needs to be fully aware of food hygiene . . . because the whole idea of this is to reduce the amount of food poisoning. But I think if everybody was made aware as a nation and, I think it would help and, yeah I really do'. (England)

TDF: Theoretical Domains Framework.

educational background was not science related. Educator confidence was reported to increase if they used a food safety resource from a trusted source. Educators mostly lacked specific training in food hygiene and safety.

Beliefs about consequences

Educators believed that school teaching could influence students' daily life by transferring behaviours to the home setting, by sharing hygiene rules; however, key messages need to be consistent in both settings to embed appropriate behaviour.

Consequences of foodborne illness, high-risk foods and insufficient food hygiene were a serious concern for educators and most reported memorable personal experiences that they shared with students.

Environment, context and resources

Environmental barriers to teaching food hygiene and safety common across all countries included time to cover the topics within the curriculum, cost, lack of facilities, equipment, lack of content in the curriculum, different examination specifications, poor school hygiene facilities and socioeconomic differences between schools. Facilitators, common across all countries, included the development of new interactive and engaging resources such as online games, board games, card games, podcasts, videos, role play; hand hygiene and food labelling posters; short practical experiments with yeast or microscope observation; hot news topics; and PowerPoints.

Memory, attention and decision processes

Educators, particularly those lacking a science background, across countries reported some difficulty remembering foodborne microbe names, the causes of foodborne illness and difficulty keeping up to date with changes in food legislation, including Food Safety Acts. Educators requested face-to-face or online training that needed to be interactive, with videos, engaging, flexible, and easy to access, and should be pedagogic but also incorporate scientific aspects. Educators reported

PEER REVIEW

Teaching young consumers in Europe: a multicentre qualitative needs assessment with educators on food hygiene and food safety

choosing resources within the curriculum framework, from trusted sources and with accompanying training, and preferred practical lessons which were memorable for students.

Intentions

Educators reported intentions to teach students about food hygiene to prevent foodborne illness from a young age using interesting, interactive resources relatable to everyday life. Educator intentions to teach food-related topics were dictated by the curriculum content, though educators reported they could incorporate hygiene and safety into many subject areas, that is, biology, Personal Social Health Economic (PSHE), technology, citizenship and chemistry.

Other themes

Educators across all countries reported that they had a role in teaching food hygiene and food safety especially to young students, instilling key hygiene messages and building on the knowledge each academic year. Educators were generally optimistic that their teaching could change the behaviour of students outside the school environment and make a positive contribution to reduce future foodborne illness rates and improve hygiene in food establishments by educating our future chefs.

Educators reported positively reinforcing student food hygiene by encouraging good practice and good behaviour, giving reminders and having set routines for good hygiene during cooking lessons. Educators described providing negative reinforcement using examples through the media or case studies on how microorganisms can grow when washing and drying utensils or crockery has not been completed to a satisfactory standard. Educators reported regulating food hygiene behaviour in students through employing rules in school such as asking students to wash their hands before starting a practical lesson, and classroom hand hygiene reminders and warnings about the importance of personal, hand and food hygiene. Regulations from the national and school curriculum ultimately decide what is taught on food hygiene and food safety.

Reported negative emotions to food hygiene and safety education included frustration and negativity towards barriers to teaching; being worried about doing scientific experiments; concerns about foodborne illness and food safety for their friends and family; and complaints about large classes. Positive emotions included students' interest in health topics, that is, healthy eating and food safety and trust in their government's food safety organisation.

DISCUSSION
Principal findings

The attitudes of educators are positive towards educating young people on food hygiene and food safety, yet there are several barriers that prevent this education from being routine in European schools including varied educator subject knowledge, lack of time to teach outside of the curriculum, lack of resources and lack of kitchen and hand hygiene facilities.

Teachers reported that social influences (culture, family, celebrities, public health campaigns, social media) can contribute to student decision making about food hygiene and food safety.

Strengths and limitations

This multicentre study across four European countries provides a wide range of educator views that are transferable across other European countries. Both interviews and focus groups were used to explore individual and group views on this subject and the open interview schedule allowed researchers to probe and explore attitudes and beliefs in detail.

Although several researchers participated in data collection and analysis, common methodology including 20% double coding and a coding framework were agreed by the project team. The inductive analysis was followed by mapping themes into the TDF to help inform future behavioural interventions.

Comparison with existing literature

Previous work with educators in Australian secondary schools reported similar environmental barriers to food

education including a lack of educational resources, facilities, human resources and content in the school curriculum.[15]

Our study reports that educators feel they have a role to play in educating young people on food hygiene and food safety topics, and this is echoed in findings in Sweden.[11,15,16] Educators in Sweden believed that food safety is an important part of HCS.[11] Home economic teachers in Australia reported that high schools are well positioned to improve adolescents' food safety knowledge[15] and this is reflected in recent research that food, health and education professionals in Australia are highly supportive of senior secondary school food literacy education.[16] Further research with parents in the USA reinforced views that food safety education needed to be taught and reinforced in school and at home.[17]

The present research indicates that educators would benefit from the development of new educational resources for use in schools (for students and teachers), food hygiene and online training to improve educator knowledge, confidence and skills. New educational resources could include interactive demonstrations; Egan et al.[10] reported that UK secondary school educators rated interactive demonstrations of good practice and practical activities involving young people preparing food as the most effective teaching method in a nationwide survey. Most teachers in an Australian study reported that they needed more training and resources to increase their confidence in teaching the food literacy curriculum,[18] which is also reflected in a USA study that found by strengthening the knowledge level of secondary educators, they were better prepared to teach food safety,[19] and early research in England and Wales found that teachers need more materials concerning food production.[20] One of the important factors needed to teach food safety in teachers in Slovenia, besides the curriculum, was sufficient knowledge and a positive attitude towards food safety.[8] Primary and secondary school educators in Romania reported that food hygiene and related risks was one of the most important topics that they, as educators, wished to learn in the context of nutrition and health and food safety.[21]

PEER REVIEW

Teaching young consumers in Europe: a multicentre qualitative needs assessment with educators on food hygiene and food safety

Our study is underpinned by theoretical behaviour, which we have not found in similar studies, and indicates key theoretical domains for educators to help inform appropriate interventions to change educator and student behaviour.

Food safety resources for high school and community colleges in the USA including a case study on foodborne illness outbreaks, a video on laboratory investigation of foodborne illness, interactive web activities and supporting materials for teachers and classroom display positively impacted educator familiarity with general microbiology, food safety strategies, regulatory requirements and terminology;[22] therefore, future EU resources should consider these types of materials.

Implications for resource development

When developing educational resources, barriers such as time, cost, lack of facilities and poor school hygiene facilities need to be considered; a combination of short activities and lesson plans including practical cooking lessons, watching videos, role play, games and apps will facilitate implementation. Food hygiene and food safety messages at home and at school need to be consistent, therefore resource developers should seek endorsement from influencers in food and social media like celebrity chefs to ensure the whole family are learning the same key messages.

Implications for schools, teachers and Ministries of Education and Health

Dissemination of our findings should be circulated to Ministries of Health and Education across Europe to provide evidence for the need to include food hygiene and food safety topics into the curriculum. Embedding these topics in the curriculum will allow teachers to prioritise delivering these important topics and help reduce the burden of foodborne illness on public health.

Schools should deliver key food hygiene and food safety messages through the curriculum, daily routines and whole school initiatives to tackle foodborne illness. Appropriate hand hygiene facilities are required in schools so that students and educators can follow appropriate hygiene rules prior to eating or preparing food. Posters and reminders throughout the school and activities to do at home will not only reinforce appropriate hand and food hygiene messages to students but also spread these messages to educators and visitors at the school and home environment.

A teacher training intervention that is accessible across Europe to food, science and technology teachers would be a useful addition to their continuous professional development to increase their knowledge, confidence and skills to deliver these important health topics.

AUTHOR CONTRIBUTIONS

England Lead: C.E. managed the project following data collection; supported England data analysis reporting; led interpretation of the overall qualitative data from all four countries; wrote and led the needs assessment report; drafted all versions of the manuscript and critically revised it; gave final approval of the version to be published; and has agreed to be accountable for all aspects of the work. France Lead: P.T.L. was the lead researcher for France; recruited schools, conducted data collection and supervised data analysis for France; commented on the needs assessment report and critically revised the manuscript; gave final approval of the version to be published; and has agreed to be accountable for all aspects of the work. Hungary Lead: G.K. was the lead for Hungary and the research that was conducted including recruitment, data collection and analysis; critically revised the manuscript; gave final approval of the version to be published; and has agreed to be accountable for all aspects of the work. Portugal Lead: M.T. was the lead researcher for Portugal, recruited schools, conducted data collection and data analysis for Portugal; commented on the needs assessment report and critically revised the manuscript; gave final approval of the version to be published; and has agreed to be accountable for all aspects of the work. England second author: C.B. managed the project during data collection, recruited schools, conducted data collection in England, gave final approval of the version to be published; and has agreed to be accountable for all aspects of the work. France second author: V.L.H. was the research assistant for France; recruited schools, conducted data collection and double coding for France; critically revised the manuscript; gave final approval of the version to be published; and has agreed to be accountable for all aspects of the work. Hungary second author: T.I. was a researcher for Hungary; recruited schools, conducted data collection and analysis for Hungary; commented on the needs assessment report; critically revised the manuscript; gave final approval of the version to be published; and has agreed to be accountable for all aspects of the work. Portugal second author: P.T. helped recruit schools in Portugal, attended needs assessment teleconferences and face-to-face meetings; critically commented on the needs assessment report; critically revised the manuscript; gave final approval of the version to be published; and has agreed to be accountable for all aspects of the work. England third author: R.S. was the research assistant for England; recruited schools, conducted data collection and data analysis for England; commented on the needs assessment report and critically revised the manuscript; gave final approval of the version to be published; and has agreed to be accountable for all aspects of the work. France third author: N.F. was a researcher for France; conducted coding for France; critically revised the manuscript; gave final approval of the version to be published; and has agreed to be accountable for all aspects of the work. Hungary third author: A.K. was a researcher for Hungary; recruited schools,

conducted data collection and analysis for Hungary; critically revised the manuscript; gave final approval of the version to be published; and has agreed to be accountable for all aspects of the work. Portugal third author: C.N. was a researcher for Portugal; conducted data analysis; contributed substantially to organise the data collected, anonymised all the data; and contributed to the needs assessment report with data analysis; critically revised the manuscript; gave final approval of the version to be published; and has agreed to be accountable for all aspects of the work. England fourth author: C.H. was the supporting research assistant for England; recruited schools, conducted data collection and double coding for England; commented on the needs assessment report and critically revised the manuscript; gave final approval of the version to be published; and has agreed to be accountable for all aspects of the work. Greece first author: K.M. has provided input from a Greece perspective; contributed to the curriculum review of food hygiene and safety in Greece; commented on the needs assessment report and critically revised the manuscript; gave final approval of the version to be published; and has agreed to be accountable for all aspects of the work. Anchor author:

C.A.M.M. had the initial idea to undertake the study; had substantial contributions to the design of the work (helped develop the protocol, commented on the interview schedule), reviewed the analysis and interpretation of the qualitative data; helped write the manuscript and critically revised it; gave final approval of the version to be published; and has agreed to be accountable for all aspects of the work.

CONFLICT OF INTEREST
The author(s) declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

ETHICAL APPROVAL
In England, Public Health England approval was granted by the Research Ethics and Governance Group. In France, ethical approval was not required (according to Article R1121-1-1 of French Public Health Code) and data protection authority's approval was obtained from the Centre Hospitalier Universitaire de Nice. In Hungary, law-compliance of the research and ethical issues was ensured by the Legal Department with the official approval of the National Food Chain Safety Office President. In Portugal,

approval was granted by the Comissão Nacional de Protecção de Dados. Educators provided written informed consent for participation in the research, audio recording and the publishing of anonymised quotes. Data were collected in line with the Data Protection Act 1998 and Caldicott 1999 regulations on handling and distributing sensitive participant information.

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SUPPLEMENTAL MATERIAL
Supplemental material for this article is available online.

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