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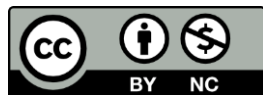
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Title Page

Title of the article: Public Health research in the UK to understand and mitigate the impact of COVID-19 and COVID-19 response measures

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Abstract

This paper reflects concerns that funding and attention should be expanded from the important focus on those suffering and dying from COVID-19, and the safety and resources of health care professionals, to address wider questions on the (unequal) health and wellbeing impacts of COVID-19 and associated response measures. While immediate priorities, such as those outlined in the WHO research agenda are undoubtedly important, additional urgent questions must be addressed. These include questions focused on 1) the non-virus impacts of preparing health and social care systems to cope with COVID-19 and 2) the health effects mediated by the educational, economic and social injuries sustained during the pandemic. Long-term, sustained and co-ordinated interdisciplinary research funding will be needed to address the long-lasting impacts of COVID-19 and its response measures.

Title: Public Health research in the UK to understand and mitigate the impact of COVID-19 and COVID-19 response measures

What do we need to know to successfully negotiate COVID-19 in the long-term?

In dealing with the COVID-19 pandemic, the importance of research has been rightly emphasised by the UK's Chief Medical Officers, scientific advisors and government. The UK public health research community is actively contributing to the evolving evidence base to understand COVID-19's impact, and the impact of the response measures on individuals, households, communities, infrastructure and systems, environment and societies worldwide. In this analysis we examine the research funding landscape and how this could reflect the breadth of the impact of COVID-19. The pandemic has shone a spotlight onto areas that have long been a concern to the public health community, particularly current and potential future inequalities¹. Now that these are in sharp relief it is the moment to highlight them, not only as individual areas, but as requiring research at a societal and community level to help reshape the way in which we organise our society for health, wellbeing, and sustainability. Here we consider the areas that should be examined as a societal collective, and the opportunities for collaborative research to understand and support population health in the short, medium, and longer-term.

The UK government and governments around the world are moving from an early, urgent and reactive phase of the response to considering how proactively to protect their populations from the virus while minimising disruption for the foreseeable future. This requires balancing the need to save lives in the coming weeks and months, with ensuring long-term population health and wellbeing. In the UK and globally, the initial reaction to the virus included focusing research activity on what was needed (and still needs) to be known to save lives acutely. With this focus the World Health Organisation (WHO) convened scientists in mid-February 2020 to agree critical research questions that need to be answered urgently [Box 1]. UK research funding was made available rapidly, reflecting these priorities. In particular, there were calls for, and awards to, projects focussed on the clinical characterization and management of COVID-19, infection prevention and control, including health care workers' protection and candidate therapeutics and vaccines²⁻⁸. While these research areas are undoubtedly vital, the nature and scale of the research funding on offer must evolve well beyond these relatively narrow areas as the effects of the pandemic, and the response to it, matures within and across countries and regions of the world. Of particular concern are the unprecedented economic impacts of the pandemic and their anticipated impacts on population health.

Box 1: WHO research agenda for immediate attention⁹

1. Virus: natural history, transmission and diagnostics
2. Animal and environmental research on the virus origin, and management measures at the human-animal interface
3. Epidemiological studies
4. Clinical characterization and management
5. Infection prevention and control, including health care workers' protection
6. Candidate therapeutics R&D
7. Candidate vaccines R&D
8. Ethical considerations for research
9. Integrating social sciences in the outbreak response.

Who contributes to population health?

Who contributes to the health of the public is something that has been debated for decades. The resounding response is usually "all of us". However, different levels of contribution by various sectors and organisations have been made apparent by this pandemic. Health and social care play an indisputable role, with much activity and embedded active research already supported. However, beyond these areas knowledge is needed about how to support other vital sectors and maintain population health and wellbeing.

Notably individuals are finding themselves labelled as critical workers, many of whom are in jobs that seem poorly valued, with poor security and low wages. Critical workers in several sectors, and not just health and social care staff, are more likely to be exposed to COVID-19 with risks all too evident, for example with higher rates of death for some groups¹⁰. Action to reduce risk to critical workers may have consequences for population health. For example, within the food system many work environments are designed such that people to work physically close together: unloading freight at ports, being bussed to workplaces, sharing a cabin when delivering produce over long journeys. Maintaining the food supply while adhering to physical distancing guidance requires careful thought¹¹.

While many organisations and sectors deemed key to population health in the short-term have been able to remain operational, others have been closed or have been operating with reduced capacity, or online only. Indeed, the health service itself has not been fulfilling all its duties for over two months. This may affect population health as the emergency becomes more protracted, and it is

worth considering inequalities in terms of who can access and use the internet (for example, the ability to engage with home schooling, bank on-line or purchase children's clothing). Closure of schools to the majority of children has revealed the extent to which different sectors have been picking up the needs arising from major inequalities in society and the impacts of austerity. This is well illustrated by the need for policy-makers, parents and teachers among others to consider how to replace education, nutritious free school meals, safeguarding, and physical activity in the absence of schools providing all their current roles, including playground space.

In part to fill gaps left by closures of 'non-essential' organisations, the UK and other countries have seen huge voluntary effort to support the COVID-19 response, alongside professional critical workers¹². These volunteers have taken on jobs including working with particularly vulnerable and marginalised populations.

Urgent research is needed to capture these changes, positive and negative, to inform not just our approaches to future pandemics, but also how we wish to emerge from this period. We need to understand the risks to critical workers and volunteers, devise ways to mitigate the risks and explore or evaluate how risk mitigation strategies might affect population health more generally. Research is needed to understand the implications for health and wellbeing in how we structure our societies and businesses, develop national and local infrastructure that has resilience to shocks, as well as specific areas such as short and long-term effects of closing schools and nurseries, as well as libraries, shops, and organisations responsible for art, sport, and social activities.

Beyond siloes

Although COVID-19 is an infectious disease, both the infection itself, and the response to it, interact with non-communicable diseases (NCDs) and their risk-factors, as well as all aspects of societal functioning. This has put the spotlight on the tendency to fund and conduct research in relatively narrow siloes. There is a need not only for research in specific areas but a higher level of integrative research, already well illustrated by the lack of attention to multimorbidity in older people due to the focus and evidence generation on specific disorders.

COVID-19 seems to be more dangerous to those with cardiovascular disease (CVD) risk-factors including behavioural risk factors (e.g.: tobacco smoking¹³); and physiological risk-factors (including overweight, hypertension and diabetes^{14,15}). This means that those working to understand the distribution of risk of severe COVID-19, are benefitting from involvement of those whose focus is the epidemiology of CVD or obesity. It also presents an opportunity to promote public health and reduce existing inequalities, by providing additional motivation for improving cardiovascular health, for

example through smoking cessation or weight loss, while other changes to our infrastructure and social environment add additional challenges and opportunities for making progress with the behavioural risk-factors for NCDs.

The effect of physical distancing and self-isolation on physical and mental health are not understood in general and certainly not for specific individuals, households, communities, and cultures. This is particularly important as these measures need to be highly stringent and are likely to be in place for a longer period for some of the most vulnerable groups in society, including the elderly. As well as understanding impacts better, we need to know whether and how negative effects can be mitigated through, for example, virtual social contacts.

To minimise the negative consequences of the COVID-19 pandemic for chronic illness, it will be important to fully understand and quantify what these are, and consider how to promote the opportunities to improve population health and wellbeing.

International cooperation is a necessity

This is a pandemic and research efforts also need to be global. Knowledge needs to be exchanged and synthesised internationally. For any country to aim for a steady-state of low level or no transmission¹⁶ all countries must aim for that. However, this is not necessarily the highest item on the agenda in every country. Notwithstanding call from the Secretary-General of the United Nations for a global ceasefire¹⁷, wars continue around the world. Even within the health sphere, concurrent serious challenges include an outbreak of Ebola in the DRC¹⁸.

Interdisciplinarity research to maximise understanding

The response to COVID-19 requires evidence-based and evidence-informed decision making, and the evidence required needs to take account of multiple perspectives. This is an opportunity to bring together all the disciplines important for human health and wellbeing¹⁹. We need to synthesise knowledge across engineering, technology, anthropology, sociology, economics, psychology, law, history, education, architecture, art, culture as well as big data and artificial intelligence. Ethical considerations for research must always be kept in mind²⁰.

The need for a wide range of disciplinary expertise to come together is illustrated by the on-going debate over the guidance on masks/ facial coverings. To understand whether these should be recommended and to whom, for what purposes, we need to fully understand the mode of transmission (including aerosol risk in different settings), the design features, and how people use masks/ facial coverings in real-life. Guidance must be conveyed to the public and trusted by them, we need to be able to produce and distribute sufficient stock, and we need to take into account

demand, finite resources, and who should be prioritised (e.g.: by occupation or by vulnerability to severe disease). Another pertinent example includes investigation of community consequences of prisoner release into the community as a strategy to limit COVID-19 transmission in prisons. Similarly, unpicking the source of ethnic inequalities in the risk of severe and critical illness with COVID-19, which could be biological, social, cultural, economic or a combination, requires multiple perspectives.

A long-term plan for the UK

In the UK, as we emerge tentatively from our 'lockdown', we are facing a very different economic reality to the one on 24th March. There is likely to be increased joblessness, loss of accommodation and stark inequalities in how these are distributed, in addition to the variation in the way virus itself has affected our population, by age, sex, ethnic group, occupation and socio-economic status. There are also opportunities post lockdown to sustain and build upon positive changes for population health, including reduced travel and associated carbon footprint due to greener modes of transport, increased home or remote working and harnessing technological innovations for more efficient organisations (including the health and education sector) in the future. Many have highlighted this moment to address systemic and major challenges such as our inequalities and sustainable futures²¹.

While immediate priorities, such as those outlined in the WHO research agenda [Box 1] are undoubtedly important, additional urgent questions must be addressed. We need to understand the non-virus impacts of preparing health and social care systems to cope with COVID-19: all the diagnoses and treatments postponed, early discharges and condensed or re-configured medical education. We need to understand the wider implications of COVID-19 response measures, the health effects mediated by the educational, economic and social injuries sustained during the pandemic.

Despite the challenges inherent for learning together in a nation with several devolved administrations, we can gain additional value from examining the whole of the UK, in which diversity of policy, health service models and demographic patterns may enable evaluation of what is effectively a set of natural experiments, including variation of approaches taken in localities within nations. Just one example is the emerging varied approaches to school opening.

Public health academics and practitioners are well-positioned to conduct real time evaluation of the health and wellbeing effects of these wider determinants. Public Health England, local authority and NHS Public Health teams have infrastructure and routine data within regional/locality bases to allow this to happen. In addition, these teams are well-placed to collect and track expenditure by public

bodies to mitigate the negative economic effects on health and wellbeing. Investing in these public health resources is likely to yield resilience in future. It also facilitates evidence and knowledge-informed decisions at local and national level. Essential to these efforts is also the need to work collaboratively (locally, nationally and internationally), and reduce duplication. This includes the need for better sharing of data across government, the health sector and academia to enable both rapid response to emerging challenges and longer-term in-depth research on social impacts.

Long-term co-ordinated and sustained interdisciplinary research funding will be needed to address the long-lasting impacts of COVID-19 and its response measures. UK funders coming together (e.g. NIHR, UKRI) and UKRI's current call inviting proposals for research addressing and mitigating the health, social economic, cultural and environmental impacts of the COVID-19 outbreak is a welcome step towards this coordinated effort²².

Contributorship Statement

CB conceived the idea of this paper, OO wrote the first draft, CB and SR further developed the draft. All members of the Faculty of Public Health Academic Research Committee had the opportunity to review the draft and many contributed to the article. OO, CB and SR finalised the version for submission.

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