What factors make a community more vulnerable to COVID-19 ?

A summary of a British Academy workshop

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The British Academy
COVID-19: Shape of the Future

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The British Academy's Shape the Future programme will explore how to create a positive post-pandemic future for people, the economy and the environment. We are convening our community in ways we have never done before, bridging across sectors and disciplines, integrating insights to help inform policy, and encouraging interdisciplinary learning; focussing on issues that cannot be treated in policy silos to bring considerations of place, ethics and shared values together with the long view and the world view.

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Executive Summary

What factors make a community more vulnerable to COVID-19?

In July 2020, the British Academy convened a workshop, chaired by Professor Sir Ian Diamond FBA, on what we know and need to know about the factors affecting the prevalence of COVID-19 in different communities. A holistic, multidisciplinary approach is needed to understand the causes of vulnerability and the workshop brought together distinguished researchers across a range of disciplines with insights into the available evidence.

The discussion considered the broad impact of the virus on vulnerable communities, including those who do not have access to different services (health, transport, employment, education) or those who are marginalised in society (social inequalities including those associated with faith, sex, race, age). Two central questions were considered: a) what do we know and where are the gaps in what we know; and b) how do we prepare for a potential second surge in the disease.

The most significant theme to emerge from the discussion was the importance of the local: this requires data, knowledge and communication in the context of the local level, and implies building analytical capability as well as links to leaders and civil society at a local level. Supporting this theme are six messages:

- Existing structural and health inequalities must be recognised to address their role as underlying causes of vulnerability.
- There will be longer term societal impacts of the pandemic. In managing these we must prepare for them with equal urgency as we did with the short-term strategies implemented to manage the disease. We need to use multiple types of evidence to foster community resilience to multiple stressors in the context of changing employment structures and opportunities.
- We need to connect a sufficiently improved local track and trace system to knowledge and experience at local levels.
- We need to better understand the social dynamics linking medical, social, and economic factors and social resilience in communities, taking a longer view. Dialogue and policy responses need to focus more on behaviour and context, not groups and categories.
- We need to learn better and quicker from existing knowledge and experience at local levels. Localisation of evidence and analytical capacity will be critical.
- Communication will need to be coordinated and tageted more sensitively, making better use of trusted and more local leadership.

There were also two cross-cutting methodological themes. Methodological innovation and greater capacity are required to capture the social dynamics, connections, structures and relationships involved in community vulnerability. Effectiveness of policies and interventions will be improved if supported by additional social science input to provide:

a) greater local specificity and contextualisation of evidence (adequacy and extent of measurement and monitoring of both COVID-related and other behaviours and attitudes relevant to the above) and

b) strengthened local capacity to collect, analyse and interpret that evidence (local authority research and analysis function, staffing, training etc).

This summary elaborates these main points and highlights the common themes around how to identify and support vulnerable communities, exploring ways to reduce the impact of the virus itself and prevent COVID-19 from exacerbating inequalities. The points synthesise those raised that received general assent during the workshop rather than being attributed to specific individuals.

The workshop was held under the Chatham House Rule and we do not attribute any of the views or statements below to individuals present at the workshop. A full list of workshop participants is provided in Annex A. Due to constraints of time, not all workshop participants were able to review this discussion summary, but it has been reviewed by a small subset of participants at the workshop, including the Academy's former Vice-President of Social Sciences and co-Chair of our *Shape the Future initiative,*[1] and independently reviewed by a Fellow not present.

- Professor Dominic Abrams FBA, University of Kent, on cohesion and vulnerability
- Professor David J Hand FBA, Department of Mathematics, Imperial College, on social dynamics and vulnerability to COVID-19
- Professor Anthony Heath FBA, University of Oxford, Professor James Nazroo FBA, University of Manchester and Dr Lindsay Richards, University of Oxford, on ethnic inequalities in COVID-19 mortality
- Dr Saffron Karlsen, University of Bristol, on explaining ethnic inequalities in COVID-19
- Professor Melinda Mills FBA, University of Oxford, on demography, deprivation and behaviour as factors for mortality and infection risks of COVID-19
- Professor Charlotte Roberts FBA, Durham University, on bioarchaeology and what insights from the past tell us about the present
- Mr Guillermo Rodriguez, Centre for Homelessness Impact, on people experiencing homelessness and COVID-19

1 The British Academy's Shape the Future programme will explore how to create a positive post-pandemic future for people, the economy and the environment. https://www.thebritishacademy.ac.uk/programmes/COVID-19-shape-the-future/

Part 1: What do we know now about the factors affecting vulnerable populations? And what are the significant gaps in knowledge?

1.1 Recognising and addressing existing structural and health inequalities

Existing structural and health inequalities must be recognised and addressed as underlying causes of vulnerability. We need to build a better methodology which puts social dynamics, connections, structures and relationships at the centre of our understanding of vulnerable communities.

The discussion highlighted that the starting point to building a better understanding of the factors affecting vulnerable populations and communities is to consider how to define a community. Care must be taken to be clear what is meant when referring to, and defining, "communities". It may require qualification and greater specificity, and some attention should be paid to who is defining them and for what purpose. Stakeholders from a range of communities need to be involved in the process of definition going forward.

When analysing evidence about communities, it is important to know how 'community' has been operationalised in terms of measurement and data analysis. Evidence collection must be capable of incorporating not only easily measured social categories and structures, but also those that are perceived and used by people themselves. When presenting evidence, then, it is important to be clear whether 'community' refers to communities in general, or particular sets of people. For example, there is a tendency to define or refer to communities by ethnic heritage of various kinds. Yet, behaviour varies considerably within any category of people

and there is usually much greater overlap than difference between categories. The presumption that demographic categories might be sufficient to explain major behavioural or other differences can be misleading.

This leads to a need for better consideration of two factors: the levels of analysis in use, and social dynamics and relationships within and between the levels. Evidence and analysis are required at the micro, meso and macro levels of variables, and across them to understand intersectionality. Individual and intrinsic ('micro') variables may be individual behaviour, attitudes, income, and biological characteristics that might include co-morbidity age, obesity, and so on. More meso level aspects include focus on the particular groups, roles, types of organisations, schools, and locations. More macro level factors might include important features that differ between regions, sectors of the economy, countries, and so on. But they can also include large-scale social categories and groups with which people identify or affiliate that may include ethnicity, faith, and political party. Increasingly, social scientists now try to understand both the distinct effects of different levels and also how they might interact (determining the 2020 exam grades, for example, has perhaps exemplified the complexities and also the importance of getting this right).

Discussion explored these challenges around ethnicity, but comparable points could be made with regard to other characteristics (sexuality, age, geographical location, type of occupation, and so forth). Regarding ethnicity, government and media narratives have suggested that vulnerability might be due to particular attributes linked to ethnicity. This implies a biological or essentialist interpretation of ethnic differences in infection and death rates linked to COVID-19.

Although it is convenient to focus on genetic, biological or cultural differences, what actually links ethnicity with vulnerability to COVID-19 are differences in experiences of poverty, deprivation, social exclusion, and inequality of treatment [see contribution from Anthony Heath and David Hand]. These factors affect individuals from multiple groups. Experiences of racism certainly adversely affect minority group members' health experiences and access to health care. However, discrimination against any protected characteristic has such effects, which are likely to be compounded in individuals with multiple protected characteristics. Having these characteristics is not itself a cause of discrimination – the causes can be found embedded in institutional practices and others' behaviour, perpetuating inequities and harm.

Efforts to link ethnicity with vulnerability to COVID-19 also highlight a methodological issue. Many of the measures used to describe socio-economic status were developed for use with white people and therefore miss aspects of status that may be relevant in other ethnic groups. Analytically, existing measures of socio-economic status confound the socio-economic differences between different ethnic groups. For instance, there is evidence of differences in the employment and income benefits of education between different ethnic groups (such as Bangladeshi and Pakistani children having higher than average attainment at secondary education despite these groups also having the highest levels of child poverty).[2] This confounding factor means that statistical effects that are sometimes ascribed to ethnicity are actually artefacts of (unmeasured) aspects of socio-economic status. Better models of vulnerability will first need to unpack the unexplained aspects of the existing models and more comprehensively address methodological limitations that may arise from outdated perspectives on race and ethnicity.

2 ONS (2020) Child poverty and education outcomes by ethnicity https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/compendium/economicreview/february2020/childpovertyandeducationoutcomesbyethnicity#education-and-ethnicity

Better, live data which are not over-constrained in limited structural terms will provide the foundation for the kind of modelling that is needed. Although data quality and quantity are improving, as highlighted below, the data currently available tend to focus attention on pre-defined categories and groups and rarely provide the depth, nuance or granularity to sensitively capture the intersectional factors driving vulnerability for numerous small or dispersed minorities.

Is more granularity the solution? How far can disaggregation go? Discussants noted that we still have a lot of problems with getting disaggregated and rapidly released data that is sufficiently detailed to address intersectional complexities. Aggregation of different ethno-cultural groups under the label 'BAME' is a very blunt approach for capturing relevant implications of ethnicity and will often obscure important and substantial diversity. Although useful to highlight the headline average existing within the rest of the population, there was general agreement this was not a helpful category for the formulation of policy.

If we continue disaggregating down to the finest level of detail, however, we may be unable to see the wood for the trees. Therefore, it is crucial to know and decide at what level of analysis we want or need to operate in addressing particular issues. In some cases, numbers of particular 'types' or categories are so small or difficult to reach that detailed qualitative evidence may be more useful and reliable than large scale quantitative data. In other cases, the context or situation in which people live or work might be a much more relevant, but relatively unmeasured, factor. Ideally, data should be available at multiple levels, both to clarify which levels have most leverage and how they connect.

There is also a (policy) tendency to look at all individuals as independent agents, whereas a great deal of behaviour, decision making and even exposure to particular types of situation and environment arise from the way people interact with and relate to one another. This means we need evidence on social relationships and networks and their importance to individuals as well as the larger systems (e.g. religious, organisational, regional) in which these relationships are embedded. Any efforts to influence behaviour will be more effective if they are based on an understanding of these social dynamics, not just the characteristics of individuals [see contribution from David Hand]. We need to find more effective ways to get the evidence into a form that can reveal the manifestations of social dynamics that affect behaviour. This will include better access to data that is not defined by narrow structural terms. Further work is also needed to establish useful analytical taxonomies of relationships, situations and contexts and to secure more comprehensive and rapidly released data to which they can be applied.

1.2 The long-term societal impact of the pandemic

There will be a long-term societal impact of the pandemic and this must be addressed with urgency even while we develop short-term strategies to manage the disease. We need to explore the linkages between factors driving vulnerability in order to move from short-term analysis along broad social categories, to deeper understanding of how people and communities may best survive, develop and thrive.

It was noted by several of the workshop's participants that vulnerabilities have emerged in ways that the models have not anticipated. Factors that, at first sight, appear to drive vulnerability may not be the underlying cause of that vulnerability.

If we dig deeper into ethnic inequalities, homelessness, unemployment, disability, digital exclusion, early life problems, workplace clusters, specific activities and personal networks, we will better understand the mechanisms generating their correlations with vulnerability to COVID-19. This is not simply a matter of granularity, but of gathering better data and a better methodology to understand risks [see contribution from Saffron Karlsen].

It also means acknowledging that biological or medical susceptibility may not be a primary cause of vulnerability but may reflect other factors that create vulnerability. Testing, vaccines and treatments may provide some protection, but we will still find that some sectors of the population remain more vulnerable because of their circumstances or behaviour. If unequal vulnerability to COVID-19 is largely an expression of a wider set of risks associated with inequalities, the implication is that the underlying factors need to be addressed and not just the manifestations in terms of disease. This underlines the importance of understanding factors like employment, deprivation, life opportunities, social relationships and support, and the local environment more prominently in modelling. Importantly, tackling these social risk factors for COVID-19 will almost certainly bring wider societal benefits in terms of health, well-being, cohesion and the economy [see contribution from Dominic Abrams].

Discussion also turned to the concept of *allostatic load* – the accumulation of stress over a prolonged time – which is one well-established link between social dynamics and medical factors. People in situations of deprivation are both physically and cognitively stressed, potentially reducing their scope and capacity to consider or decide on healthy life choices or contact and engage with the health service. The same concept can help to understand the links between early childhood events, disability and other structural factors. Social isolation, lack of social capital and lack of control are also important contributors to allostatic load, and it is easy to envisage a cocktail of lethal ingredients that compound one another's effects – lack of material resources making all of the other factors even more consequential by reducing any options to cope with them. In any situation, some individuals will also have fewer psychological or social coping resources than others, so not all are affected in the same way. However, it is clear that the dangers are greatest for those who experience a combination of a greater number of external stressors and lower resources to cope. As more non-medically related economic and social impacts like unemployment or housing evictions begin, these will create further health impacts and new areas of vulnerability which, in turn, will affect people's needs and demands on existing services.

A critical resource is access to services and support for sufficient standards of living. Homelessness is a clear example which also connects to and illuminates the impact of housing density and over-crowding on vulnerability [see contribution from the Centre for Homelessness Impact]. In the UK, during lockdown, homeless people were moved from overcrowded temporary accommodation into hotels. In the US, where this policy was not followed, the resulting rates of infection were 30-40%. As homeless people are returned to temporary accommodation in the UK, there is a risk of the same numbers generating new clusters of infection, in addition to the risk of continued precarious living circumstances.

Discussion also highlighted how the first phase of the pandemic saw effective modelling of the spread of the virus around hospitals. We know that the vast majority of cases are driven by some kind of cluster, and clusters are now emerging as a result of social dynamics – where people interact around activities like football matches, or in workplaces, or through social settings. Going forward, to identify emerging clusters and vulnerabilities caused by likely contact with those clusters, services other than hospitals may need to be the focus. For example, we know that just before becoming homeless, people approach their GPs. Other indications may be identifiable in patterns of movement in and out of restaurants or workplaces or use of transport hubs and other services. We also need to consider how we can categorise different types of workplace where they share characteristics that matter in terms of predicting behaviour. Even more than many workplaces, schools and universities are not just educational but are also social environments that traditionally depend on and encourage social interaction and interconnection. The challenge is to provide a framework to enable them to provide that social connection safely. Within this, we can then acknowledge the differences in risks faced by those who can work at home compared to those who cannot.

To understand socially-related risks it is also necessary to understand social dynamics. As noted earlier, discussion highlighted that whether someone becomes infected or not relies just as heavily on the behaviour of others around them as their own. Therefore, a focus solely on an individual's self-protective behaviour may overlook the main locus of the risk (i.e. the presence and behaviour of other people). Research evidence shows clearly that people generally have a fundamental need to relate – to feel they belong, and have a meaningful existence and identity. Therefore, it is inevitable that people will seek and want to sustain social contact. It is likely that they will engage in social contact in the context of their understanding of shared risk. To accommodate this, strategies need to build in an understanding of the risks people pose to others in different situations, and the degree of control people may have over their exposure to (risky) others at least as much as the risks they take personally. That means understanding their relationships, self-identity, and the normative framework in which people are operating and living.

Part 2: How do we prepare for and mitigate effects of future waves?

2.1 Connect track and trace to knowledge and experience at local levels

Track and trace serves a vital function within an improved response to the virus going forward, that is in providing data. These data should be properly collected, shared quickly and used to inform a dynamic response at local levels.

The insight it generates should be available to trusted leaders in communities to enable the effective communication of these insights to the public, as reiterated below. The effective use of such data also depends on the availability and deployment of suitably qualified social science data analysts, which may well be lacking in many local authorities and communities. But an effective track and trace system alone is not a panacea given the deep structural issues at play, as discussed above.

We must incorporate behaviour and relationships into the discussion more directly. The track and trace system appears to rely on judgements of questionable reliability on how much time the infected person has spent with another and how close they were to that other person. Getting this right is difficult. For example, in the case of TB contact tracing in the UK, it was often difficult for homeless people to name or identify their contacts. Monitoring self-isolation also requires detailed measurement to deal with socially desirable reporting, accurately capture the duration and forms of compliance, and any factors that prevent compliance. Further issues will arise if people are asked to isolate repeatedly – do the current forms of data collection permit any insight into how many times people will comply, who they are isolating from, and how social dynamics or networks may affect this (see below). A further challenge is that individuals whose employment situation is precarious may be unwilling to share information that might leave them without income for two weeks. Security of income and employment needs to be addressed in order to maximise self-reporting and minimise avoidable transmission.

2.2 Examine social dynamics linking medical, social and economic factors

Examine social dynamics linking medical, social and economic factors and social resilience, taking a longer view. Dialogue and policy responses need to focus more on behaviour and context, not groups and categories.

The reasoning behind a shift in focus towards social dynamics is given above. In terms of what we do differently based on this, a starting point is to recognise that vulnerable groups may not be protected as effectively by track and trace, and to consider how the linkages between medical, social and economic factors can be used to shape policy to protect vulnerable communities from COVID-19.

Social dynamics are the underlying latent factor which manifests itself through behaviour in terms of risks associated with a range of variables – ethnicity, deprivation, employment and so on. Those are manifestations of this underlying variable. This is where the scientific development is needed, which can then inform operational decisions. To reiterate the point, effective action requires understanding the connections between economic, social, and bio-medical factors as a dynamic system and not to privilege one above the others [see contribution from Melinda Mills].

Across the board there are overlapping vulnerabilities that an approach grounded in social dynamics will uncover more effectively. Economic factors are significant given the principal policy response to the first wave was the lockdown, which has clearly been more facilitating for 'middle-class' parts of the population. It has been relatively more manageable for most people who have secure jobs, those that can work from a home, those with a garden, those with spare space to work, resources for children to study, opportunities to interact virtually, and the knowledge, skills and ability to adapt to the changed circumstances. Inequality of outcomes is likely to increase as the economic impacts of the first lockdown reveal themselves directly (such as employment risks) and indirectly (such as increasingly overcrowded housing or eviction rates). To prepare for further lockdowns or economic shocks – nationally or locally – better support needs to be in place for those who are economically vulnerable and were hardest hit by the lockdown. We also need to look more closely at the economic incentives and constraints with social dynamics in mind and design interventions on that basis. For example, considering the way different generations respond to individual versus collective incentives and support structures.

Social interaction and engagement benefits also matter as much as economic and health outcomes and are very important for a lot of people. This will also vary by generations with differences between responses to collective and individual incentives. So, policy needs to factor in how people's values and the meaning people find in social interactions relate to behaviour and therefore, in this context, vulnerability to COVID-19. In another example, a lack of social contact and change in routines in care homes residents led to excess mortality among dementia sufferers attributed to old age on death certificates.

2.3 Localisation of evidence and analytical capacity will be critical

Localisation of evidence and analytical capacity will be critical; we need to learn better and quicker from existing knowledge and experience at local levels.

The core to the response around track and trace and interventions based on linkages between social dynamics and medical science will be more effective if they respond swiftly to developing knowledge and experience at local levels. Part of this falls to the social scientists with good evidence to communicate and use it effectively, but we also need much better localisation of evidence collection and analysis.

We also need to think about mitigations that can be taken while we are still waiting for more perfect information about correlation and causation by using research that already exists. For example, what sort of evidence do we have on disability? There is a clear problem around the difficulties with social distancing for those who are visually impaired or use of face masks for those with hearing loss. Discussants also noted that victim-blaming has emerged as a consequence of the lockdown. Meanwhile, digital exclusion can compound different forms of social exclusion and access to information. Evidence that digital exclusion is affecting some of the hardest to reach groups is emerging from free social welfare legal services, the Prison Reform Trust and Prisoners' Education Alliance.

Up to now, we also know much less than we need to about what goes on in local communities. Tapping into local knowledge would be very effective complementary tool to contact tracing. Emerging evidence indicates that people have greater confidence in their local agents than national ones. Evidence also suggests that even those who volunteer are likely to be forming better and stronger relationships relative to those who are key workers and regularly facing involuntary engagement with others. Thus, the collection and reporting of evidence, and interventions to influence behaviour, may well require closer linkage with local community networks to be fully optimised.[3]

3 See https://www.belongnetwork.co.uk/resource-centre/research-projects/beyond-us-and-them-research-project/

2.4 Draw on lessons from past research to coordinate and target communication more sensitively and build trust

The lessons learned from previous health behaviour challenges illustrate risks that are misdirected, or risks that are not communicated, can create vulnerability through ignorance, fear and stigma. This highlights the importance of focusing on behaviours and avoiding the stigmatisation of particular groups.

Public communication responses (from multiple sources) to COVID-19 have frequently fallen into similar traps: the focus on inequality of mortality has attracted commentators to focus on intrinsic biological or medical factors associated with vulnerability. Yet, this itself creates further vulnerabilities (to stigma, fear-based rejection, suspicion) of the groups that people may infer are more likely to be infectious. Meanwhile, a failure to reach some groups and to involve communities in the process has contributed to vulnerability to COVID-19.

Lessons from past eras and episodes reverberate [see contribution from Charlotte Roberts]. Discussion noted how fear-based messages and highlighting of 'at risk' groups in the early phases of the HIV/AIDS epidemic had proved counter-productive, reinforcing inaccurate perceptions of norms (e.g. that others were more promiscuous than oneself) and a false sense of security and resistance to behaviour change because the risks were perceived as being confined to particular groups. Subsequently, more effective strategies combined local intervention (e.g. working with drug injectors in Glasgow) and public education about the forms of transmission, the importance of safe sex, and communicating practical actions and norms without moral overtone. Positive side effects of this shift were to substantially improve public knowledge and also to transform sex education in schools, as well as greatly accelerating efforts to challenge homophobia and establish equal rights in terms of sexuality.

Learning these lessons to improve communication will help to avoid amplifying vulnerability and contribute to prevention. As with other aspects of the pandemic, good practice here is likely to promote good practice in other domains too. Evidence from the past suggests that people's concepts of disease and their level of education can vary, making understanding of information challenging. Different audiences will also need to be addressed differently depending on an understanding of how they are able or willing to respond, including understanding of how language itself resonates with different groups, including those with disabilities. Much of the messaging so far has been focused on a pro-social message (stay home-support the NHS-save lives) but this does not necessarily resonate with those individuals who by dint of values, attitudes, social pressures or material necessity are less likely or able to heed such messages.

The question of how to communicate, and who is best placed to do so, connects with the way people understand risk and uncertainty. The effects of the pandemic mean that people will continue to have to deal with heightened uncertainty, both within their own spheres and when they move outside of them. People typically respond to uncertainty by seeking information, and this is usually sought by comparing with similar others, which provides a clear social frame of reference for behaviour. Norms

are also provided by visibly salient information (e.g. the presence of a lot of young people around a pub implies that it is a place for young people, the absence of older people on the streets implies that older people are staying home and are fearful). And even when such inferences are incorrect or misleading, they will provide reference points for people's decisions about their own actions. If strategies do not attend to this subjective aspect of the normative context, they will very likely fall short of the desired levels of compliance or behaviour change.

Trust is crucial to reach vulnerable people, and trusted interlocutors are needed to target the messaging on the basis of understanding of the people being targeted. In any second wave, we will know more, but channelling the knowledge effectively and with more consistent and coordinated messaging is itself a challenge that needs to be addressed through testing and research. All the lessons from social and behavioural sciences can be better used to reach out to vulnerable communities. Mistakes will be made, but like vaccine development, finding the most effective messages would benefit enormously from investment in multiple labs and approaches. Such work can be done quickly and efficiently, but at present we do not have a networked lab structure that is funded in a way to enable it to happen.

A crucial change in the approach to communication going forward to help prevent vulnerability to COVID-19 will be communicating via trusted leaders and influencers in local communities. Trusted individuals at local levels are excellent vehicles for sharing, challenging or establishing norms, but it is important to bear in mind that these trusted individuals may not be those who are in formal positions of power or are part of formal local (or even national) organisations or bodies. Identifying and making good use of them will rely on better understanding about the social dynamics discussed at length throughout this paper. How messages are communicated will also need to be understood and tailored in the same way. We need more evidence to understand which leaders are trusted and what factors are central for trusting them around this particular issue.

Clear, consistent and coordinated communication via trusted interlocutors will be essential going forward. It will need to take on board more evidence from social and behavioural sciences and be responsive to developing insights. In choosing the right messages, we also need to understand the extent to which people feel they have any voluntary control over their behaviour and their risks. Different groups may face different or changing levels of control over their behaviour, considering again a point made above on 'allostatic load'. And in an age of digital communications and availability of information of varying quality, we need to understand where people get information from. Political strategies that, for other purposes, seek to undermine the most trusted sources of information (e.g. the BBC) or organisations (e.g. the NHS), or to over simplify levels of certainty (e.g. 'the science') are problematic when people need clarity and parameters around certainty and risk.

Trust is a complementary aspect of communication and trust in government, while reasonably high, is generally lower than trust in more local sources. Given this, we need to know more precisely who people will trust and why people trust certain sources of influence or information rather than others. In practical terms, this information could be used to engage with trusted sources to encourage and enable them to communicate critical information effectively.

Annex A

List of workshop participants

The following individuals were present at the workshop held on 20th July 2020.

Prof. Sir Ian Diamond FBA *Chair*	Statistics, National Statistician, Office for National Statistics
Prof. Melinda Mills FBA *Speaker*	Sociology and Demography, Leverhulme Centre for Demographic Science, University of Oxford
Prof. Dominic Abrams FBA *Contributor (reflections)*	Social Science and Psychology, The British Academy, University of Kent
Prof. Sir Tim Besley FBA	Economics, London School of Economics
Prof. Mark Birkin	Geography, University of Leeds
Prof. Dame Hazel Genn FBA	Law and Health Inequalities, University College London
Prof. Robin Goodwin	Psychology, University of Warwick
Prof. David Hand FBA	Statistics, Imperial College London
Dr Guy Harling	Social Epidemiology, Institute for Global Health (IGH), University College London
Prof. Anthony Heath FBA	Sociology, University of Oxford
Prof. Julia Gog	Mathematics and Mathematical Biology, University of Cambridge
Dr Saffron Karlsen *Contributor*	Sociology, University of Bristol
Prof. Kamlesh Khunti FMedSci Submitted report prior to workshop, not in attendance	Primary Care Diabetes and Vascular Medicine, UK National Institute for Health Research, University of Leicester
Prof. MM McCabe FBA	Philosophy, King's College London; Philosophy in Prison
Dr Samuel Okyere	Sociology, University of Bristol
Prof. Charlotte Roberts FBA	Archaeology, Bioarchaeology Durham University
Guillermo Rodriguez-Guzman	Centre for Homelessness Impact
Prof. Richard Sennett FBA	Sociolog, London School of Economics
Prof. Peter Taylor FBA	Geography and Urban Studies, Northumbria University
Prof. Peter Taylor-Gooby FBA	Social Policy, University of Kent
Francesca Lamarque	Cabinet Office
Alice Moden	COVID-19 Response Team – International, GO-Science
Hetan Shah	The British Academy
Dr Molly Morgan Jones	The British Academy
Dr Adam Wright	The British Academy
Bronwen Butler	The British Academy
Charise Johnson	The British Academy

Addendum

Independent contributions from workshop participants

The following contributions have been made from various workshop participants following direct invitations to a number of those who attended who expressed an interest in providing further detail and information on specific points and themes. Each piece is an independent contribution submitted in the name of each individual author(s) as an overview and assessment of evidence related to the given topic which emerged as a focal point during the workshop on factors affecting prevalence of COVID-19 in vulnerable populations. The contributions have been independently reviewed by two Fellows of the British Academy, but may not be representative of Academy views or positions.

Implications of the COVID-19 Pandemic for Cohesion, and Vice Versa

Professor Dominic Abrams FBA,
Centre for the Study of Group Processes,
University of Kent

Research context

As we emerge from tackling the immediate health challenges of COVID-19, **societal cohesion** will play a crucial role in suppressing the virus and moving the economy forwards. It will affect how far people are willing to cooperate with safety measures, how they respond to local outbreaks, and how able they are to adapt in order to conduct their lives meaningfully. Cooperation of all communities will depend on **who people trust, where they believe their actions will have consequences, and the strength of their connections to public and civic local institutions.** We therefore need to ask how the different ways in which individuals and groups stick together or pull apart might be shaping their capacity and motivation to respond positively. This report describes recent evidence, including insights from our work through the British Academy's Cohesive Societies programme[4], ESRC's UK in a Changing Europe programme[5] and COVID-19 programme, and Nuffield Foundation's current COVID-19 programme[6].

Current evidence suggests that the majority of the population are abiding by the evolving rules and instructions emanating from government.[7] Yet some are disregarding the rules and we need to understand why. A number of factors emerge as being particularly relevant:

1. **Trust and self-relevance are critical.** First, even if the science is accepted as valid, if the authorities responsible for determining rules and regulations are perceived to be disingenuous, dishonest, incompetent or inconsistent, the regulations are less likely to be accepted or acted upon, and may be actively rejected. Second, if people think they are at low risk or the issue is of low relevance for them, they are also less likely to comply with regulations.

2. If people perceive the **rules as being about groups or sectors of society that do not include themselves or their in-groups,** they are less likely to take them seriously. Currently, much of the scientific information communicated to the general public on the risks of COVID-19 refers to the vulnerabilities of, or risks posed by, specific social categories (e.g., school children, people over 70, ethnic minorities, Leicester, Muslims, young people, people from particular countries, etc.)[8]. There are two possible consequences of the contradictions or ambiguities arising from evolving regulations:

4 https://www.thebritishacademy.ac.uk/programmes/cohesive-societies/
5 https://ukandeu.ac.uk/
6 https://www.nuffieldfoundation.org/research/COVID-19
7 YouGov (2020). *Public overwhelmingly backs the government's new measures to tackle coronavirus.* https://yougov.co.uk/topics/health/articles-reports/2020/03/24/public-overwhelmingly-backs-governments-new-measur
8 NHS (2020). *Who's at higher risk from coronavirus.* https://www.nhs.uk/conditions/coronavirus-COVID-19/people-at-higher-risk/whos-at-higher-risk-from-coronavirus/

A. People from those singled-out categories may be stigmatised and scapegoated by others for the spread of the pandemic.

B. People will infer that social categories not labelled as being 'at risk' must be relatively safe.

Added to this, many of the rules seem contradictory (e.g., it is safe to mix in pubs and restaurants but not in narrow streets or corridors).[9] Resultant confusion or uncertainty may well leave greater space for motivated reasoning, lack of receptiveness to worrying information, and in-group favouring assumptions about risk (e.g. 'our family/village/town should be ok because it is much worse down the road'; 'no one I know has had it').

In order to lower the risks of transmission, all categories of people need to adapt their behaviour in various ways. Because public communication and regulations largely emanate from central government, and because the threat may seem remote to some groups or communities, many people are likely to turn to social norms to gain greater certainty about how to behave and what consequences might follow. Who people feel connected to also determines who has influence over them. For example, observing large numbers of apparently healthy people sitting or standing in close proximity in local pubs and restaurants may convey that the danger is low, that others feel comfortable with the risk level, and there is less need for concern. The presumption of minimal danger may then become a local norm which may accelerate informal relaxation of distancing and masking rules. In that context, people who continue to wear masks outdoors may feel embarrassed or implicitly intimidated, becoming more avoidant of that situation and thereby ironically reinforcing the norm. In a different setting, such as a rural town with an older population, people may find a masked stranger in the street more reassuring than an unmasked one. The challenge is to know which norms prevail and how, if necessary, to ensure that local and national or wider norms are in or out of alignment.

Disengagement with UK government

At present, we see that many people have rather little trust in high level authorities such as government. Although there was some post-general election recovery in trust following lockdown[10], this is now declining. Moreover, fragility in trust interacts with perceived risks, and evidence on trust, threat and perceived risk highlights the following issues:

1. Lowered trust seems to accelerate group defensiveness (amplifying aversion to outgroups).[11]

2. Motivation to comply with safety procedures is weaker if those who are both less trusting of politicians/government also perceive a lower personal threat from the virus.[12]

If trust on the one hand, or perception of vulnerability on the other, can be elevated, there is a good chance people might comply more consistently, with knock on benefits in terms of reinforcing safer social norms.

9 The Guardian (2020). *Why are indoor settings higher risk for COVID – and are restaurants safe?* https://www.theguardian.com/politics/2020/aug/07/why-are-indoor-settings-higher-risk-for-COVID-and-are-restaurants-safe

10 Will COVID-19 change what the public expect of government? (UKRI/ESRC project: Curtice, Abrams, Jessop, NatCen Social Research forthcoming).

11 Abrams, D., & Travaglino, G.A. (2018). Immigration, political trust and Brexit – testing an Aversion Amplification Hypothesis. *British Journal of Social Psychology,* 57, 310-326. doi:10.1111/bjso.12233

12 Lalot, F., Abrams, D., & Travaglino, G.A. (2020). Aversion amplification in the emerging COVID-19 pandemic: The impact of political trust and subjective uncertainty on perceived threat. *Journal of Community & Applied Social Psychology, in press.*

But even if trust in national level government is not readily improved, there are other avenues to pursue. One consequence of the pandemic has been a social and behavioural retreat to local levels. This ranges from home working, to local volunteering, to more home and local procurement of goods and services, to a more local interest and focus on policy, infection rates and other things.[13] Research surveying the 5 local integration areas as well as comparing Scotland, Wales and one region of England, is revealing two important patterns.

1. The initially unifying effect of lockdown is starting to dissipate and we are seeing the re-emergence of schisms based on ethnicity, age, region and Brexit preferences. The focus on social categories increases the likelihood these schisms will widen further and others will emerge, for example pitting young 'reckless' people against old 'vulnerable' people, or a growing sense of division between London and the rest of the country.

2. For the local authorities, the strengthening of engagement with their communities is proving vital on both sides of the relationship. For example, residents who are working to sustain others are experiencing the pandemic very differently depending on whether they are doing so as volunteers (with a high level of choice and control over their engagement with others) or as key workers (who are required to do so). For the former, their local engagement means that the situation is relatively empowering and brings closer relationships to family and community. For the latter, their work against the pandemic is relatively depersonalised, stressful and is linked to greater mistrust in government and a weakening of connections to family.[14]

Survey evidence from individuals and communications with local authorities also point to advantages in **investing in cohesion from the bottom up** – to build regional, sub-regional and local relationships and resources that people can understand and trust, to equip individuals to avoid infection and cope with the wider effects of the pandemic. Trust also remains much higher in local politicians (including MPs) than in UK government, and this trust can be capitalised upon.

A reasonable assumption is that a higher proportion of people will become unemployed, will work locally, or work from home. These changes mean that the local community will become even more important for their physical, psychological and economic survival. It will also play a stronger role in providing norms and structures for action. As such investment in maintaining and strengthening levels of social cohesion and integration locally are vital. As well as supporting local government to identify and prioritise specific communities and groups for support, communications, transmission reduction and longer term preventative health outcomes it will also shore up communities against a rise in community tensions, intergroup rivalry and hate crime.

It is crucial that the most vulnerable people are not left out of this potentially richer and mutually supportive local social mesh. There are clear risks that those who live in more isolated places or with fewer transport options, those with the lowest incomes, those living with disabilities, those who do not have English as a first language, those without good digital connections, and those who are too anxious to meet others, could well be left behind as social transformations get under way.

13 Abrams, D., Lalot, F., Broadwood, J., & Platts-Dunn, I. (2020). *'Beyond us and them' – Perception of COVID-19 and social cohesion. July 2020 Report.* https://www.belongnetwork.co.uk/wp-content/uploads/2020/07/Research-Project-Report-July-2020-public-1.pdf

14 Abrams, D., Lalot, F., Broadwood, J., & Platts-Dunn, I. (2020). *All in it, but not necessarily together: Divergent experiences of keyworker and volunteer responders to the COVID-19 pandemic.* https://www.belongnetwork.co.uk/wp-content/uploads/2020/08/All-in-it-but-not-necessarily-together.pdf

Recommendations

Evidence on cohesion points towards a number of policy implications for managing the pandemic effectively:

1. Management will be more effective via devolution of resources and power to local and regional authorities. Drawing on their local connections and higher levels of trust and engagement they will be better able to implement unpopular measures (for example hyperlocal lockdowns) and more likely to be able to ensure compliance.
2. Building on existing studies, a national evidence base is needed to better understand how trust, social connection, in-group / out-group preferences, perceived threat and risk and intergroup relations influence people's behaviour in response to guidance and compliance with necessary public health measures.
3. Longer term investment is needed to bridge between different groups and communities so that there is less likelihood of the crisis leading to fractures of good relations locally and nationally.

Conclusion

Cohesion is a fundamental force that, at national and local levels, can either be mobilised or seriously disrupted by government strategies that affect people's capacity to cope with, respond to, and emerge strongly from this pandemic. By building a shared understanding of what the risks and threats are, consensus about what sacrifices and behaviour changes are needed, localised norms for action, and trusted leadership at a level that is relevant and meaningful, cohesion can be used to very positive effect.

Research is largely focussing on national trends, demographic differences, or individual attitudes. Relatively little research explicitly incorporates attention to the role of the regional, sub-regional and local levels at which people interrelate[15] (though examples include the BA's work on social integration and cohesion[16], Nuffield's emerging work in this area[17], and programmes such as Born in Bradford[18]). MHCLG is not currently prioritising local level work and so organisations such as Belong (the Cohesion and Integration Network) and the LGA are important routes for sustaining this focus. Our current evidence is that areas with stronger cohesion and integration strategies and that furnish a stronger place-based identity are also showing lower levels of prejudice and higher levels of trust, but also perceive growing disunity across the UK and greater separation from London. Significant further investment is needed to ensure a coherent nationally comparable evidence base and policy framework to build on the strengths of places to support the nation as a whole.

15 Only 3 of the 140 COVID-related projects supported by ESRC projects focus on place https://esrc.ukri.org/files/news-events-and-publications/news/esrc-COVID-19-activity/

16 https://www.thebritishacademy.ac.uk/projects/cohesive-societies-local-actions-promote-social-integration/, https://www.thebritishacademy.ac.uk/documents/291/British_Academy_IYCDOT_Case_Studies.pdf

17 https://www.nuffieldfoundation.org/research/COVID-19

18 https://borninbradford.nhs.uk/research/

Social dynamics and vulnerability to COVID-19

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The *vulnerability* of an individual to COVID is determined by two factors:

(i) The probability of contracting the illness.

(ii) The risk to health given that one contracts the illness.

Given that one has contracted the illness, social dynamics will impact severity and vulnerability through social attitudes to contacting health services, and this will be mediated by responses to publicity about the pandemic and its risks. The less severe cases, which will be the majority, will recover regardless of whether they contact health services, so here I focus on (i) above.

The number infected at a chosen point in time is the prevalence of the illness, and the number becoming infected during a given period is the incidence.[19] This means that prevalence is determined by incidence. Our aim is to explore what patterns of social interactions within a community impact COVID-19 incidence and prevalence (perhaps with the latent objective of identifying those interventions which reduce incidence, which will in turn reduce prevalence).

COVID-19 incidence is determined by:

(i) The number and pattern of interactions. Interactions might be within household groups (where they will vary between different household structures, such as multi-generational households vs single person households), or related to occupation, leisure, housing, religious behaviour, age, etc.[20 21 22] Care homes provided an early tragic example of how infection could be propagated rapidly between members of relatively closed communities.

(ii) The capacity for adopting preventative measures. Clearly this is more limited in less affluent communities, and the pandemic has brought into focus some social disparities. The sequel to the Marmot Review[23] demonstrated the link between deprivation, health, and shorter life expectancy, and data on COVID-19-related deaths and socioeconomic deprivation are given in.[24]

(iii) The nature of the interactions (duration, proximity, ...).

19 Everitt B.S. and Palmer C.R. eds (2011) *Encyclopaedic Companion to Medical Statistics*. 2nd ed., John Wiley and Sons.

20 Scala A., Flori A., Spelta A., Brugnoli E. Cinellin M., Quattrociocchi W., and Pammolli F. (2020) Time, space and social interactions: exit mechanisms for the COVID-19 epidemics. Nature Research, 13 August 2020. https://www.nature.com/articles/s41598-020-70631-9

21 *Disparities in the Risk and Outcomes of COVID-19.* Public Health England. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/908434/Disparities_in_the_risk_and_outcomes_of_COVID_August_2020_update.pdf

22 *Beyond Sex and Gender Analysis: An Intersectional View of the COVID-19 Pandemic Outbreak and Response.* Global Policy Institute, Queen Mary University of London. https://www.qmul.ac.uk/media/global-policy-institute/Policy-brief-COVID-19-and-intersectionality.pdf

23 *Health Equity in England: The Marmot Review 10 Years On.* http://www.instituteofhealthequity.org/resources-reports/marmot-review-10-years-on

24 *Deaths Involving COVID-19 by Local Area and Socioeconomic Deprivation.* Office for National Statistics, https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/deathsinvolvingCOVID19bylocalareasanddeprivation/deathsoccurringbetween1marchand31july2020

(iv) The structure of the population, and the relative physiological susceptibility to becoming infected and becoming infectious (for example, there have been questions about the extent to which young children are infectious).[25]

(v) How interventions (quarantining, social distancing, face masks, handwashing, ...) impact the patterns of interactions.[26] It is important to note that this includes how people react to government guidelines/advice/instructions, not how the interventions would impact incidence if everyone followed them perfectly.

(vi) The number currently infected. At one extreme, a low prevalence rate will mean a low incidence rate because there will be fewer opportunities to become infected. At the other extreme, herd immunity after many have become infected (and recovered) will imply a low incidence rate. In between these extremes lie opportunities for high rates of incidence, with large numbers becoming infected at around the same time.

(vii) Duration of resistance to reinfection.

(viii) How social behaviour changes over time, in response to the pandemic and the restrictions imposed (including 'behavioural fatigue'[27] and also a relaxation of precautions if the threat seems to have diminished). This seems to impact different age groups differently.

(ix) Web propagation of information and misinformation.[28]

These factors have various implications, including:

Blanket bans on all kinds of group gatherings might be unnecessary. The key factor is how many people individuals come into close contact with ((i) and (ii) above). For example, in weddings, raves, and packed commuter trains a high number of pairwise contacts are likely to occur (albeit perhaps for limited duration). In contrast, in theatres and cinemas, if the entry and exit procedures are carefully controlled, contacts are only with those seated nearby.

1. Targeted lockdowns are a valuable tool, limiting economic damage.
2. Social bubbles, minimising inter-bubble contacts can be effective. If bubbles were tightly maintained, testing could focus on the inter-bubble contacts.
3. A strategy for quickly identifying and containing outbreaks is critical. (With the general concomitant, that rapid and reliable testing is central to containing the pandemic.)
4. The shift towards remote working is a highly effective strategy for minimising contacts, but may have other unsuspected social consequences.

The strategies listed above will be effective only with properly framed public information programmes, particularly given the propensity for misinformation to spread on the web. An example is the recent targeted locked down of Leicester just

25 Davies N.G., Klepac P., Liu Y., Prem K., Jit M., CMMID COVID-19 Working Group, and Eggo R.M. (2020) Age-dependent effects in the transmission and control of COVID-19 epidemics. *Nature Medicine,* 26, 1205-1211. https://www.nature.com/articles/s41591-020-0962-9

26 Bailey P., Wenzel R.P. (2020) *The Importance of Non-Pharmacological Interventions for the Prevention of COVID-19 Transmission.* International Society for Infectious Diseases. https://isid.org/wp-content/uploads/2020/07/ISID_GUIDE_COVID-19_NPI.pdf

27 Abbasu K. (2020) Behavioural fatigue: a flawed idea cental to a flawed pandemic response. *British Medical Journal,* 370. https://www.bmj.com/content/370/bmj.m3093

28 Jolly J. (2020) Your social feed is crowded with misinformation about coronavirus. Here's how to spot it. *USA Today,* https://eu.usatoday.com/story/tech/columnist/2020/08/16/COVID-19-misinformation-how-spot-your-timeline/3305281001/

before Eid,[29] which some described as targeting Muslims, but which might more usefully and accurately have been described within that community as a government effort to protect Muslim lives.

Likewise, more and better communication is also needed about the uncertainties associated with the pandemic. Honesty about what is not known, and about the methods which were being made to find out, could have helped alleviate adverse reaction to what some in the public saw as flip-flopping recommendations.

29 Shaw N. (2020) Hancock says "Happy Eid" and denies lockdown is to stop celebrations. *Leicester Mercury,* 31 July. https://www.leicestermercury.co.uk/news/uk-world-news/hancock-says-happy-eid-denies-4381742

Ethnic inequalities in COVID-19 mortality

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The available evidence clearly shows that ethnic minorities have experienced significantly higher COVID-19 related death rates than has the white population. Studies looking at the disadvantaged socio-economic positions of minorities, and at their experience of comorbidities, have made important contributions to our understanding of these ethnic differentials but have failed to explain fully the ethnic differences in susceptibility to COVID-19. Additional factors therefore need to be taken into account if we are to understand these inequalities and to provide effective policy responses. These additional factors should include the nature of the (adverse) changes affecting minorities during lockdown and recession, and their exposure to unequal treatment both within the healthcare system and in the wider society. Policy responses need to address both the entrenched disadvantages which have already been extensively documented, and to protect minorities from unequal treatment and from adverse changes to their situation during and after the pandemic.

A number of studies, drawing on a range of data, have demonstrated that there are marked ethnic inequalities in COVID-19 related deaths.[30] For example the Office for National Statistics (ONS) has reported that, in England and Wales, males of Black ethnic background (aged nine years and over) had a significantly higher age-standardized mortality rate of death involving COVID-19 than males of other ethnic backgrounds - 255.7 deaths per 100,000 population, a rate 2.9 times greater than those of White males. There were also notably raised rates of death among males in the Bangladeshi or Pakistani (2.2 times that of white males), Indian (1.8 times), and Other (1.9 times) ethnic groups. Females had a lower rate of death involving COVID-19 than males across all ethnic groups, but the pattern of ethnic differentials was similar to that among males.[31] Within these broad ethnic groupings employed by the ONS,

30 Intensive Care National Audit and Research Centre (2020) Report on COVID-19 in critical care. https://www.icnarc.org/OurAudit/Audits/Cmp/Reports; Khunti, K., Singh, A. K., Pareek, M. & Hanif, W. (2020) 'Is ethnicity linked to incidence or outcomes of COVID-19?' British Medical Journal 369, m1548; Office for National Statistics (2020a) Coronavirus (COVID-19) related deaths by ethnic group, England and Wales: 2 March 2020 to 15 May 2020, https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/coronavirusCOVID19relateddeathsbyethnicgroupenglandandwales/2march2020to15may2020; Public Health England (2020a) Disparities in the risk and outcomes of COVID-19, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/890258/disparities_review.pdf; Public Health England (2020b) Beyond the data: Understanding the impact of COVID-19 on BAME groups, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/892376/COVID_stakeholder_engagement_synthesis_beyond_the_data.pdf; Public Health England (2020a) Disparities in the risk and outcomes of COVID-19, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/890258/disparities_review.pdf; Platt, L. and R. Warwick (2020) 'Are some ethnic groups more vulnerable to COVID-19 than others?' https://www.ifs.org.uk/inequality/chapter/are-some-ethnic-groups-more-vulnerable-to-COVID-19-than-others/; Williamson, Elizabeth J et al. (2020) 'Factors associated with COVID-19-related death using OpenSAFELY. Nature. https://doi.org/10.1038/541586-020-2521-4; Pan, D et al. (2020) 'The impact of ethnicity on clinical outcomes in COVID-19: a systematic review', EClinical Medicine 23, 100404, June 01, 2020.; Bhala, N., Curry, G., Martineau, A.R., Charles Agyemang, C. and Bhopal, R. (2020) 'Sharpening the global focus on ethnicity and race in the time of COVID-19', The Lancet, 395, 1674-1676, doi:10.1016/ S0140-6736(20)31054-0

31 Office for National Statistics (2020a) Coronavirus (COVID-19) related deaths by ethnic group, England and Wales: 2 March 2020 to 15 May 2020. *Table 5*. https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/coronavirusCOVID19relateddeathsbyethnicgroupenglandandwales/2march2020to15may2020

it is likely that there is a considerable range between subgroups. For example, the Black group is highly diverse and it is likely that communities such as that of Somali background might be even more severely affected than the average. There are also indications that some white minorities may also have higher death rates than do the white British.[32] The extent of ethnic disparities might therefore be even greater in practice than in the ONS figures.

A range of possible explanations for these ethnic differentials has been suggested. These explanations have largely focussed on socio-economic factors and on co-morbidities. We begin by reviewing these explanations, where there is now a solid evidence base, before turning to additional potential factors, such as the adverse impacts of lockdown and the unequal treatment of minorities, on which further research is needed.

Socio-economic factors as explanations for ethnic differences

Socio-economic factors, such as living in densely-populated areas, are likely to affect the risks of infection while factors such as material deprivation may also affect susceptibility to more severe outcomes once infected. Such factors have been shown to be correlated with COVID-19 related mortality and go some way towards explaining (in a statistical sense) the ethnic differentials. However, substantial ethnic differentials remain even after taking account of socio-economic factors.

ONS, for example, has used linked Census and registration data to take account of region of residence, population density, area deprivation, household deprivation, social class position, household composition and living arrangements (including multigenerational households), and measures of occupational exposure (namely key worker status and exposure to others). The research found that region and population density were important in explaining ethnic differentials, with other socio-economic variables making small additional contributions to the explanation of ethnic differentials. After controlling for these socio-economic factors, the size of the ethnic minority hazard ratios were reduced by a third or more, but remained substantial and statistically significant in most cases (except for the Chinese and mixed groups). Thus after statistical controls, the Black hazard ratio was still double that for whites and the Bangladeshi/Pakistani ratio was 1.5 times that for whites.

A limitation of this work by the ONS is that the socio-demographic measures came from the 2011 census, but other studies using contemporaneous data[33] have broadly confirmed the ONS conclusions.

In addition, some of the measures available in the Census were quite blunt instruments. For example, there is likely to be considerable variation within the 'key worker' category in exposure to infection. Further research by ONS[34], using more granular measures, showed that certain jobs such as taxi drivers and care workers had particular elevated risks of death. Minorities tend to be over-represented in many of these specific high-risk occupations.

32 Nazroo, J. and Bécares, L. (2020) 'Evidence for ethnic inequalities in mortality related to COVID-19 infections: Findings from an ecological analysis of England and Wales', medRxiv, doi: https://doi.org/10.1101/2020.06.08.20125153

33 Raisi-Estabragh, Z., Mccracken, C., Bethell, M.S., Cooper, J., Cooper, C., Caulfield, M.J., Munroe, P.B., Harvey, N.C. and Petersen, S.E. (2020) 'Greater risk of severe COVID-19 in Black, Asian and Minority Ethnic populations is not explained by cardiometabolic, socioeconomic or behavioural factors, or by 25(OH)-vitamin D status: study of 1326 cases from the UK Biobank', Journal of Public Health, 25, 1–10.; Williamson, Elizabeth J et al. (2020) 'Factors associated with COVID-19-related death using OpenSAFELY. Nature. https://doi.org/10.1038/541586-020-2521-4.

34 Office for National Statistics (2020b) 'Coronavirus (COVID-19) related deaths by occupation, England and Wales deaths registered between 9 March and 25 May 2020.' https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/causesofdeath/bulletins/coronavirusCOVID19relateddeathsbyoccupationenglandandwales/deathsregisteredbetween9marchand25may2020

Comorbidities as explanations for ethnic differences

Public Health England (PHE) has raised the possibility that comorbidities and obesity might be further factors that could explain the ethnic differentials, increasing minorities' susceptibility to serious illness: "These are important factors because they are associated with the risk of acquiring COVID-19, the risk of dying, or both. Other evidence has shown that when comorbidities are included, the difference in risk of death among hospitalised patients is greatly reduced."[35]

One study has indeed found that, among patients who had been admitted to hospital, there was no association between ethnicity and risk of dying once comorbidities were taken into account.[36] However, another study using UK Biobank data on hospitalised patients who had been tested for COVID-19, found that household deprivation, household overcrowding, and higher BMI all had significant associations with a positive test result for COVID-19 but did not explain the ethnic differentials, which remained substantial (log odds of 1.73 comparing the white and minority groups as a whole). Moreover, there was no significant association with vitamin-D status, diabetes, hypertension, high cholesterol or recent myocardial infarction.[37]

Furthermore, a much larger study by Williamson and colleagues[38] using over 17 million electronic GP records linked with registration data was able to cover a much wider range of comorbidities, of which a considerable number were significantly related to COVID-19-related mortality (including in descending order of effect size, organ transplant, recent haematological malignancy, other neurological disease, reduced kidney function, other immunosuppressive disease, stroke or dementia, severe diabetes, high body mass index, liver disease, recent cancer (non-haematological), and respiratory disease (excluding asthma). However, controlling for these comorbidities (plus age and area deprivation) only went a small way towards explaining the ethnic differentials. Thus the hazard ratio for the Black group (relative to the White group) fell from 1.88 (in a model controlling only for age and gender) to 1.48 (in the fully adjusted model); for the South Asian group from 1.69 to 1.45; and for the mixed group from 1.62 to 1.43. The authors concluded "Our findings show that only a small part of the excess risk is explained by a higher prevalence of medical problems such as cardiovascular disease or diabetes among BAME people, or by higher levels of deprivation".[39] The authors also pointed out that comorbidities only partially explained the effects of area deprivation and concluded that more research needed to be devoted to understanding social factors in general.

Adverse changes in life situation and allostatic load as explanations

The research cited above on socio-economic explanations has taken a static rather than a dynamic approach to measuring socio-economic disadvantage. Thus, ONS[40] used socio-economic measures from the 2011 census and assumed that these would

35 Public Health England (2020a) Disparities in the risk and outcomes of COVID-19, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/890258/disparities_review.pdf

36 Harrison, E., Docherty, A. and Semple, C. (2020) 'Investigating associations between ethnicity and outcome from COVID-19'. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/886433/s0238-co-cin-report-ethnicity-outcomes-250420-sage29.pdf

37 Raisi-Estabragh, Z., Mccracken, C., Bethell, M.S., Cooper, J., Cooper, C., Caulfield, M.J., Munroe, P.B., Harvey, N.C. and Petersen, S.E. (2020) 'Greater risk of severe COVID-19 in Black, Asian and Minority Ethnic populations is not explained by cardiometabolic, socioeconomic or behavioural factors, or by 25(OH)-vitamin D status: study of 1326 cases from the UK Biobank', Journal of Public Health, 25, 1–10.

38 Williamson, Elizabeth J et al. (2020) 'Factors associated with COVID-19-related death using OpenSAFELY. Nature. https://doi.org/10.1038/541586-020-2521-4.

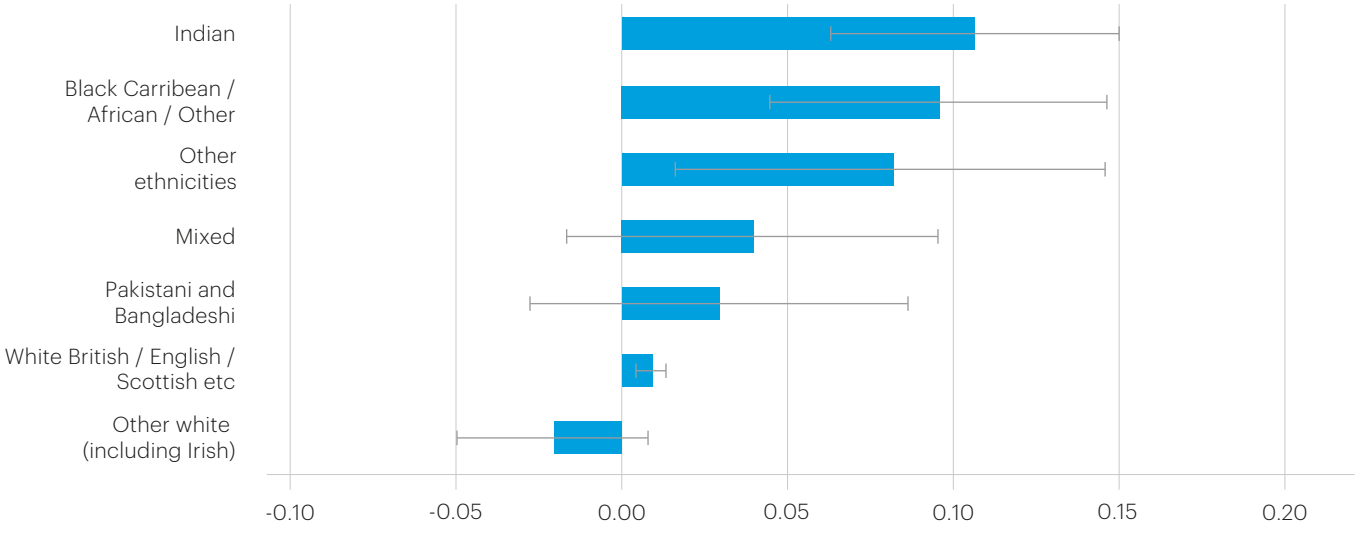
39 Williamson, Elizabeth J et al. (2020) 'Factors associated with COVID-19-related death using OpenSAFELY. Nature. (pp. 2) https://doi.org/10.1038/541586-020-2521-4.

40 Office for National Statistics (2020a) Coronavirus (COVID-19) related deaths by ethnic group, England and Wales: 2 March 2020 to 15 May 2020. https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/coronavirusCOVID19relateddeathsbyethnicgroupenglandandwales/2march2020to15may2020

be a reasonable proxy for current socio-economic status. This is not unreasonable, and the ONS measures can be thought of as capturing minorities' entrenched (long-standing) disadvantage. However, the impact of lockdown and the accompanying economic recession might well have exacerbated these entrenched disadvantages (as previous recessions appear to have done in the past). In other words, minorities might have been more likely to experience adverse changes in their circumstances than were the white British. The involuntary character of these changes may be expected to make them particularly burdensome psychologically.

Hu[41], using data from the UK Longitudinal Household Survey COVID-19 survey and previous waves of the LHS has confirmed these expectations, particularly with respect to ethnic minority migrants to Britain. Hu found that ethnic minority migrants were significantly more likely than white natives to have lost their jobs during the lockdown and were more likely to have experienced adverse changes in their financial circumstances. As far as we know, there has been no study as yet on the relationship between such adverse changes in life-situation and susceptibility to COVID-19. However, one might hypothesize that adverse changes of this kind may have affected minorities' resilience to COVID-19 infection, for example resulting from increased stress and allostatic load. In essence allostatic load – a composite index of biomarker measures tapping the strain experienced by the neuroendocrine, cardiovascular, immune and metabolic systems - is a measure of the 'wear and tear' exacted on the body over time by efforts to adapt to life experiences. It is strongly correlated with subclinical conditions as well as morbidity and mortality.[42] Other research has shown that allostatic load varies both with socio-economic position and with changes in position over the life-course.[43] Our own preliminary research, using the UKLHS data, shows that some of the main minority groups in Britain also experience excess allostatic load, even after controls for age, gender and socio-economic position.[44]

Figure 1. Allostatic Load adjusted for age, sex, social class, UK born, and region (with 95% confidence intervals)



41 Hu, Yang (2020) 'Intersecting ethnic and native–migrant inequalities in the economic impact of the COVID-19 pandemic in the UK', Research in Social Stratification and Mobility 68, August 2020, 100528

42 McEwen, Bruce S. and Eliot Stellar (1993) 'Stress and the Individual. Mechanisms Leading to Disease.' Archives of Internal Medicine 153(18): 2093–2101. doi: 10.1001/archinte.1993.00410180039004.; McEwen, Bruce S. (2015) 'Biomarkers for Assessing Population and Individual Health and Disease Related to Stress and Adaptation.' Metabolism 64 (3, Supplement 1): S2–S10. doi: 10.1016/j.metabol.2014.10.029.

43 Präg, P., N-S Fritsch & L Richards (2019) 'Intragenerational mobility and wellbeing in Great Britain: a biomarker approach'. Paper presented at the ISA Research Committee 28 Spring meeting, Frankfurt, 2019.

44 The measure of allostatic load available in the UKLHS overlaps partially with the comorbidities identified by Williamson et al (2020). Ideally one needs to identify specific measures of, for example, stress.

Unequal treatment and inequalities in access to healthcare and resources as explanations

The published research cited above neglects experiences of unequal treatment, focussing instead on the characteristics of the individuals affected. We do however know from rigorous field experiments that minorities are at risk of unequal treatment in the labour and housing markets[45] while self-reports of discriminatory treatment have been documented in the government's Citizenship Survey across a range of other domains too. Unequal treatment of these kinds is likely to be a major factor in accounting for minorities' entrenched disadvantage cited above, and thus may be indirectly implicated in minorities' vulnerability to COVID-19.

Unequal treatment may also have direct effects on vulnerability to COVID-19. There is extensive research showing the association between experiences of discrimination and health problems.[46] Mechanisms such as stress are likely to be involved and could potentially explain increased vulnerability.

In addition to direct discrimination, unequal access to healthcare and personal protective equipment may also be important. Lack of access to PPE has for example been suggested by the South Asian Health Foundation as a potential factor in ethnic differentials.[47] There might also be inequalities in access to healthcare, such as to GP appointments, and in consequence later diagnosis. Unequal treatment and inequalities in access to care could potentially explain the ethnic-specific risks of COVID-19 related mortality that remain after socio-economic disadvantage and comorbidity have been taken into account.

Conclusions

The recent meta-analysis by Pan and colleagues concluded that "Data in the published medical literature on ethnicity in patients with COVID-19 ... remains limited and should be addressed by routine reporting of disaggregated data on ethnicity as part of routine governmental surveillance data, large scale international registries and clinical trials to inform future public health interventions and mechanistic studies".[48] We concur with this recommendation. We would further argue that policy responses need to address the entrenched socio-economic disadvantages which have already been extensively documented, and which are also implicated in minority patterns of comorbidity. Even if such factors do not fully explain minorities' vulnerability to COVID-19, they are clearly important contributors to that vulnerability. There is also a clear risk that lockdown measures and the associated economic recession may have exacerbated these entrenched disadvantages. Equality impact assessments therefore need to be carried out with respect to policies tackling the pandemic and the accompanying recession, and mitigations need to be set in place to protect minorities. The unequal treatment experienced by minorities at all stages of their lives remains a serious challenge for governments. In the current context a priority is to ensure that any unequal treatment within the health and social care systems is identified through regular monitoring, and appropriately tackled when identified.

45 Heath. A. F. and V. Di Stasio (2019) 'Racial discrimination in Britain, 1969-2017: A meta-analysis of field experiments on racial discrimination in the British labour market', British Journal of Sociology (online) doi: 10.1111/1468-4446.12676

46 Nazroo J. Y. (2003) 'The structuring of ethnic inequalities in health: economic position, racial discrimination, and racism', American Journal of Public Health, 93, 2, 277–284. https://doi.org/10.2105/ajph.93.2.277; Wallace, S., Nazroo, J.Y. and Bécares, L. (2016) 'Cumulative exposure to racial discrimination across time and domains: exploring racism's long term impact on the mental health of ethnic minority people in the UK', American Journal of Public Health, 106, 7, 1294-1300. doi: 10.2105/AJPH.2016.303121; Williams, D., Lawrence, J., &. Davis, B. (2019) 'Racism and health: Evidence and needed research', Annual Review of Public Health, 40, 1, 105-125

47 https://static1.squarespace.com/static/5944e54ab3db2b94bb077ceb/t/5f059972f6680542c546897f/1594202487799/COVID19_SAHF_Final+for+Release.pdf

48 Pan, D et al. (2020) 'The impact of ethnicity on clinical outcomes in COVID-19: a systematic review', EClinical Medicine 23, 100404, June 01, 2020.

Explaining ethnic inequalities in COVID-19

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Research from the UK has repeatedly shown that people defined as having 'Black' and 'Asian' ethnicities are more likely to both be infected by and suffer complications and death from COVID-19 than those with other ethnicities.[49] To date, speculation regarding the reasons for this inequality has tended to focus on cultural, behavioural or genetic factors.[50] These include cultural preferences for forms of religious expression and living arrangements which increase risk of infection as well as the implications of the documented higher rates of diabetes, heart disease and obesity among some ethnic groups compared with the general population. The role played by broader societal factors has been far less prominent in these discussions. This is despite research which consistently shows that the most convincing explanations for ethnic inequalities in COVID-19 and other health conditions are societal, not genetic or cultural, in origin. This myopia means our efforts to document, understand and address ethnic inequalities in the impact of COVID-19 continue to be thwarted.

No single factor can entirely explain ethnic inequalities in COVID-19. But evidence indicates that the presence of illnesses such as diabetes or heart disease explain less of the ethnic inequality in deaths from COVID-19 than other factors.[51] Far more significant are issues related to differences in the circumstances in which people's lives are lived. People with minority ethnicities are more likely to be essential workers. They are more likely to rely on public transport. They have, on average, lower incomes, even compared with white British people doing the same work and with the same qualifications and language skills. It is these lower incomes, not cultural preferences, which explain the higher risk of overcrowding in BAME households. All of which make them more susceptible to infection. Low incomes also make people more likely to experience complications following infection, due to their poorer living conditions and diets and other factors which lower resilience. Factors related to socioeconomic position offer a far more convincing explanation for ethnic differences in heart disease and diabetes than genetics or particular behaviours.[52] Poverty, and geography, also affect people's access to good health care, further reducing their chances of recovery when they become ill. An individual's decisions cannot be divorced from the economic circumstances in which those choices are made. This evidence parallels that from the large body of international evidence regarding ethnic inequalities in other health conditions.[53]

But our understanding of these relationships remains limited. This is partly an issue of framing. Preconceived ideas about the drivers of these inequalities has limited the research undertaken to investigate them. Research funding calls have prioritised a

49 https://www.gov.uk/government/publications/COVID-19-review-of-disparities-in-risks-and-outcomes; https://www.ifs.org.uk/inequality/chapter/are-some-ethnic-groups-more-vulnerable-to-COVID-19-than-others/

50 https://www.sciencemediacentre.org/expert-comments-on-bme-groups-and-risk-of-hospitalisation-with-COVID-19/; https://www.theguardian.com/society/2020/apr/10/uk-coronavirus-deaths-bame-doctors-bma

51 https://arc-w.nihr.ac.uk/COVID-response/rapid-reports/the-impact-of-COVID-19-on-black-asian-and-minority-ethnic-communities/

52 https://raceequalityfoundation.org.uk/wp-content/uploads/2018/03/health-brief16.pdf

53 https://www.tandfonline.com/doi/abs/10.1080/09581590010005331?journalCode=ccph20;

search for 'genetic' or 'cultural' explanations, with an associated rise in attempts to do just this.[54] This is despite the large body of already existing evidence indicating the futility of such efforts.[55] This framing has also stunted research in more potentially fruitful areas. For example, assumptions that genetic or other health-related factors explain ethnic inequalities in COVID-19 deaths among key workers[56] has undermined effective investigation of whether there may be other influential factors at play related to, for example, ethnic differences in the nature of people's particular roles, access to protective equipment, pay and security, or other circumstances. Such assumptions also encourage policies – such as removing BAME essential workers from front line services – which, if maintained in the long term, risk perpetuating ethnic economic inequalities without justification. Assumptions that ethnic variations in in-hospital deaths are entirely explained by the presence of other health conditions[57] has also limited investigation into whether there might be barriers to the receipt of care which disproportionately affect those with minority ethnicities and may help explain their more negative experiences with COVID-19.

Moreover, the focus on the experiences of people infected with COVID-19 has limited investigation of the impact of policy responses to the pandemic, and whether this also varies by ethnicity. Those with minority ethnicities are likely to have been particularly significantly affected by the lockdown. Those with minority ethnicities are more likely to be self-employed and employed in occupations which were more affected by the shutdown, could not support home working or furlough, and without savings to help them manage any shortfall in income. The digital divide also disproportionately affects those with minority ethnicities, whether they are at work or school. Without documenting the scale and nature of these problems, we cannot hope to understand how to help people out of the current crisis, or support them better during the next one.

There are also problems with the research which has been conducted, which contribute to these persistent gaps. The ethnic group classifications adopted are often extremely crude. Research has established significant differences in the COVID-19 experiences of Bangladeshi, Pakistani and Indian people, and also those who might be considered Black African and Black Caribbean.[31] Yet much existing research combines these into 'Asian', 'Black' or 'BAME' categories. This curtails opportunities to accurately identify the nature of these inequalities and ways to address them.

Existing research has established the important influence of socioeconomic position on these inequalities, as well as age, geography and gender.[31] Typically, the statistical approaches used in such research attempt to remove socioeconomic variations between the groups to explore whether any ethnic differences persist. However, the measures used do not comprehensively account for the inequalities which exist. Analyses may include occupation, for example, but will rarely account for the ethnic variations in pay, security or benefits which exist even within particular positions. They may adjust for the concentration of some ethnic minority households in poorer geographical areas, but not the ethnic inequalities which persist within them. Research shows that some people with minority ethnicities are more likely to live below the poverty line. But, some are more likely to live on the edge of poverty, making impossible decisions to prevent themselves and their families from falling into poverty. It is difficult to argue that these are not also disadvantaged. As such, the economic adjustment offered by these measures can only ever be

54 https://www.nihr.ac.uk/documents/highlight-notice-COVID-19-and-ethnicity/24657
55 https://journals.sagepub.com/doi/abs/10.1177/0306312708091926?journalCode=sssb
56 https://www.hsj.co.uk/exclusive-deaths-of-nhs-staff-from-COVID-19-analysed/7027471.article
57 https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)31423-9/fulltext

partial. Unfortunately, these limitations are often overlooked, further encouraging assumptions that the explanations for any remaining 'ethnic' effect are individual or cultural.

We need more creative and nuanced engagement with the lives of those with minority ethnicities living in the UK in our research, in general and in relation to experiences of the COVID-19 pandemic. This requires a concerted effort to collect more detailed data from both national and local government, and other public institutions, and support to do so from research funders.

We must also acknowledge the ways in which all these inequalities are explained by racism.[58] The stress of living in a society you know to be racist, and experiencing that racism in healthcare settings, at work, in public and through media reports are an important factor in the higher levels of heart disease and other poor health conditions among certain BAME groups. Racism also has indirect health effects through the way it limits people's access to good quality health care,[59] housing,[60] education[61] and employment,[62] higher incomes[63] and healthier lifestyles.[64] Together these dramatically increase the risks of contracting COVID-19 and experiencing complications and death as a result. The legacies of racism also undermine trust in social institutions which lead to less willingness to engage, and additional stress when this occurs.

We need policies which work to address the persistent racism which exists in British society and redress the inequalities which have developed as a result. We must also be mindful of the ways in which future policy can serve to perpetuate this. For example, the effectiveness of approaches to track and trace may be limited for those living in economic disadvantage and undermined by the distrust of government institutions expressed by many in BAME communities.[65]

As a starting point, we must acknowledge that the responsibility to address these inequalities lies with Britain's public institutions, not its public. Then, we must commit to action.

58 https://www.annualreviews.org/doi/full/10.1146/annurev-publhealth-040218-043750
59 https://www.bmj.com/racism-in-medicine
60 https://blogs.lse.ac.uk/politicsandpolicy/racial-discrimination-in-housing/
61 https://www.runnymedetrust.org/projects-and-publications/education/the-school-report.html
62 https://www.nuffield.ox.ac.uk/news-events/news/new-csi-report-on-ethnic-minority-job-discrimination/
63 https://www.ethnicity.ac.uk/research/projects/racism-at-work/
64 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5783341/
65 https://www.bmj.com/content/369/bmj.m2122

Vulnerability to COVID-19: Demography, Deprivation and Behaviour

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The mortality and infection risk for COVID-19 is much higher in some groups and communities. The demographic composition of the population, conditions of socio-economic deprivation, population density and behavioural differences are key factors explaining these differences. Behavioural interaction and risk perceptions by different segments of the population are likewise key.

Demographics

The demographic composition of a population includes key factors such as age, sex, ethnicity and intergenerational households. A study published in April 2020 showed how the population age structure interacts with high COVID-19 mortality rates at older ages to generate a larger number of deaths in nations with older populations.[66] Figure 1 illustrates this point.

The top panel of population pyramids compare the population composition by age and sex (left panel) with estimated COVID-19 deaths (right panel). The top panel compares Italy, which has a considerably older population with 23% over the age of 65, with the considerably younger population of South Korea. The bottom panel shows two populations of similar size – Brazil and Nigeria. Based the age structure of the population alone, estimates showed that the considerably older population in Brazil was likely to suffer three times more deaths than a relatively younger population such as Nigeria.

Demography includes multiple differences beyond the age distribution of the population, including variation of COVID-19 fatalities, infection and transmission by sex, ethnicity, population density, household size, composition and intergenerational relations, partnership status, interaction with migration and social cohesion, labour market participation, access to healthcare, co-morbidities and patterns of inequalities. Few countries are routinely releasing their COVID-19 data that includes this detailed demographic information to study these topics, with many of these aspects still needing urgent attention.[67]

66 J. B. Dowd et al., Demographic science aids in understanding the spread and fatality rates of COVID-19. *Proc. Natl.* Acad. Sci. 117, 9696–9698 (2020).

67 J. B. Dowd et al., Reply to Nepomuceno et al.: A renewed call for detailed social and demographic COVID-19 data from all countries. *Proc. Natl. Acad. Sci.* 117, 13884–13885 (2020).

Socio-economic deprivation and pandemic preparedness

Areas with high socioeconomic deprivation and population density have also been shown to have the highest COVID-19 mortality rates. A study mapping the geography of the availability of hospital beds in England and Wales revealed that certain communities were vulnerable based on their demographic composition of: older populations, level social deprivation, population density and percentage of ethnic minority groups.[68] Simply based on the older age distribution of the population, for instance, the article predicted Harrow to have the most severe hospital problems in London, which was realized with Northwick Park Hospital Harrow being the first hospital to call a critical incident on March 19 2020 (see Figure 2). The models, developed in March 2020, turn out to be highly predictive of the current LSOA regions in lockdown in Manchester as of September 2020. Based on demographic information, higher health pressures were predicted in specific areas of Bolton, Salford, Bury, Trafford and others. Although governmental lockdowns are often broad-based focussing on larger areas, these more granular geo-spatial risk maps could provide more proactive local interventions. These predictions can be examined using an online interactive dashboard that allows for changes in the infection rate and hospital-capacity: *https://COVID19.demographicscience.ox.ac.uk/demrisk*
The relationship between deprivation, ethnicity, population density and higher COVID-19 deaths is attributed to multiple factors. First, people living in conditions of deprivation are more likely to become infected since they are more often key workers (e.g., bus or delivery drivers, care assistants), need to rely on public transport and have poorer or no internet connections, putting them at a higher risk of contact. Areas of social deprivation also have high population density, translating to the inability to engage in social distancing and with limited access to water or hand-washing. Second, those within areas of higher socio-economic deprivation are more likely to die from infections due to higher levels of underlying conditions (e.g., diabetes, chronic respiratory disease), prior infections in childhood, poorer health care, but also exposure to higher levels of stress and pollution. As COVID-19 spread to Latin America and Africa, although many have structurally younger populations, not only demographic factors will play an important role, but also socio-economic conditions and pandemic preparedness. Local expertise from previous outbreaks combined with rapid and strict lockdowns in Africa may mean that it experiences fewer deaths than first anticipated.[69] Further research is required to determine whether the higher BAME COVID-19 deaths in the UK are related to social deprivation, intergenerational households, and types of occupations rather than ethnicity per se.

Behavioural responses

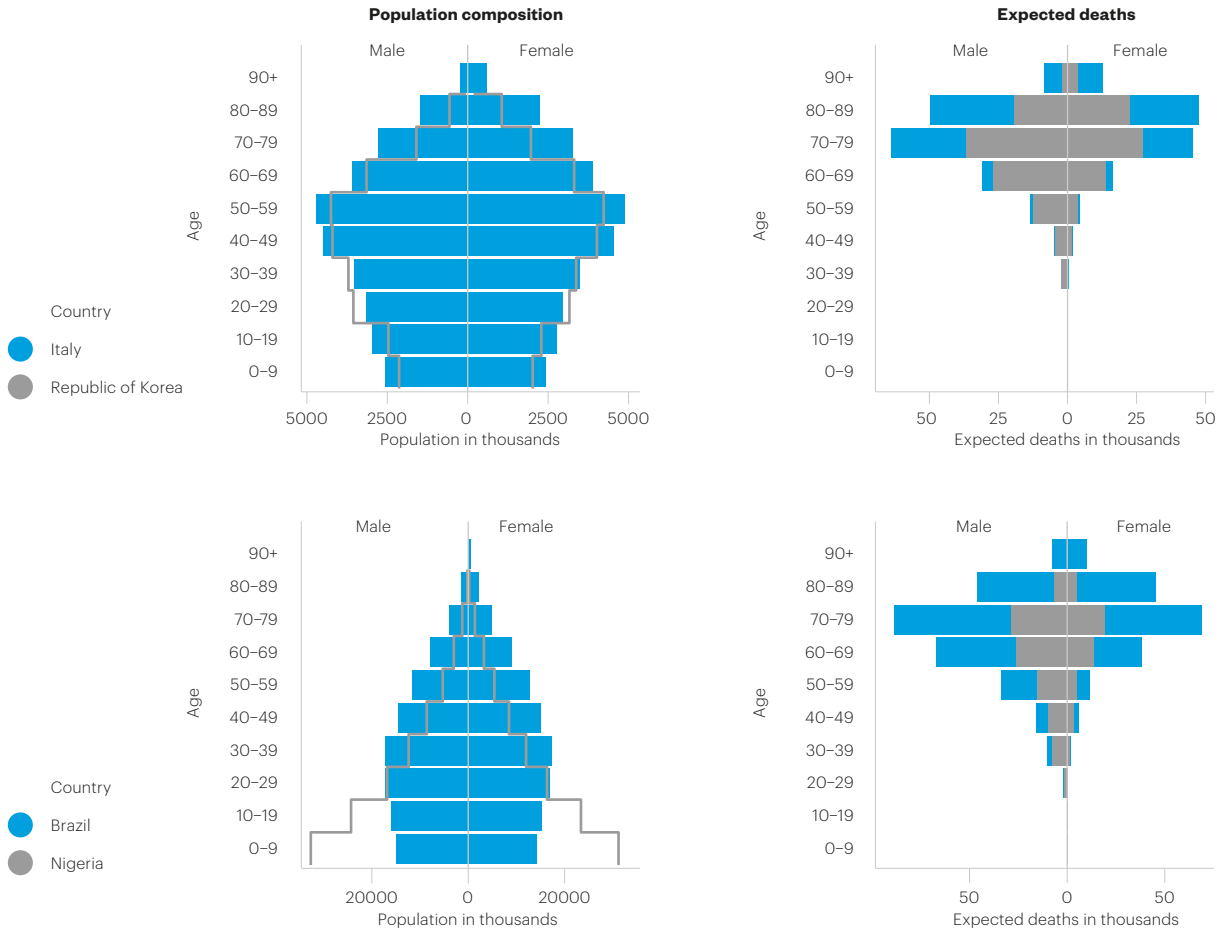
As the public becomes fatigued by lockdowns, other **behavioural social network strategies** can be adopted to help people gradually return to work and school. Opening a floodgate of full contact can result in a higher spread of infection. A recent study used mathematical statistical models (stochastic infection curves) that include infection information from epidemiology with social network models and statistical relational event models. They showed that behavioural social network strategies can be used in multiple settings (schools, workplace) to lower transmission, with building bubbles through repeated contact being shown as the most effective strategy.[70] By modelling the behaviour of networks, infection spread can be reduced particularly by: (1) repeated contact and avoiding changing interaction patterns

68 M. Verhagen, D. M. Brazel, J. B. Dowd, I. Kashnitsky, M. C. Mills, Forecasting spatial, socioeconomic and demographic variation in COVID-19 health care demand in England and Wales. *BMC Med.* (2020), doi:10.1186/s12916-020-01646-2.

69 B. Gaye et al., Socio-demographic and epidemiological consideration of Africa's COVID-19 response: what is the possible pandemic course? *Nat. Med.* 26, 996–999 (2020).

70 P. Block et al., Social network-based distancing strategies to flatten the COVID-19 curve in a post-lockdown world. *Nat. Hum.* Behav. 4, 588–596 (2020).

Figure 1. Population composition and expected deaths in population in Italy and Republic of Korea, Nigeria and Brazil*



*Projections assume 10% population infection rate and current sex-specific case fatality rates from Italy.

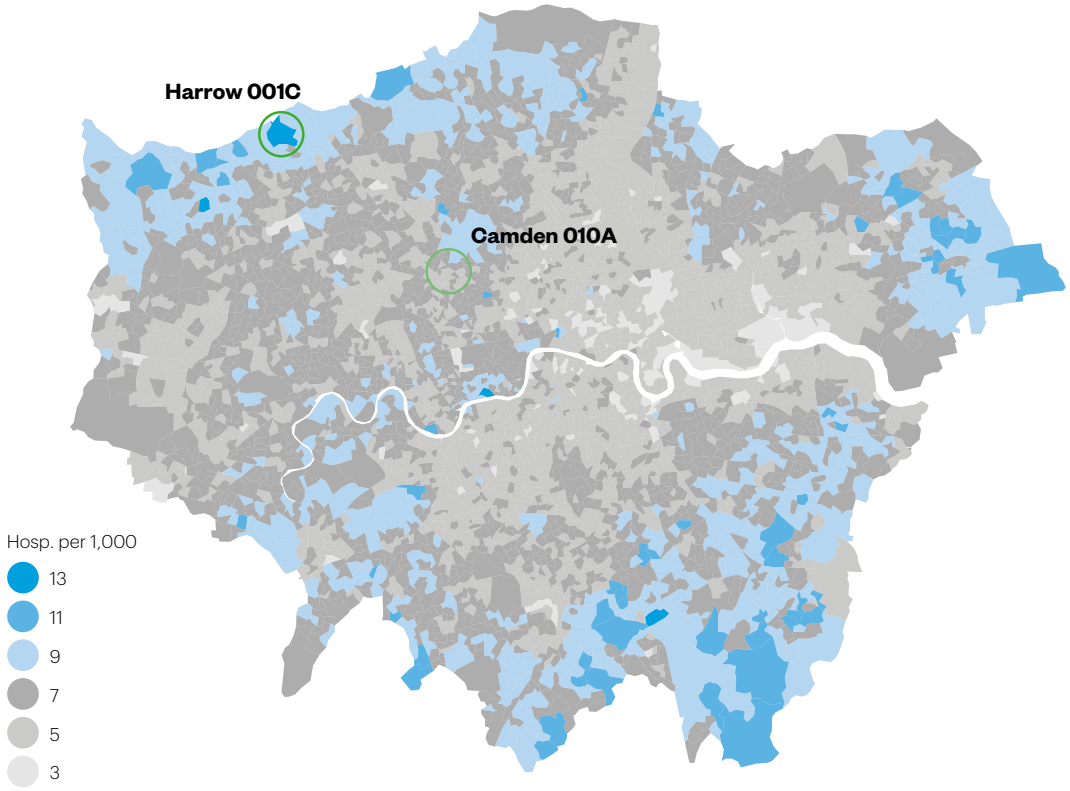
(closed networks), (2) strengthening community cohesion (avoiding interaction with broader networks) and (2) seeking similarity (homophily) such as socio-demographic, same workers on shifts or children in a classroom.

Core socio-behavioural factors are likewise key in **understanding public adherence** to COVID-19 interventions such face coverings, vaccination, hand hygiene and remaining in quarantine. A recent British Academy and Royal Society report on behavioural approaches to face coverings found five key factors.[71] A systematic review isolated key socio-behavioural factors to understanding public adherence to wearing face coverings, namely:

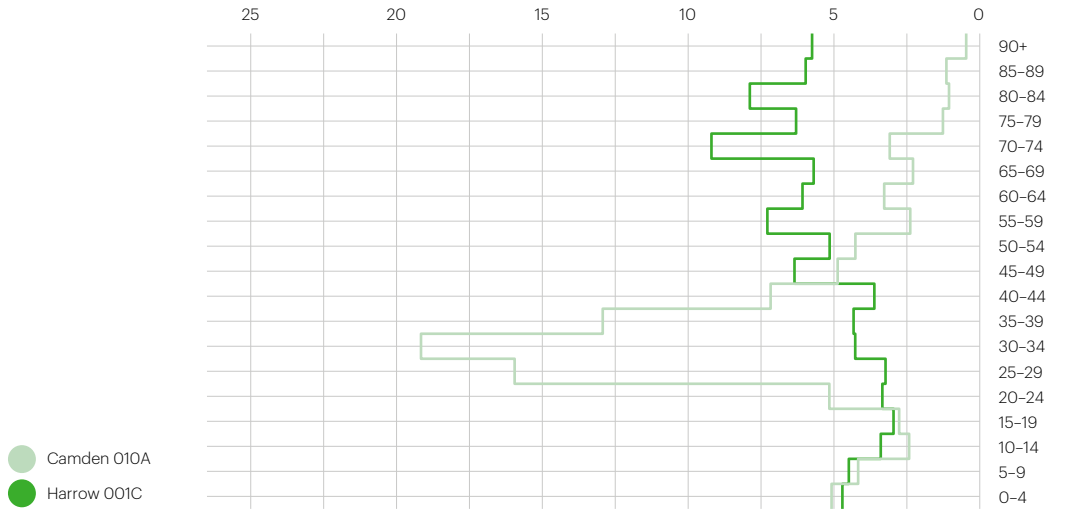
1. public understanding of virus transmission, including efficacy of source versus wearer protection, diagnostic uncertainty and inability to self-diagnose;
2. risk perception, individuals' underestimation of health risks and perception that protection is only relevant for vulnerable groups, or outside of their proximity.

71 M. C. Mills, E. T. Akimova, C. Rahal, "Face masks and coverings for the general public: Behavioural knowledge, effectiveness of cloth coverings and public messaging" (2020), (available at https://royalsociety.org/-/media/policy/projects/set-c/set-c-facemasks.pdf?la=en-GB&hash=A22A87CB28F7D6AD9BD93BBCBFC2BB24).

Figure 2. London local differences in hospitalization need in case of a 10% overall infection and age distribution



Proportion of the population %



Note: Main map shows the hospitalization need in case of 10% infection with the graphic comparing the proportion of the population by age, with areas of Harrow having a relatively older population compared to the younger Camden population.

3. previous national pandemic experience resulting in rapid response and socio-political systems, allowing for more or less coordinated action and public trust
4. individual characteristics, such as younger people and men having a lower threat perception and compliance with interventions
5. perceived barriers, lack of supply of surgical masks and perceived competition with medical resources, resource constraints to obtain coverings, comfort and fit.

The report also showed that **consistent and effective public messaging** is vital, with nonpharmaceutical interventions more effectively seen as part of 'policy packages' in order to acknowledge that interventions are interrelated, to be reviewed in tandem. Finally, it showed that public communications must be clear, consistent and transparent. Inconsistent, premature, alarmist information and information without a clear source raise scepticism and lower compliance.

Key message and recommendations

- Demographics are central to forecasting and understanding COVID-19, primarily age, sex, ethnicity, population density and level of social deprivation
- Although governmental lockdowns are often broad-based focussing on larger areas, more granular geo-spatial risk maps could provide more proactive local interventions
- More research is required to separate whether higher BAME COVID-19 exposure and deaths are related to ethnicity or driven by social deprivation, occupation concentration of certain groups, inability to social distance and use of public transport
- Behavioural social network strategies can be used in multiple settings (schools, workplace) to lower transmission, with building bubbles through repeated contact
- Core socio-behavioural factors to understanding public adherence to COVID-19 interventions (face coverings, vaccination, hand hygiene) are: (1) understanding of virus transmission, (2) risk perception, (3) socio-political system and history, (4) individual characteristics; and, (5) perceived barriers

People Experiencing Homelessness and COVID-19: New trends and key recommendations for a programme of work

Centre for Homelessness Impact

Summary
People experiencing homelessness, and those from vulnerable populations more widely, face higher health and economic risks related to COVID-19. While the number of people facing homelessness increased, they are overwhelmingly low support needs and a large proportion have no recourse to public funds. This invites consideration for a new approach, particularly, considering models to support people with lower support needs. The single biggest challenge we face is accelerating the use of data to respond more promptly. The COVID-19 pandemic highlighted the need for a joined-up approach between different services and how bringing data from different sources can help articulate a multi-sectoral response. A strategic programme of work should i) consider the characteristics of this new group facing homelessness, ii) understand the impacts of accommodation alternatives available on COVID-19 infections and wider outcomes, iii) prioritise understanding the effects on specific services and regions, and iv) ascertain the cost-effectiveness of the policies being implemented.

1. People experiencing homelessness are particularly at risk from COVID-19
Poverty is one of the main drivers of poor health[72] and has been identified[73] as one of the risk factors for severe COVID-19 illness. We also know that coronavirus disproportionally affects ethnic minorities and other disadvantaged groups[74], and that these worse outcomes are partly explained[75] by the large share of people from working in sectors with higher exposure to the virus[76] (e.g. those with more face-to-face contact such as retail, or key workers). People experiencing homelessness are more likely to suffer the ill impacts[77] of COVID-19 as they lack conditions to isolate, are more likely to have comorbidities and, when employed, they overwhelmingly work in low-paying jobs such as retail which may pose greater risks.

2. Reduction in long-term rough sleeping and contained the number of deaths
Even if the *expected* health risks for this group were higher, the Government took decisive and unprecedented actions to house over 15,000 people experiencing street homelessness across England who were reallocated to hotels and other types of emergency accommodation. This concerted effort **drastically reduced long-term rough sleeping and contributed to contain the number of infections and deaths**

72 http://www.instituteofhealthequity.org/resources-reports/marmot-review-10-years-on
73 https://www.cdc.gov/coronavirus/2019-ncov/COVID-data/investigations-discovery/assessing-risk-factors.html
74 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/908434/Disparities_in_the_risk_and_outcomes_of_COVID_August_2020_update.pdf
75 https://www.ifs.org.uk/inequality/chapter/are-some-ethnic-groups-more-vulnerable-to-COVID-19-than-others/
76 https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/whichoccupationshavethehighestpotentialexposuretothecoronavirusCOVID19/2020-05-11
77 https://www.homelessnessimpact.org/post/COVID19risk

among those sleeping rough (only 16 according to a recent ONS release[78]).[79,80]

3. Loss of income is likely to hit vulnerable populations harder and drive homelessness

Projections of poverty as a result of the pandemic[81] indicate that many people are being pushed into 'extreme poverty'. People from more disadvantaged backgrounds are also more likely to be employed in sectors (such as retail) where unemployment can become more acute as the government policies such as the furlough scheme taper off later in the Autumn. There are also sound concerns about how this may increase rent arrears and lead to evictions and homelessness. Some initiatives like the recently extended ban on evictions can delay the direct links between loss of income and homelessness, but the ban doesn't mean people aren't being served notice and the number of people who face eviction proceedings will continue to mount up. Other structural factors such as affordability of housing will compound these pressures in a context of lower incomes - particularly, there are areas with relevant differences between the LHA rate and local housing markets that often require other sources of income to supplement the benefit entitlements.

4. The number of people who are street homeless increased in London, but these are overwhelmingly low support needs

Newly released data[82] on street homelessness for Greater London suggests a few changes in homelessness trends. While the number of those with longer histories of homelessness (deemed to be living on the streets) decreased by about 30% there was a steep increase in the total number of street homelessness - a +33% increase compared to the same period in 2019. Significantly, this is driven by people who are **new to the streets and have considerably lower support needs than previous cohorts**. A large proportion of these have **no recourse to public funds and are twice as likely to be black as previous cohorts**. These new trends may call for a different response - for instance, focusing on supporting them back into employment and understanding differences between groups including the experiences of ethnic minorities.

Some key elements for a research agenda

Homelessness is a complex social problem with causes and impacts rooted in different domains including housing stability, health, income and employment, capabilities and wellbeing, and crime and justice as highlighted by our Evidence and Gap Maps.[83] The challenges of people experiencing homelessness are compounded by COVID-19 as we argued above. The single biggest challenge we face is accelerating the use of data to respond more promptly. The COVID-19 pandemic highlighted the need for a joined-up approach between different services looking at multiple outcomes and how bringing data from different sources can help articulate a multi-sectoral response. Accelerating the development of the key data foundations will also

78 https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/coronavirusanddeathsofhomeless-peopleenglandandwalesdeathsregisteredupto26june2020/2020-07-10

79 Recent data from the ONS highlighted that only 16 people died from COVID in England and Wales. https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/coronavirusanddeathsofhomelesspeopleenglandandwalesdeathsregisteredupto26june2020/2020-07-10

80 The "Everybody In" policy by which street homeless and people in congregate housing were moved to hotels probably helped avert a larger impact on this cohort. Some evidence from the US suggests that the infection rates there in homeless shelters were around 30-40% vs 3-4% in the UK where policies were put in place to allow people to self-isolate. Estimates from Al Story and Andrew Hayward suggest that this policy averted over 25k infections and 300 deaths in this cohort in the UK. https://www.nature.com/articles/d41586-020-01389-3

81 https://www.worldbank.org/en/topic/poverty/brief/projected-poverty-impacts-of-COVID-19

82 https://data.london.gov.uk/dataset/chain-reports

83 https://centreforhomelessnessimpact.github.io/egm/

contribute to generate the evidence we need to tackle homelessness.

CHI's Evidence Tools[84] highlight the need for better UK evidence on what works to end homelessness. We co-created with multiple stakeholders in the sector a list of research priorities particularly relevant in the context of COVID-19:

Expand the focus from people experiencing street homelessness to those who might be at risk of homelessness: The concerted efforts during the pandemic helped to reduce long-term rough sleeping. Putting an end to homelessness requires a wider focus on vulnerable populations and prevention upstream. A key enabler will be creating a better data infrastructure that highlights the interactions between services and allows for a more joined-up approach, paired with support to local authorities to derive insights from their data and act promptly. Interventions targeted at preventing homelessness should consider support in multiple domains including housing stability (e.g. evictions), physical and mental health, income and employment, wellbeing, and criminal justice (e.g. programmes to discharge people from prison). Investing in understanding 'what works' would ensure we roll out interventions that provide the best possible outcomes in a context of limited resources.

Settled Housing vs Temporary (congregate) Accommodation: After the "Everybody in" policy comes to an end, it is fundamental to understand the impacts of moving people back to different forms of temporary accommodation vs settled housing. Temporary accommodation available (e.g. shelters, B&Bs, homeless hostels) might not be suitable for self-isolation and there is some evidence they lead to worse outcomes in other domains.[85] These types of accommodation also represent a very large proportion (close to 40%) of all homelessness expenditures. It would be relevant to explore ways to reduce these expenditures, for instance, by comparing the outcomes of households placed in non-traditional or "new" types of TA, such as shipping containers, little houses, or "pop-up" modular homes. CHI and Cardiff University have also been awarded funding by UKRI to explore the relative effectiveness of the housing models being employed across 5 Local Authorities. This research will shed light on the impacts they have on COVID-19 and wider outcomes.

Understanding impacts on specific services: The impacts of COVID will disproportionately affect different areas so a more localised agenda might be needed. Understanding the potential impacts of an economic downturn on specific types of services and regions will help inform these approaches. For instance, a common question is how to identify the risks of a rise in eviction rates to inform the number of people that may present to their LAs as homeless. In the USA, a team led by Dr Patrick Fowler used data from the 2009 financial crisis to formulate scenarios such as the number of evictions and the impacts on other outcomes such as homelessness.[86]

How to support people with lower support needs: We need to better understand which programmes are most effective to support people experiencing homelessness, for instance, in how to regain and sustain employment, especially in a context where the job market is likely to become more competitive.

84 https://www.homelessnessimpact.org/tools
85 https://www.homelessnessimpact.org/intervention/shelters
86 https://www.annualreviews.org/doi/abs/10.1146/annurev-publhealth-040617-013553

Bolt-on evaluations for Government programmes and emphasis on cost-effectiveness: We lack evidence on how many large government programmes are operating and the impacts they achieved across multiple outcomes. For example, we only have indirect estimates of the impact of "Everybody In" and no indication of **its cost-effectiveness**. The looming fiscal pressures highlight the need to focus on the most cost-effective interventions.

Any questions, please contact Guillermo Rodriguez-Guzman, Head of Evidence and Data at the Centre for Homelessness Impact at: *Guillermo@homelessnessimpact.org*

Mortui vivos docent: Let the dead teach the living in a post-pandemic landscape

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Introduction

As a former NHS nurse, and now an academic – bioarchaeologist - working on the history of disease – palaeopathology[87], my research focuses on the origin, evolution and history of infectious diseases based on what we can identify in the remains (skeletons) of past humans.[88]

The processes through which bioarchaeology interprets and understands ancient infectious disease mirror how we understand their impact on communities today. Bioarchaeology is a holistic field that takes advantage of different disciplinary understandings. It uses archaeological and historical information to provide insight to risk factors related to the socioeconomic, political, and environmental contexts in time and place.[89] It provides the deep time perspective for infections that informs understandings in the present day. Our study of disease has strong synergies with evolutionary medicine[90] and uses the principles of evolutionary biology to better understand, prevent and treat disease affecting our societies now.

While identifying viral infections like COVID-19 in the past is challenging, requiring ancient DNA analysis[91], these diseases likely killed people very quickly. In this short evidence summary I provide bioarchaeological insights related to vulnerability to COVID-19, and suggest how policymakers can use these insights to inform decisions around vulnerability in a post-pandemic landscape through multidisciplinary and intersectional approaches, better communication, and by taking the long view.

Bioarchaeological insights

Can we use what we know from bioarchaeology to inform responses to future pandemics through identifying social fault lines in populations affected by infectious diseases?

Pandemics expose inequality but the roots of inequality (and often xenophobia)

87 Roberts CA 2016 Palaeopathology and its relevance to understanding health and disease today: the impact of the environment on health, past and present. Anthropological Review 79(1):1-16: https://doi.org/10.1515/anre-2016-0001; Roberts CA, Manchester K 2005 The Archaeology of Disease. 3rd edition. Gloucester, Sutton Publishing & Ithaca, Cornell University Press; Roberts CA, Cox M 2003 Health and disease in Britain: from prehistory to the present day. Gloucester, Sutton Publishing

88 Roberts CA, Buikstra JE 2003 The bioarchaeology of tuberculosis: a global view on a re-emerging disease. Gainesville, University Press of Florida.; Müller R, Roberts CA, Brown TA 2014 Genotyping of ancient Mycobacterium tuberculosis strains reveals historic genetic diversity. Proceedings of the Royal Society B 281: 20133236: https://doi.org/10.1098/rspb.2013.3236; Baker B, Crane-Kramer G, Dee MW, Gregoricka LA, Henneberg M, Lee C, Lukehart SA, Mabey DC, Roberts CA, Stodder ALW, Stone AC, Winingear S 2020 Advancing the understanding of treponemal disease in the past and present. Yearbook of Physical Anthropology: https://doi.org/10.1002/ajpa.23988; Roberts CA 2018a Human remains in archaeology. A handbook. 2nd edition. York, Council for British Archaeology

89 Roberts CA 2018b The bioarchaeology of leprosy: learning from the past. Chapter 11.1 in DM Scollard, TP Gillis (eds): International Textbook of leprosy: http://www.internationaltextbookofleprosy.org/; Human remains in archaeology. A handbook. 2nd edition. York, Council for British Archaeology; Roberts CA 2020 Leprosy. Past and Present. Gainesville, Florida: University of Florida Press

90 Nesse RM, Williams GC 1994 Why we get sick. The new science of Darwinian medicine. New York, Vintage Books

91 Appelt S, Fancello L, Le Bailly M, Raoult D, Drancourt M, Desnues C 2014 Viruses in a 14th-Century coprolite. Applied Environmental Microbiology 80(9): 2648-2655: https://doi.org/ 10.1128/AEM.03242-13

are clear from bioarchaeology. We know that vulnerable populations existed in the distant past, and that they experienced infectious diseases, especially in towns and cities, and that animals could pass on their diseases to them.[92] This is particularly so for more recent periods of time in Europe (11th century, or medieval period, onwards). This knowledge comes from the voices we give to the skeletons of the dead that we study. We appreciate that cultural, social, and biological factors influence the human experiences of infections in different settings. Many people with infectious diseases in the past could be stigmatized, marginalized, and quarantined often because of racism, xenophobia or other prejudice (e.g. those with leprosy). Archaeological evidence from plague pits of the dead, to individual biomolecules from these people, shows that the world's population has experienced pandemics before.[93] However, infectious diseases *per se* are complex entities, and in understanding them better we must move beyond the disease (medical/scientific approach) to people and communities affected (a societal view); this is ultimately more productive. This section provides some case studies as evidence to illustrate what we know about vulnerable populations in the past, but we should understand that the human species has enormous capacity for resilience and is extremely good at addressing and adapting to the challenges that face it.

Age, gender, and ethnicity

We know that the current pandemic has affected more people living in urban settings. Looking at past urbanites we also see their increased vulnerability to infections.[94]

Although COVID-19 has affected more men than women, during the Black Death in 14th century London men and women buried in a plague cemetery were equally affected. However, when looking at age specific deaths, the risk of death increased for older people and frail people of all ages[95], as it has for COVID-19. Nevertheless, we should remember that the Black Death was caused by a bacterium and transmitted to humans via fleas from black rats and respiratory droplets in the air; COVID-19, a virus, is transmitted mainly via droplets (coughing and sneezing), and contact with contaminated surfaces.

A comparison of modern and historic populations exposed to plague also showed that risks of death were not uniform across age, being this time concentrated in five and nine year old children (sleeping and playing on the ground: bites of fleas) and young adults (work bringing them into contact with infected rats/fleas).[96] Of relevance here is '*you are what you eat*', with your immune systems being compromised by deprivation and famine if you are vulnerable to becoming ill. Chemical indicators in teeth tell us that people could be nutritionally stressed shortly before death due to

92 Geber J, Murphy E 2018 Dental markers of poverty: Biocultural deliberations on oral health of the poor in mid-nineteenth-century Ireland. American Journal of Physical Anthropology 167:840–855: https://doi.org.10.1002/ajpa.23717; Roberts CA, Cox M 2003 Health and disease in Britain: from prehistory to the present day. Gloucester, Sutton Publishing; Mant ML, Jaagumagi Holland A (eds) 2019 Bioarchaeology of marginalized people. Academic Press; Thomas R 2019 Nonhuman animal paleopathology—Are we so different? In JE Buikstra (ed): Ortner's Identification of pathological conditions in human skeletal remains. Academic Press, 809-822

93 Grainger I, Hawkins D, Cowal L, Mikulski R. 2008. The Black Death Cemetery, East Smithfield, London. Museum of London Archaeological Services Monograph 43. London: Museum of London Archaeological Services. https://medievallondon.ace.fordham.edu/exhibits/show/medieval-london-sites/eastsmithfield; Bos KI et al 2011 A draft genome of Yersinia pestis from victims of the Black Death. Nature 478: 506–510: https://doi.org/10.1038/nature.10549; Keller et al 2019 Ancient Yersinia pestis genomes from across Western Europe reveal early diversification during the First Pandemic (541–750). Proceedings of the National Academy of Science 116 (25): 12363-12372: https://doi.org/10.1073/pnas.1820447116

94 Roberts CA in press What lies beneath those urban settings? The value of bioarchaeology in understanding the complexities of urban health and well-being. In TK Betsinger, S DeWitte (eds): The Bioarchaeology of Urbanization - The Biological, Demographic, and Social Consequences of Living in Cities. Switzerland, Springer Nature; Roberts & Cox 2003: especially medieval communities.

95 DeWitte SN, Wood JW 2008 Selectivity of Black Death mortality with respect to preexisting health. Proceedings of the National Academy of Science 105:1436–41: https://doi.org/10.1073/pnas.0705460105

96 Rubini M, Gualdi-Russo E, Manzon VS, Rinaldo N, Bianucci R 2016 Mortality risk factors show similar trends in modern and historic populations exposed to plague. The Journal of Infection in Developing Countries 10(05):488-493: https://doi.org/10.3855/jidc.7974

famine[97], while poor oral health in 19th century Irish workhouse people tell us that a diet mainly of potatoes and dairy products was the cause, along with lifestyle factors such as pipe smoking.[98] When thinking intersectionally, behavioural risk factors certainly crosscut age and gender and can make people more susceptible to illness.

Bioarchaeology has also shown that Britain has received migrants for hundreds of years from non-British regions, including North Africa[99], and has been diverse for a long time. Today we know that Black, Asian, and minority ethnic groups are being disproportionately affected by COVID-19. These groups can 'vary in behaviours, comorbidities, immune profiles, and risk of infection'[100], as they would have in the past. While migration of people and their ultimate health in their new homeland has seen attention today, there is an increasing focus in bioarchaeology too, again using chemical analysis. Changing place of residence (e.g. for work), and encountering diseases the immune system of a migrant has not experienced before, can predispose them to poorer health.[101] In one bioarchaeological study, however, it was found that migrant individuals experienced a better overall state of health than the "locals".[102] This shows that bioarchaeology sometimes can overturn theories about migrant health.

Health across the life course

COVID-19 has shown that people with underlying health problems can be more vulnerable to the virus and die. Bioarchaeology tells us that people who had poor health early in life could also die prematurely, as they can today. Defects in tooth enamel that develop in utero or in early childhood tell us about socioeconomically determined stress during growth, and studies show that people in the past who experienced defects were more frail and more likely to die earlier than their peers.[103]

Relevant here is the story of a 100-mile march from Dunbar to Durham by Scottish soldier survivors of the 17th century Battle of Dunbar. Once arriving in Durham, they eventually died of malnutrition, disease and cold. However, their early lives had already compromised their later health by being born into a period of Scottish famine and disease.[104] French skeletons with tuberculosis show too that this disease reduced survival[105], and physical and past (and present) structural violence is relevant in

97 Petersone-Gordina, Montgomery J, Millard AR, Roberts CA, Grocke D, Gerhards G 2020 Investigating dietary life histories and mobility of children buried in St Gertrude Church cemetery Riga, Latvia, 15th-17th centuries AD. Archaeometry 62 Supplement 1: 3-18: https://doi.org/10.1111/arcm.12520.

98 Geber J, Murphy E 2018 Dental markers of poverty: Biocultural deliberations on oral health of the poor in mid-nineteenth-century Ireland. American Journal of Physical Anthropology 167:840–855: https://doi.org.10.1002/ajpa.23717

99 Leach S, Lewis M, Chenery C, Müldner G, Eckardt H 2009 Migration and diversity in Roman Britain: a multidisciplinary approach to the identification of immigrants in Roman York, England. American Journal of Physical Anthropology 140:546-561: https://doi.org/10.1002/ajpa.21104

100 Pareek M, Bangash MN, Perrek N, Pan D, Sze S, Minhas JS 2020 Ethnicity and COVID-19: an urgent public health research priority. The Lancet 395: 1421-1422: https://doi.org/10.1016/S0140-6736(20)30922-3

101 Kendall E, Montgomery J, Evans J, Stantis C, Mueller V 2013. Mobility, mortality, and the middle ages: identification of migrant individuals in a 14th century Black Death cemetery population. American Journal of Physical Anthropology 150:210–22: https://doi.org. 10.1002/ajpa.22194

102 Groves SE, Roberts CA, Lucy S, Pearson G, Nowell G, Macpherson CG, Gröcke D, Young G 2013 Mobility histories of 7th-9th century AD people buried at Early Medieval Bamburgh, Northumberland, England. American Journal of Physical Anthropology 151(3): 462-476: https://doi.org/10.1002/ajpa.22290

103 Armelagos GJ, Goodman AH, Harper KN, Blakey ML 2009 Enamel hypoplasia and early mortality: Bioarcheological Support for the Barker Hypothesis. Evolutionary Anthropology 18:261–271: https://doi-org.ezphost.dur.ac.uk/10.1002/evan.20239; Roberts CA, Steckel RH 2019 The developmental origins hypothesis and the history of health project. In Steckel RH, Larsen CS, Roberts CA, Baten J (eds): The Backbone of Europe. Health, Diet, Work and Violence over Two Millennia. Cambridge, University Press, 325-351

104 Gerrard CM, Graves P, Millard A, Annis R, Caffell A 2018 Lost lives. New voices. Unlocking the secrets of the Scottish soldiers from the Battle of Dunbar 1650. Oxford, Oxbow

105 Blondiaux J, de Broucker A, Colard T, Haque A, Naji S 2015. Tuberculosis and survival in past populations: a paleo-epidemiological appraisal. Tuberculosis 95:S93–100: https://doi.org/10.1016/j.tube.2015.02.002

undermining normal growth and health.[106] That said, the European project described above concluded that health actually improved for people after the first pandemic in European history (Justinian plague: 6th-8th century AD) because those who did not die were in demand for work, and had better living conditions and diet[107]; also seen after the 14th century Black Death. Looking after people of ages and backgrounds clearly benefits their health and, for the young, relative susceptibility to later health problems - in post-pandemic periods health and well-being can potentially improve for various reasons.

We know too that conditions that have made people more susceptible to COVID-19 existed in higher status people in the past[108] as well as in the poor, likely making them more vulnerable to other problems. Likewise, we have evidence of co-morbidities (more than one illness). Information from the skeleton of a 12-14 year old Quaker boy chime well with Leicester's June 2020 COVID-19 spike, where working and living conditions were blamed. This boy had vitamin C (scurvy) deficiency, lung disease (TB), and phossy jaw, the latter a condition associated with the phosphorus used for making matches.[109] Living and working in a phosphorus polluted atmosphere also led to lack of UV light and rickets (vitamin D deficiency). This boy's age and his poor quality living and workplace conditions show the intersectional nature of disease.[110] A similar story to that of the northeast boy is repeated in a 19th century almshouse population from Rochester, New York where sinusitis in skeletons of the poor was linked to squalid air quality.[111] COVID-19 has also been linked to air pollution.[112]

Bioarchaeology further shows that ethnicity has a significant influence on health, again as seen in COVID-19. Skeletons of 19th century African Americans revealed that these men had more infection than Euro-Americans[113] especially those born during Reconstruction post- American Civil War where reintegrating seceded states/determining the legal status of African Americans occurred. More infection was caused by enslavement, postliberation migration to the industrialized north, crowded urban living conditions, and poor sanitation.

106 Cardoso HFV, Spake L, Wasterlain SN, Ferreira MT 2018 The impact of social experiences of physical and structural violence on the growth of African enslaved children recovered from Lagos, Portugal (15th–17th centuries). American Journal of Physical Anthropology 168:209–221: https://doi.org/10.1002/ajpa.23741

107 Steckel RH, Larsen CS, Roberts CA, Baten J (eds): The Backbone of Europe. Health, Diet, Work and Violence over Two Millennia. Cambridge, University Press

108 Heart disease: Thompson RC, Allam AH, Lombardi GP et al 2013 Atherosclerosis across 4000 years of human history: the Horus study of four ancient populations. The Lancet 381:1211-1222: https://doi.org/10.1016/S0140-6736(13)60598-X; obesity and diabetes: Jankauskas R 2003 The incidence of diffuse idiopathic skeletal hyperostosis and social status correlations in Lithuanian skeletal materials. International Journal of Osteoarchaeology 13:289-293: https://doi.org/10.1002/oa.697

109 18th/19th century North Shields Tyne and Wear: Roberts CA, Caffell A, Filipek-Ogden KL, Gowland R, Jakob T 2016 'Til Poison Phosphorous Brought them Death': A potentially occupationally-related disease in a post-medieval skeleton from north-east England. International Journal of Paleopathology 13:39-48: https://doi.org/ 10.1016/j.ijpp.2015.12.001

110 See also: Steckel RH, Larsen CS, Roberts CA, Baten J (eds): The Backbone of Europe. Health, Diet, Work and Violence over Two Millennia. Cambridge, University Press. Time, place, age, sex, height, disease, socioeconomic status/occupation, settlement type, topography, elevation, European region, and climate were considered in tracing health in this European project

111 DiGangi EA, Sirianni JE 2017 Maxillary sinus Infection in a 19th Century almshouse skeletal sample. International Journal of Osteoarchaeology 27(2):155-166: https://doi.org/10.1002/oa.2526

112 Travaglio M, Yu Y, Popovic R, Sellet L, Leal NS, Miguel Martins L 2020 Links between air pollution and COVID-19 in England. medRxiv: https://www.medrxiv.org/content/10.1101/2020.04.16.20067405v5

113 de la Cova C 2011. Race, health, and disease in 19th-century-born males. American Journal of Physical Anthropology 144: 526–537: https://doi.org/10.1002/ajpa.21434

People with infections in the past were often the vulnerable and poor and they could experience stigma, discrimination, and marginalization, as for COVID-19 (e.g. deviant burials, 17th century Poland[114]; 15th-17th century colonial, Spain[115]). Shuler[116] noted evidence for stress, abuse, disease and malnutrition in a 1660-1820 enslaved population in the Caribbean; Pietrobelli et al[117] reveal that syphilis in a 14th-16th century Jewish community fuelled negative perceptions of *Jewishness* among Christians of Bologna, Italy; and we know leprosy hospitals were founded in medieval Europe.[118] Some research shows that our assumptions about discrimination however can be incorrect. While leprosy hospitals were opened and there is evidence of care, medieval people with leprosy were not always stigmatized and were buried in normal parish cemeteries.[119] This suggests that they were more accepted by their communities than we think.[120] We have to remember too that understandings of disease varied in the past (and varies), according to time and place, and may not corroborate the western view.[121] This can affect the efficacy of western treatments and cause a lack of understanding.

How can we use this evidence to inform decisions around vulnerability to COVID-19 in a post-pandemic landscape?

Bioarchaeological insights to populations vulnerable to infections show that pandemics are complex. Understanding the historical, socio-political and economic context that contributes (ed) to this complexity can help to inform public health interventions for the current pandemic. This can highlight those factors which precipitated pandemics in the past which are the same and/or different to today.

On this basis, one might conclude that policy interventions today should be **multidisciplinary and intersectional**, focus on **improved communication**, and **take the long view**; and the interventions should be proactive rather than reactive. Each point is explored in turn.

Multidisciplinarity and intersectionality: **Understand key factors of identity of an individual and wider community at local, regional and national levels** that contribute to deprivation - there are variations in behaviours, co-morbidities, immune profiles, and risk of infection.

Information from across all disciplines, particularly from the arts, humanities, and social sciences, that provides evidence for helping vulnerable groups post-pandemic can and should be utilized in planning. This includes understanding why they are vulnerable, including from structural violence.[122] Reducing and eliminating

114 Gregoricka LA, Scott AB, Betsinger T, Polcyn M 2017 Deviant burials and social identity in a postmedieval Polish cemetery: An analysis of stable oxygen and carbon isotopes from the "vampires" of Drawsko. American Journal of Physical Anthropology 163:741–758: https://doi.org/10.1002/ajpa.23244

115 Santana J, Fregel R, Lightfoot E, Morales J, Alamón M, Guillén J, Moreno M, Rodríguez A 2016 The early colonial atlantic world: New insights on the African Diaspora from isotopic and ancient DNA analyses of a multiethnic 15th–17th century burial population from the Canary Islands, Spain. American Journal of Physical Anthropology 159:300–312: https://doi.org/10.1002/ajpa.22879

116 Shuler KA 2011 Life and death on a Barbadian sugar plantation: Historic and bioarchaeological views of infection and mortality at Newton Plantation. International Journal of Osteoarchaeology 66–81: https://doi.org.10.1002/oa.1108

117 Pietrobelli A, Mariotti V, Fusari S, Gasparini A, Bettuzzi M, Pia Morigi M, Belcastro G 2020 Syphilis in an Italian medieval Jewish community: A bioarchaeological and cultural perspective. International Journal of Paleopathology 30: 85-97: https://doi.org/10.1016/j.ijpp.2020.06.001; Roberts CA 2020 Leprosy. Past and Present. Gainesville, Florida: University of Florida Press

118 Roffey S, Tucker K 2012 A contextual study of the medieval hospital and cemetery of St Mary Magdalen, Winchester, England. International Journal of Paleopathology 2:170-180: https://doi.org/10.1016/j.ijpp.2012.09.018

119 Roberts CA 2018b The bioarchaeology of leprosy: learning from the past. Chapter 11.1 in DM Scollard, TP Gillis (eds): International Textbook of leprosy: http://www.internationaltextbookofleprosy.org/

120 Rawcliffe C 2013 Urban bodies: communal health in late medieval English towns and cities. Woodbridge, UK, Boydell & Brewer Ltd.

121 Metzl JM, Kirkland A (eds) 2010 Against health. How health became the new morality. New York University Press

122 Farmer PE, Nizeye B, Stulac S, Kashavjee S 2006 Structural violence and clinical medicine. Plos Med: https://doi.org/10.1371/journal.pmed.0030449

poverty and ensuring equality in all aspects of people's lives is important. Infectious pathogens can further tell us about their evolution through their ancient DNA[123], including genes responsible for susceptibility and resistance to infections[124]; this may help with treatments. Further, engaging with the many variables that pose risk for infections and which intersect with age, gender and ethnicity is essential. All can vary across the life cycle, from the very young right through to the older generation.

Communication: **Messages should be unambiguous, multi-lingual, address equality, diversity and social inclusion and thus cater for all people from different backgrounds and knowledge bases, including those with disabilities,** and acknowledge that different groups may not view the causes and consequences of infections the same as others.

Archaeology and history has shown us that infections today can carry historical baggage with them and the words that are used and communicated can be steeped in the past. In 2020 the word "leper" was used in Leicester to signify shame at having COVID-19, a word that has remained with us throughout history. Words are very powerful. Stigmatizing people with infections can have profound and far-reaching effects on their lives. Policy makers should be improving public health messaging to reduce the problem of stigma and blame, and ensure containment measures for a future pandemic do not exacerbate stigma, discrimination or marginalization. A better (intersectional) understanding of COVID-19 related stigma will help to develop more nuanced approaches to communication in the future, and respect for personal circumstances should be part of any strategy.

Taking the long view: **'Understand the past – and apply the valuable lessons it can teach'**[125]. Bioarchaeology can show how 'how epidemics in the past provide a temporal depth to our understanding of disease dynamics and consequences and the social, biological, and environmental circumstances that give rise to epidemics'.[126] While we need to think about the future, including addressing wider global challenges and inequalities, such as *Black Lives Matter*, archaeology as a wider discipline has an immense contribution to make in a post-pandemic landscape.[127]

123 Keller et al 2019 Ancient Yersinia pestis genomes from across Western Europe reveal early diversification during the First Pandemic (541–750). Proceedings of the National Academy of Science 116 (25): 12363-12372: https://doi.org/10.1073/pnas.1820447116

124 Barnes I, Duda A, Pybus OG, Thomas MG 2011 Ancient urbanization predicts genetic resistance to tuberculosis. Evolution 65(3) : 842–848: https://doi.org/10.1111/j.1558-5646.2010.01132.x

125 Frankopan P 2020 Past pandemics exacerbated disadvantages – what can we learn from them about the coronavirus recovery? The Conversation 29th June: https://theconversation.com/past-pandemics-exacerbated-disadvantages-what-we-can-learn-from-them-about-the-coronavirus-recovery-141254

126 DeWitte SN 2016 Archaeological evidence of epidemics can inform future epidemics. Annual Review of Anthropology 45:63-77: https://doi.org/10.1146/annurev-anthro-102215-095929

127 Barker G, Roberts CA, Gosden C, Horning A, Welham K 2016 Reflections on archaeology. London, British Academy: https://www.thebritishacademy.ac.uk/publications/reflections-archaeology/

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