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Why do People From Ethnic Minorities Have a Higher Mortality Risk From COVID-19 in England?

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Title: Why do people from ethnic minorities have a higher mortality risk from COVID-19 in England ?

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Abstract

This is a synthesis paper collating analysis, data and research from public bodies and academics to understand the impact of COVID-19 on ethnic minorities in England. The paper follows the hypothesis that the excess risk of dying from COVID-19 for ethnic minorities is driven by socioeconomic factors. The evidence gathered shows that geography, socioeconomic factors and pre-existing health conditions explain a large part of the disparities. However, there is some residual excess risk of dying from COVID-19 after accounting for all the above factors for some ethnic minorities compared to White population. This needs further investigation as it may be due to aspects of data quality or factors not included in the model.

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1. Introduction

The coronavirus pandemic has had a disproportionate impact on ethnic minorities in the UK. For example, men from the Black African ethnic group had 3.7 times the risk of dying from COVID-19 compared to White men of the same age during the first wave in England (4 January 2020 to 11 September 2020) (ONS, 2021). Analysis from the Office for National Statistics (ONS), Public Health England (PHE) and academia revealed that a range of socioeconomic and geographical factors coupled with pre-existing health conditions were contributing to the higher infection and mortality rates for ethnic minority groups, with a part of the excess risk remaining unexplained for some groups.

This paper aims to present the analysis undertaken within England on the disproportionate impact of COVID-19 on ethnic minorities. It will present analysis conducted from government sources, academic and scientific groups. The first section of this paper presents the risk factors related to infection and mortality from COVID-19 and how they link with issues faced by ethnic minority groups within the UK. The paper focuses on risk factors such as geography, housing, occupation and pre-existing health conditions. The second section presents mortality analysis and how different risk factors explain the higher risk of dying from COVID-19 for some ethnic minorities in England. It also describes how the risk of dying from COVID-19 changed between the two waves in England for different ethnic groups. Lastly the paper discusses why some ethnic minority groups still have a higher risk from dying from COVID-19 than the White group, after taking into account factors such as geography, occupation, housing and health conditions.

2. Risk factors related to COVID-19

According to SAGE (SAGE, 2020), social factors such as poverty and occupation make a large contribution to the greater burden of COVID-19 in ethnic minorities.

According to the World Health Organisation

- Current evidence suggests that the COVID-19 spreads mainly between people who are in close contact with each other, typically within 1 metre (short-range). A person can be infected when aerosols or droplets containing the virus are inhaled or come directly into contact with the eyes, nose, or mouth.
- The virus can also spread in poorly ventilated and/or crowded indoor settings, where people tend to spend longer periods of time. This is because aerosols remain suspended in the air or travel farther than 1 metre (long-range).

To prevent an explosive outbreak of COVID-19 many governments have suggested that their citizens avoid the so-called “Three Cs” (closed spaces, crowded places, and close-contact settings)

A risk factor (for infection) is something that increases a person's chance of becoming infected with COVID-19. Such factors include geography, population density, age, deprivation, overcrowding, living in a multigenerational household, certain occupations (in particular those that are public-facing) and lifestyle factors.

People who are at a higher risk of infection may face higher risk of mortality, mainly because of the higher infection rates that occured in some groups. However there are also risk factors linked with higher risk of mortality from COVID-19 (factors that increase a person's chance of dying with COVID-19 once infected). Examples of risk factors for mortality include age, sex and (some) underlying health conditions. Some factors, like underlying health conditions, are risk factors for both higher risk of infection and mortality.

This section describes the geographical, housing, occupation and health conditions that may have put people from ethnic minorities at higher risk of contracting COVID-19 in England (as it can be seen in figure 1a and 1b) and, as a result, may have contributed to higher mortality rates.

Figure 1a: Risk of death involving COVID-19 compared with White British people during the first wave of the pandemic (24 January 2020 to 11 September 2020), expressed as hazard ratios, by ethnicity and sex

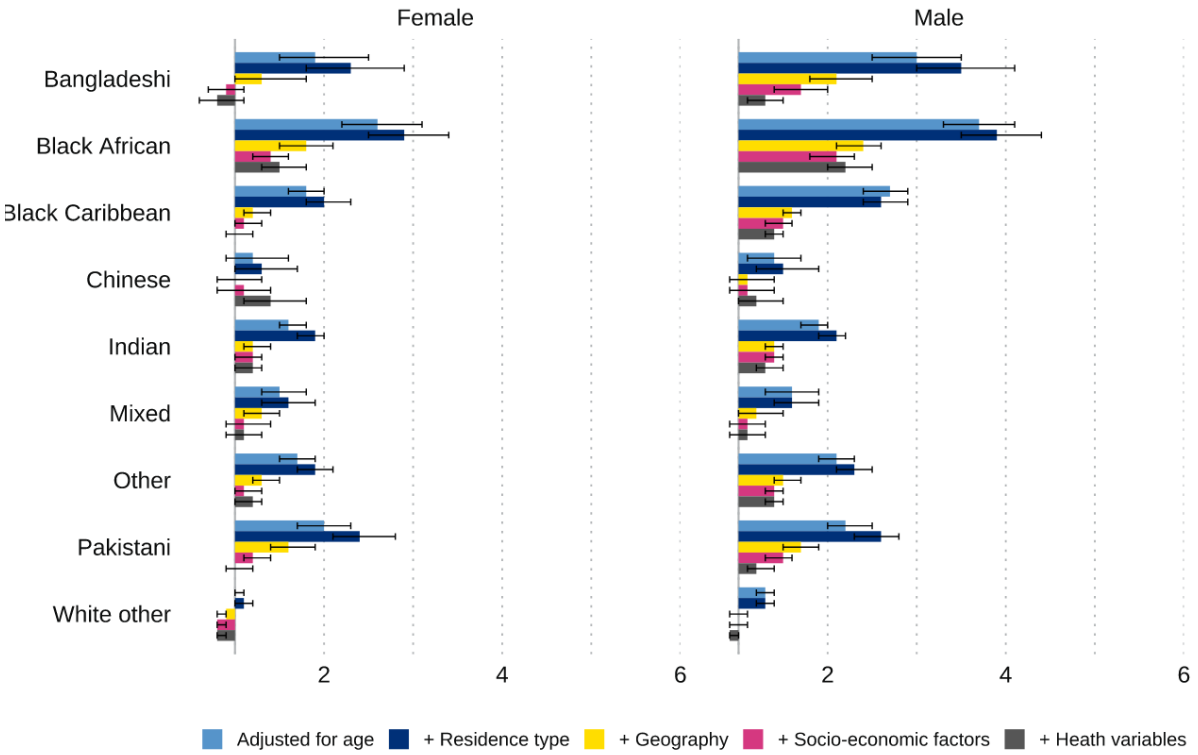
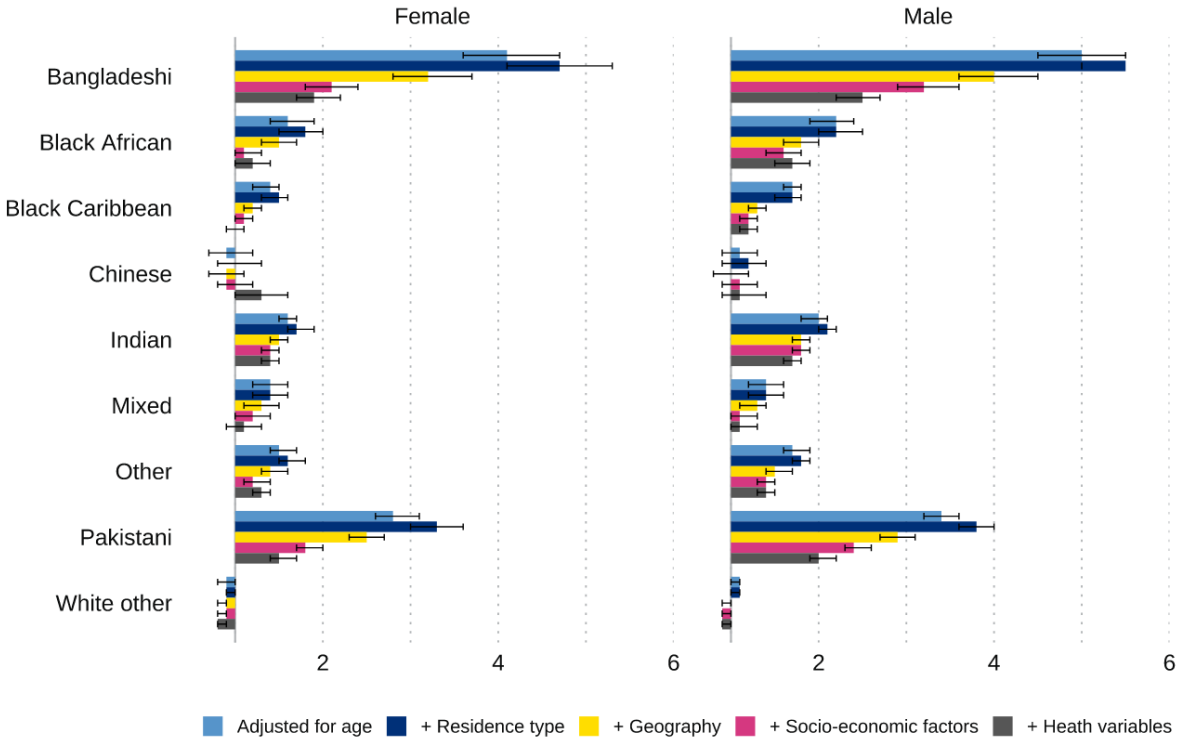


Figure 1b: Risk of death involving COVID-19 compared with White British people during the second wave of the pandemic (12 September 2020 to 31 March 2021, expressed as hazard ratios, by ethnicity and sex



Source: ONS

2.1 Geography

Geography is one of a number of key factors that determine how vulnerable people are to COVID-19.

Within England people in urban areas are more likely to spread the virus because of the higher population density, ample leisure amenities, a generally younger population, and a lot of people using crowded public transport. Urban areas, such as London, had a significantly higher age-standardised mortality rate of deaths involving COVID-19 than any other type of areas in England and Wales (ONS, 2020). And Public Health England (PHE) data shows that age-standardised mortality rate of deaths involving COVID-19 is higher in the most deprived areas in England compared to the least deprived areas, with the variance in mortality rate by deprivation appearing to be greater during 'peaks' of the COVID-19 wave (PHE, 2021). The risk of infection and death in high density population areas will be exacerbated in those areas that are also relatively deprived.

This may have contributed to the increased infection and mortality rates from COVID-19 seen for ethnic minorities in England and Wales. For example, 99.1% of Pakistani, 98.7% of Bangladeshi and 98.2% of Black African people lived in urban areas within England and Wales compared to 79.1% of White people. Similarly, 31.1% of Pakistani, 19.3% of Bangladeshi and 17.4% of Mixed White and Black Caribbean people lived in the most deprived 10% of neighbourhoods in England and Wales compared to 9% of White people (Race Disparity Unit, n.d.).

Certain local authorities in England and Wales have been described as places of enduring COVID-19 prevalence. Enduring prevalence is a term used to describe a repeating pattern of early increasing prevalence of COVID-19 at a local authority level and a slower decline in prevalence than the surrounding local authorities. The particular factors that contribute to enduring prevalence are complicated and vary by area, although there is evidence to suggest a link with deprivation (SAGE, 2021).

As shown in table 1, some of the areas of enduring prevalence have substantial ethnic minority populations. Living in an area where there are more infected people, for longer, may create greater capacity to become infected. For example Bradford, in which 26.8% of the population is Asian, had one of the highest number of days spent in the epidemic phase[1]. Other local authorities with a notable percentage of Asian people living in them, have been places of enduring prevalence, such as Peterborough, Kirklees, Rochdale, Leicester, Blackburn with Darwen, Luton and Oldham.

Table 1: Ethnic minority population in the top 10 local authorities with the highest number of days spent in the epidemic phase

	Asian	Black	Mixed	White	Other
Local authorities with the highest number of days spent in the epidemic phase	%	%	%	%	%
Peterborough	11.7	2.3	2.7	82.5	0.8
Bradford	26.8	1.8	2.5	67.4	1.5
Kirklees	16	1.9	2.3	79.1	0.6
Rochdale	14.9	1.3	1.7	81.7	0.4
Leicester	37.1	6.2	3.5	50.5	2.6
Luton	30	9.8	4.1	54.7	1.5
Blackburn with Darwen	28.1	0.6	1.2	69.2	0.8

[1] The epidemic phase is characterised by a greater mean number of daily cases, higher variability, and a stronger correlation between case numbers across consecutive days.

Northampton	6.5	5.1	3.2	84.5	0.7
Oldham	19.2	1.2	1.8	77.5	0.3
Sheffield	8	3.6	2.4	83.7	2.2

Source: PHE and Race Disparity Unit

2.2 Households

The size and the number of generations living in households are important contributors to the transmission of COVID-19. According to SAGE (SAGE, 2020), household composition - the number of people in the household and their ages - are key factors in terms of the risk of COVID-19 infection and mortality, even when controlling for deprivation and other factors.

Ethnic minorities in England and Wales are more likely to live in overcrowded and multigenerational households. According to OpenSAFELY, 3.5% of people from White British ethnicity lived in households of six or more people, compared to 21.3% for Indian, 33.6% for Pakistani, 32% for Bangladeshi, 7.3% for Caribbean and 20.6% for African ethnic groups (SAGE, 2020). ONS reports that just under 10% of men and women aged 65 and older from a White ethnic group live in a multigenerational household. The same measure was significantly higher in the 65+ age group for Bangladeshi men (58.4%) and women (60.0%), and Pakistani men (59.1%) and women (58.4%) (SAGE, 2020).

Furthermore, South Asian ethnic groups are more likely to live in large and multigenerational households. ONS data shows that Bangladeshi and Pakistani over-70s are much more likely to have contact with adults and school age children within the same household (56.4% and 34.7% respectively, compared with 1.5% of White adults of the same age) (ONS, 2020). This may have led to increased infection and mortality for South Asian ethnic groups, as in the second wave there was an associated increased risk of infection, ICU admission and COVID-19 mortality, possibly related to schools being opened in the second wave (until end December 2020 and then again in March 2021) (Race Disparity Unit, 2021).

2.3 Occupation

Workers in some occupations have more contact with more people, and more often than in other occupations - so-called public-facing occupations. And the closer and more sustained the contact, the greater the risk.

VirusWatch research shows that certain occupations, such as healthcare workers, indoor trade or leisure and personal service workers, had at least twice the total odds of seropositivity (presence of antibodies) compared to people employed in other occupations (Virus Watch, 2021).

People from minority ethnic groups make up just over a quarter of dental practitioners, medical practitioners and opticians. They are also more likely to be nurses, medical radiographers, nursing auxiliaries and assistants and technicians (ONS, 2020).

In addition Black and Asian men are more likely to work in occupations that have had a higher risk of death involving COVID-19. For example around a third of taxi drivers and chauffeurs are Bangladeshi or Pakistani men, and there are other services where ethnic minorities have a relatively high proportion of jobs, such as security and cleaning (ONS, 2020).

For working women, there were higher rates of death involving COVID-19 in four professions including nursing, and people working as care workers or home carers. Of women working as care workers and home carers, a relatively high proportion were from Black ethnic backgrounds (13.2%) (ONS, 2020). There were also higher proportions of women in nursing from Indian, Black and Other ethnic backgrounds.

2.4 Pre-existing health conditions

According to an OpenSAFELY study (OpenSAFELY, 2020), for the general population COVID-19-related death was associated with: greater age; being male; deprivation; diabetes; severe asthma; and various other medical conditions. This was based on research in which the primary care records of 17 million adults were pseudonymously linked to almost 11,000 COVID-19-related deaths.

The report also mentioned that only a small part of the excess risk of COVID-19 infection and poor outcomes experienced by ethnic minorities is explained by a higher prevalence of medical problems such as cardiovascular disease or diabetes among people from ethnic minorities. ONS (ONS, 2021) and PHE (PHE, 2020) came to similar conclusions using different data sources.

According to The King’s Fund (The King's Fund, 2021) the picture on health inequalities is complex, both between different ethnic groups and across different conditions, and understanding is limited by a lack of good quality data. For example the incidence of cancer is higher for White people but the incidences for cardiovascular disease (CVD) and diabetes are higher among Black and South Asian groups. This complex picture may be the reason that comorbidities explain only a small part of the excess risk of COVID-19 mortality for ethnic minorities.

3. Mortality analysis

To understand the impact of COVID-19 mortality on ethnic minorities and how the risk factors mentioned above explain the disparities we need to have data available on the ethnicity and socioeconomic characteristics of individuals who died from COVID-19.

Such data (for other diseases) was scarce in England prior to the pandemic. To address the data gap, ONS linked data on deaths from COVID-19 with the 2011 Census, which allowed ONS to ascertain the self-reported ethnicity of the deceased and other demographic factors (albeit 10 years previously). The lack of administrative statistics, such as the recording of ethnicity as part of death certification, has been an obstacle to the analysis of health inequalities related to ethnicity. ONS's linkage provided a large population and a robust dataset, which allowed the detection of statistically significant differences. Furthermore, the study provided data on socioeconomic characteristics, such as occupation and household size, which are not included in other studies. The main drawback of the study is that the data are from Census 2011, so the study doesn't account for immigration (or new births) since 2011. ONS also linked these statistics to Hospital Episodes Statistics for 2017 to 2019 in order to obtain data on comorbidities.

ONS used a Cox proportional hazards model. This is a multiple regression procedure that measures the association between survival time and a characteristic of interest such as ethnic background, while adjusting for other characteristics. This approach provides an understanding of which factors drive the differences in mortality across ethnic groups. The baseline model presented hazard ratios adjusted only for age. Then the model adjusts for factors likely to affect the risk of infection mostly but also the risk of having a pre-existing condition.

In more detail the model accounts for

- **Age**
- **Residence type** (private household, care home, other communal establishments)
- **Geography** (local authority district and population density)
- **Socio-economics, household characteristics, occupational exposure variables** (Index of multiple deprivation, household deprivation, household tenure, socioeconomic classification of household head, level of highest qualification, household size, family type, household composition, key worker type, key worker in household, exposure to disease, proximity to others, household exposure to disease and household proximity to others)
- **Health variables, interacted with age > 70 years** (number of admissions to admitted patient care, Number of days spent in admitted patient care, Body Mass Index, chronic kidney disease, cancer and immunosuppression, other conditions)

The analysis also presents the hazard ratios (HRs) for the two different COVID-19 waves that occurred in England. As the ONS has defined these periods, the first wave occurred between 24 January 2020 and 11 September 2020, and the second wave between 12 September 2020 and 31 March 2021. Further information on the methodology, variables used and data can be found in the ONS technical Appendix.

First wave

During the first wave of the pandemic, males from all ethnic minority groups were at elevated risk of COVID-19 mortality compared with males identifying as White British; females from all ethnic minority groups other than Chinese and White Other were also at greater risk compared to White British females. For example the HR for Black African men was 3.7 and Black African women 2.6; similarly Bangladeshi men had an HR of 3.0 and Bangladeshi women 1.9 (table 2)

Adjusting for residence type, the HR for all ethnic minority groups increased or remained similar. This is mainly because people who died in care homes were predominantly White and ethnic minorities did not face the same disparities in care home deaths as they faced in the general population analysis.

However, adjusting for geography reduced the HR for all ethnic minority groups and seems to be the characteristic that explains the largest part of the excess risk of COVID-19 mortality. For example, the HR for Black African men and women was reduced from 3.7 and 2.6 to 2.4 and 1.8 respectively.

Table 2: Hazard ratios of death involving COVID-19 by ethnic group and sex, England: 24 January 2020 to 11 September 2020

Ethnic group	sex	Age	+ Residence type	+ Geography	+ Socio-economics /household /occupation	+ Heath variables, interacted with age > 70 years
Bangladeshi	Male	3.0	3.5	2.1	1.7	1.3
	Female	1.9	2.3	1.4	0.9	0.8
Black African	Male	3.7	3.9	2.4	2.1	2.2
	Female	2.6	2.9	1.8	1.4	1.5
Black Caribbean	Male	2.7	2.6	1.6	1.5	1.4
	Female	1.8	2.0	1.2	1.1	1.0
Chinese	Male	1.4	1.5	1.1	1.1	1.2
	Female	1.2	1.3	1.0	1.1	1.4
Indian	Male	1.9	2.1	1.4	1.4	1.3
	Female	1.6	1.9	1.2	1.2	1.2
Mixed	Male	1.6	1.6	1.2	1.1	1.1

	Female	1.5	1.6	1.3	1.1	1.1
Other	Male	2.1	2.3	1.5	1.4	1.4
	Female	1.7	1.9	1.3	1.1	1.2
Pakistani	Male	2.2	2.6	1.7	1.5	1.2
	Female	2.0	2.4	1.6	1.2	1.0
White other	Male	1.3	1.3	1.0	1.0	0.9
	Female	1.0	1.1	0.9	0.9	0.8

Source: ONS

Accounting for socioeconomic characteristics, household occupation and health, the HR reduced further for most of the ethnic minority groups. The HR remained high for Black African men and women, at 2.2 and 1.5 respectively. However, there was no greater risk of death involving COVID-19 for White Other, Mixed and Chinese males; Bangladeshi, Black Caribbean, Mixed, Indian, White other, Other and Pakistani females compared with the White British group.

Second wave

Compared with the first wave, during the second wave the excess risk of death involving COVID-19 increased for people from the Bangladeshi and Pakistani ethnic groups. Adjusting only for age, Bangladeshi males had a HR of 5.0 and females 4.1, while Pakistani males had an HR of 3.4 and females 2.8. On the other hand, the risk of dying from COVID-19 decreased for Black African and Black Caribbean ethnic groups compared with the first wave. Black African males had a HR of 2.2 and females 1.6; Black Caribbean males had an HR of 1.7 and females 1.4.

Table 3: Hazard ratios of death involving COVID-19 by ethnic group and sex, England: 12 September 2020 to 31 March 2021.

Ethnic group	sex	Age	+ Residence type	+ Geography	+ Socio-economics/ household/ occupation	+ Heath variables, interacted with age > 70 years
Bangladeshi	Male	5.0	5.5	4.0	3.2	2.5
	Female	4.1	4.7	3.2	2.1	1.9
Black African	Male	2.2	2.2	1.8	1.6	1.7
	Female	1.6	1.8	1.5	1.1	1.2
Black Caribbean	Male	1.7	1.7	1.3	1.2	1.2

	Female	1.4	1.5	1.2	1.1	1.0
Chinese	Male	1.1	1.2	1.0	1.1	1.1
	Female	0.9	1.0	0.9	0.9	1.3
Indian	Male	2.0	2.1	1.8	1.8	1.7
	Female	1.6	1.8	1.5	1.4	1.4
Mixed	Male	1.4	1.4	1.3	1.1	1.1
	Female	1.4	1.4	1.3	1.2	1.1
Other	Male	1.7	1.8	1.5	1.4	1.4
	Female	1.5	1.6	1.4	1.2	1.3
Pakistani	Male	3.4	3.8	2.9	2.4	2.0
	Female	2.8	3.3	2.5	1.8	1.5
White other	Male	1.1	1.1	1.0	0.9	0.9
	Female	0.9	0.9	0.9	0.9	0.8

Source: ONS

After adjusting further for all the other factors mentioned above, HRs decreased for most ethnic groups. For example, the HR for Bangladeshi men was reduced to 2.5, and to 1.9 for Bangladeshi women. The biggest contribution to the reduction for HR for the Bangladeshi groups was the geography factors, but the socioeconomic factors (including household type and occupation exposure) also contributed.

In both waves geography was the risk factor that explained the largest part of the excess risk of COVID-19 mortality for ethnic minorities compared to White people. This is partly because ethnic minorities are more likely to live in areas with higher population density and urban areas compared to White people.

The above findings are consistent with SAGE's view that the higher mortality faced in ethnic minorities in England was because of socioeconomic factors rather than genetics. The results are also in line with analysis from academics working with the OpenSAFELY (OpenSAFELY, 2021) platform who stated "after accounting for sociodemographic and clinical factors, household size further explained differences in COVID-19 outcomes for South Asian groups."

It is important to mention that some of the higher risk of COVID-19 mortality for ethnic minorities still remains unexplained. This may be because of factors that have not been included in the model or due to methodological reasons. The following section explores this in more detail.

4. Discussion: Is ethnicity a risk factor for infection or mortality from COVID-19 ?

People from ethnic minority groups are more likely to experience various risk factors linked with higher COVID-19 infection rates. And for a few ethnic minority groups, residual disparities compared with the White group remain after taking account of known risk factors.

The data shows a significant residual excess risk for Pakistanis and Bangladeshis even after adjusting for all known risk factors including occupation and co-morbidities for the second wave. Taken alongside the PHE (PHE, 2020) work that showed worse survival for people from the Bangladeshi group in particular, this indicates that for people from some ethnic groups, some aspect of their ethnicity itself may be a risk factor. But what underlies that excess residual risk is not known – it could be caused by some as yet, unmeasured / unmeasurable risk factors for which ethnicity is a proxy, or it could be partly genetic.

The importance of risk factors can be quantified using multiple regression. This allows analysts to identify the contribution that each risk factor (individually and collectively) is making to the likelihood of infection or death. In the context of COVID-19 mortality, for example, we see that there are wide disparities between ethnic minority groups and the White group - but, when taking account of known risk factors, most of these disparities are reduced significantly or even disappear. This does not mean that people from ethnic minority groups haven't been affected by COVID-19 much more than people from the White group; however, it does mean that the known risk factors account for most of the disparities. This enables decision-makers to take these factors into account in planning interventions or making decisions about prioritisation.

The risk for some ethnic minorities groups may actually increase when we take into account some characteristics. For example ethnic minorities may have lower incidence of certain diseases that are related to COVID-19 mortality, such as dementia, and as a result when these data are added in the regression model the risk of mortality for some ethnic groups appears to increase. Another example is when in the above analysis we counted in the model for residence type, as the majority of deaths in care homes were for White ethnic group.

In looking at the impact of risk factors on different ethnic groups, this regression approach is only applicable when we have data about each person's COVID-19 status (such as: infected, hospitalised, died of/with COVID-19), their ethnicity, and the presence/absence of a range of

risk factors. In the absence of such data, analysts have been resourceful during the pandemic - for example:

- ONS used occupation data from death certificates to identify those occupations with higher COVID-19 mortality rates, and also looked at the ethnic profile of the 'at risk' occupations, allowing inferences to be drawn.
- ONS subsequently linked death records with the 2011 Census to get estimates of COVID-19 mortality by ethnicity and occupation (albeit the occupation data was old).

Even after taking account of a range of risk factors, some excess risk still remains for some ethnic minorities like Bangladeshi men and women during the second wave. Analysis from PHE (PHE, 2020) showed that, of those infected and testing positive, people from the Bangladeshi, Chinese, Pakistani, Black Other and Indian ethnic groups had an increased risk of death.

It isn't possible to say for sure why there are some residual disparities in the relative risk of mortality. This could be because of

- aspects of data quality, such as out of date statistics - for example, ONS' work to take account of people's occupations and people's housing conditions uses data from the 2011 Census.
- data on some risk factors not being available - for example the impact of schools reopening on adults becoming infected by children - Bangladeshi and Pakistani over-70s are much more likely to have contact with adults and school age children within the same household; there have been larger increases in the R rate when schools have been opened. Other examples include compliance with NPI rules, access to health services, or the number (and intensity) of contacts with people who have the infection.
- Other risk factors that have not been included in the model - for example, the role of genetics.
- Existing research suggests that genetics are unlikely to explain the inequalities in ethnic groups from COVID-19; the health disparities among ethnic groups are largely explained by underlying social differences rather than genetic differences (SAGE, 2020).
    - However, a gene cluster identified as a risk factor for severe coronavirus symptoms is carried by approximately 50% of people in South Asia, compared with 16% of people in Europe (Zeberg & Pääbo, 2020) This gene cluster is associated with a risk of respiratory failure and may partially explain why the Bangladeshi population has the poorest survival rates, but more research on this is needed.
    - In addition, research from the International Investigator Group for Ethnicity and COVID-19 estimated a 4-fold increased risk for COVID-19–related hospitalization and a 2.6-fold increased risk for COVID-19–related death for people with sickle cell disease. It concludes that "Several aspects of sickle cell phenotypes overlap with the pathophysiology of severe COVID-19 , which could be relevant mechanisms worthy of further study, as should the directionality of infection and sickle crisis." (Clift et al., 2021)

The next steps of research will include

- Ongoing work to improve understanding of risk factors and impact on other disproportionately impacted groups.
- Monitor the wider impacts of COVID-19 for example the impact of lockdowns on mental health, employment and income of ethnic minorities.
- Improving data quality on ethnicity, such as filling data gaps, harmonising ethnicity data and better data recording as outlined in the Quality Improvement Plan (RDU, 2020) for government data on ethnicity.

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