NEIGHBOURHOOD LEVEL COVID-19 MORTALITY IN LONDON

Technical Paper for London's Poverty Profile

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Contents

Key findings

This short analysis considers the relationship between neighbourhood level COVID-19 mortality in London and deprivation. It provides technical insight into the model that we have created and the challenges of drawing conclusions from the available data.

After accounting for a range of other neighbourhood characteristics that are related to both COVID-19 mortality and deprivation, it finds:

- Even after controlling for a wide range of other neighbourhood measures, the most deprived 20% of neighbourhoods saw, on average, 23 more COVID-19 deaths per 100,000[1] than the least deprived 20% of neighbourhoods.
- The most important neighbourhood factor overall was the count of residents aged 65 or older. Areas with 'high' numbers[2] of over 65s would be expected to have 25 more COVID-19 deaths per 100,000 than those with 'low' numbers of over 65s.
- The impact of higher numbers of care home residents is also large (21 more COVID-19 deaths for areas with high numbers of care home residents compared to low),
- Ethnicity was important independently of other factors, particularly neighbourhoods with high numbers of Black and Asian residents. Neighbourhoods with 'high' numbers of Asian residents would be expected to experience 9 more COVID-19 deaths per 100,000, and those with 'high' numbers of Black residents 13 more deaths compared to neighbourhoods with 'low' numbers of each ethnicity.
- Neighbourhoods with higher numbers of residents working in sales and customer service occupations, and those with higher number of children aged 0-14 had lower COVID-19 mortality when controlling for other factors

These findings provide vital insights into the links between COVID-19 mortality and a range of neighbourhood characteristics; particularly with regard to ethnicity, deprivation and age. They also show the complex nature of these relationships and the complex analysis needed to unpick them. Importantly, our analysis also shows the need for more data and more research: the measures we have at neighbourhood level explain just 35% of the variation in COVID-19 mortality - i.e. the majority of influencing factors (65%) are not captured in our data.

[1] There were 1,775 COVID-19 deaths in the most deprived 20% of neighbourhoods (average IMD ranks split into quintiles across England), on average 9.1 per neighbourhood. This compares to 7.2 per neighbourhood in the least deprived 20% and a total of 942 deaths.

[2] 'High' and 'low' numbers refers to the difference of 1 standard deviation in the linear regression input.

Introduction

The UK is slowly emerging from the economic and social restrictions needed to limit the spread of COVID-19 and is beginning to face up to the "new normal" of society living with the virus around us. As this happens, all eyes have turned to how policymakers, businesses, charities and those delivering frontline support services, can help those struggling most with the economic and social fall-out of the crisis.

The problem is that this is hard. Not because of a lack of desire to help. Instead, because understanding the differing impacts across different people, neighbourhoods, communities and regions of the UK is hindered by a lack of data. The datasets that researchers typically rely on to understand things like poverty, living standards and wellbeing amongst individuals and families in the UK usually only appear 18 months or so after the period in question (because of the nature of collecting and preparing data on responses from tens of thousands of households). A key example is the Family Resources Survey, which is the go-to source of data on poverty in the UK. The problem is that if researchers want to understand how poverty in the UK fared in the period following March 2020, they will have to wait for the data to be published in around May 2022. This is clearly too late.

This means new methods, approaches and sources of data are needed. In this respect, there is already good news. The Government, Office for National Statistics (ONS) and others have stepped up to produce new statistics, datasets and surveys throughout the COVID-19 period, some of the household surveys are also changing their approach to make data available more quickly, and a host of innovative data sources are beginning to be explored.

The team behind London's Poverty Profile (LPP) are committed to supporting this work. As new data becomes available, where feasible, we will include it on LPP. We will also undertake our own analysis to understand how the impacts of the COVID-19 crisis have been impacted by, and could contribute to, the nature of poverty and inequality in the Capital. This is the first of our analyses in this space, it considers how COVID-19 mortality in London varies by neighbourhood characteristics, including deprivation, age and ethnicity.

Neighbourhood characteristics and COVID-19 mortality

In the three months between March and the end of May 2020 more Londoners lost their lives to COVID-19 than in any other English region - according to the ONS, 8,188 people died representing nearly 1 in 5 of all the COVID -19 deaths in England. This becomes all the more stark when we consider that London is well known to be younger on average than the rest of England (see London's Poverty Profile), and because we know that COVID-19 claims the vast majority of its victims from the over 65s (89% of deaths according to the ONS). This would suggest London has been disproportionately impacted by the worst effects of the coronavirus for reasons yet to be fully understood.

To understand how this looks within London, we can use neighbourhood level (MSOA[3]) data released by the ONS, which allows us to see where deaths[4] due to COVID-19 have been most and least prevalent. Given our focus on poverty and inequality in London, our first consideration is whether the correlation between deprivation and COVID-19 mortality reported elsewhere is also present in London.

In this respect, Table 1 shows the neighbourhoods in London worst hit in terms of COVID-19 mortality. It shows that the highest rates were found in neighbourhoods within Hammersmith and Fulham, Hillingdon, Newham, Harrow and Waltham Forest. Of the worst affected 20 neighbourhoods, three (one in Haringey and two in Brent) were in the most deprived quintile of the IMD. Two were in the least deprived quintile (neighbourhoods in Croydon and Richmond).

Table.1: The 20 neighbourhoods in London with the highest COVID-19 mortality rates

Neighbourhood name	Borough	Average IMD rank decile	COVID-19 deaths per 100,000
Ravenscourt Park North	Hammersmith and Fulham	5	344
Harefield	Hillingdon	5	343
Little Ilford West	Newham	2	334
Stanmore Park	Harrow	8	315
Greenford South	Ealing	4	308
Chingford Green East	Waltham Forest	6	308
Bexleyheath Broadway	Bexley	7	300
Barnhill The Avenue	Brent	5	296
Greenford West	Ealing	3	295
Norwood Green South	Ealing	3	294
Chase & Crews Hill	Enfield	5	293

[3] MSOAs are Middle Layer Super Output Areas, a statistical geography devised by the Office for National Statistics comprised of approximately 7,200 persons.

[4] ONS's note on data quality: "The figures provided in this publication are provisional counts of the number of deaths registered in England and Wales for which data are available. The number of deaths involving coronavirus (COVID-19) featured in this release are based on any mention of COVID-19 on the death certificate, unless stated otherwise."

Acton Central	Ealing	3	292
Stonebridge	Brent	1 most deprived	289
Church End	Brent	1 most deprived	276
Hampton Hill	Richmond upon Thames	10 least deprived	274
Hammersmith Broadway	Hammersmith and Fulham	2	272
Forty Lane	Brent	3	271
Sanderstead	Croydon	10 least deprived	270
Woodside Park	Barnet	7	267
Tottenham Green East	Haringey	1 most deprived	266

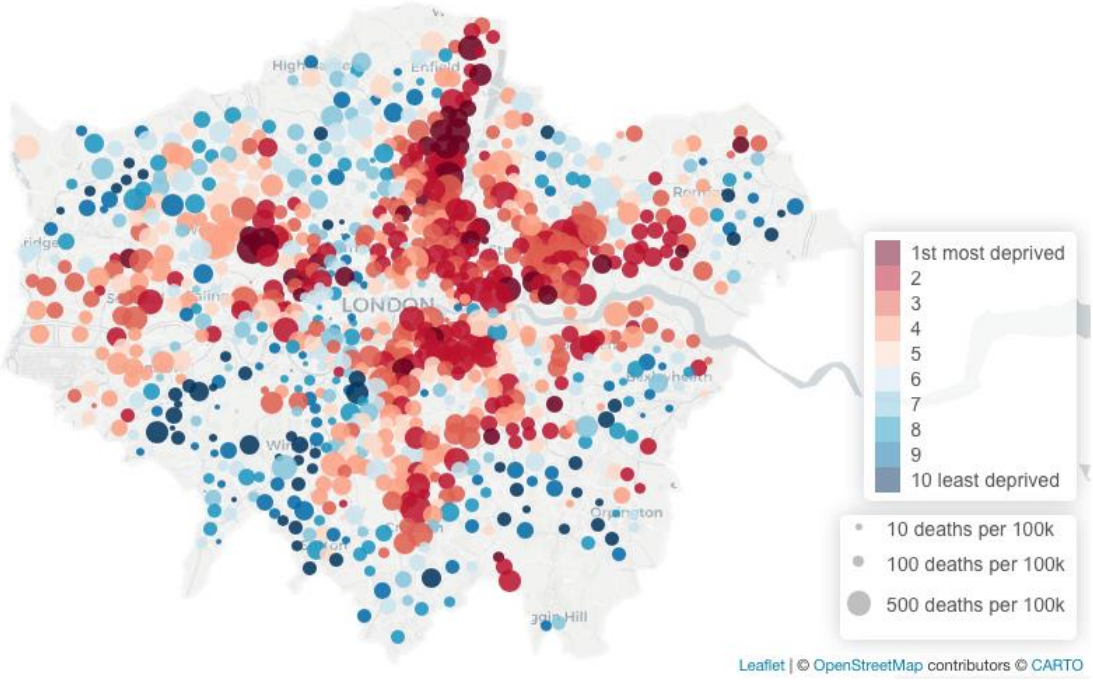
Sources: Indices of Multiple Deprivation, MHCLG; Deaths involving COVID-19 by local area and deprivation, ONS; MSOA names, House of Commons Library

Map 1 shows how this looks across London, after adjusting for age[5]. Bubble size represents the deaths per 100,000 population if all neighbourhoods had the same age composition. The colour coding shows deprivation (the average of IMD ranks split into deciles) red being more deprived, blue being least deprived.

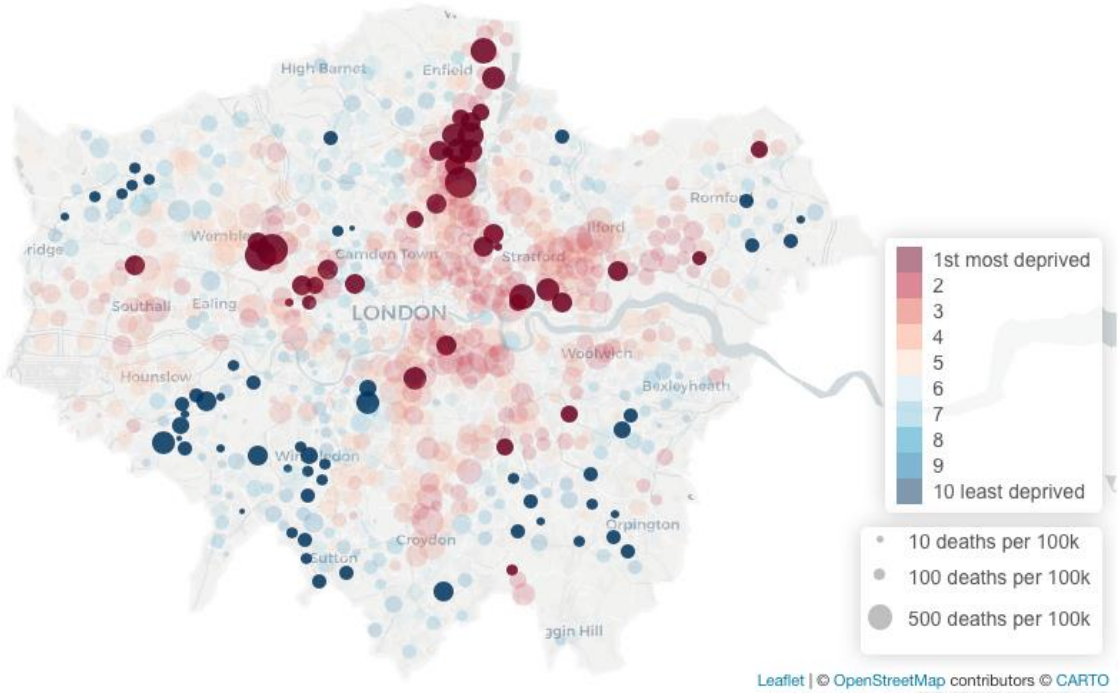
From this we can see that there were high COVID-19 death rates in both deprived and non-deprived neighbourhoods, but the more deprived areas seem to have fared worse overall. Indeed this can be seen perhaps a little more clearly if we highlight just the most and least deprived areas as in Map 2 (click on the link to the interactive map to explore the data further).

[5] Indirect age standardisation using mid-year 2018 population estimates for MSOAs and England and Wales in 5-year age bands

Map 1. COVID-19 deaths in Middle Super Output Areas by deciles of average deprivation



Map 2. COVID-19 deaths in Middle Super Output Areas by most and least deprived deciles of average deprivation



Sources: Indices of Multiple Deprivation, MHCLG; Deaths involving COVID-19 by local area and deprivation, ONS

Interactive map link

However, whilst on the face of it, these results look compelling, on their own they tell us relatively little. This is because we already know that COVID-19 mortality varies based on a range of other factors too. Other studies have looked at the relationships between COVID-19 and many things (Public Health England found increasing age, sex (being male), ethnicity (Black and Asian) as the main risk factors. Other commentators have looked at the role of housing, the built environment, obesity, ethnicity, and occupation.

Many have found significant correlations. However, very few have tried to hold other things constant, and no-one has yet to unpick the role of comorbidity (i.e. underlying health conditions that may exacerbate the reaction to the Coronavirus). This means that, whilst we know all these things are really important - they need to be considered together. We've demonstrated below how this looks through the lens of deprivation and ethnicity, before presenting full results of a conditional analysis of neighbourhood characteristics.

Deprivation

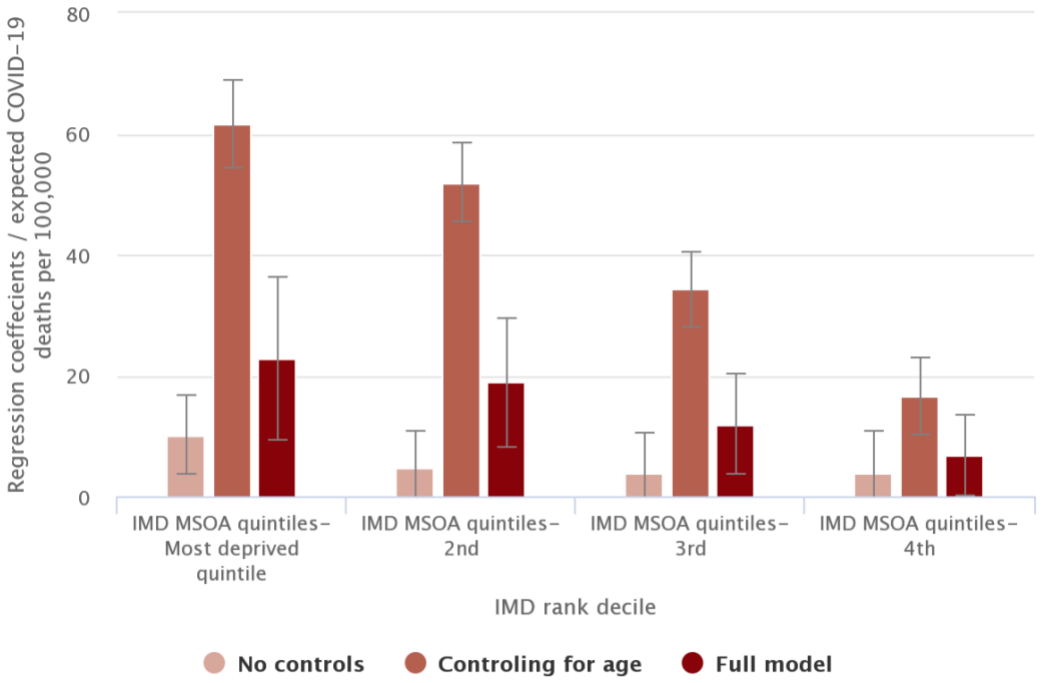
We started with deprivation. ONS discovered a strong association in their first local area COVID-19 work. We want to understand how this looks in London and to extend the analysis to other neighbourhood characteristics. To do this, we conducted three linear regressions:

1. Using IMD quintiles[6] to predict their effect on COVID-19 death rates per 100,000 people (the 'no controls' series in the graph below).
2. Adding in the numbers of people in the MSOA in 4 age groupings (0-14, 15-39, 40-64, and 65+) as controls ('controlling for age' in the graph).
3. Adding in a wide range of neighbourhood data from census and other sources that we felt could be important ranging from the numbers of people of various ethnicities, employment statuses, occupations, housing types, population density etc. ('full model') (see annex).

Figure 1 shows the results from this analysis. The regression coefficients tell us the difference in COVID-19 deaths per 100,000 people if each deprivation quintile shown in the graph is compared (or contrasted) against the least deprived quintile (hence 'least deprived' is not shown on the graph).

[6] Deciles were used in the maps, but we used quintiles in the regressions to improve statistical strength.

Figure 1: Expected COVID-19 mortality per 100,000 by average IMD rank quintile compared to "Least deprived quintile - 5th" (MSOA level)



Sources: Indices of Multiple Deprivation, MHCLG; Deaths involving COVID-19 by local area and deprivation, ONS

The first thing to note is that, building on Map 1, Figure 1 shows little relationship with deprivation until we control for age, and then we see a similar relationship with deprivation as the ONS[7]. It shows that COVID-19 deaths per 100,000 population increase the more deprived a neighbourhood is. In fact, it suggests that the most deprived neighbourhoods would be expected to have around 62 more COVID-19 related deaths per 100,000 on average than the least deprived neighbourhoods.

However, as shown throughout the work of the LPP, deprivation is closely related to a range of other inequalities, which may also point to higher COVID-19 mortality. If this were the case, the overall impact on deprivation might be overestimated. This is confirmed in the results from the full model (light blue) where we estimate 23 more deaths on average in the most deprived neighbourhoods compared to least deprived (63% fewer than the 62 deaths per 100,000 in regression 2). This gets us closer to seeing the independent impact of deprivation on neighbourhood level COVID-19 mortality[8].

A key point here is that the addition of full model controls reduces the estimated effects of deprivation quintiles - showing why it's important not to just look at a single factor in isolation.

The addition of these variables also significantly improved our ability to understand the variation in COVID-19 mortality at a neighbourhood level. In fact, the first "no controls" model was non-significant and explained just 1% of the variation in COVID-19 mortality per population. Adding age controls increased this to 18% and the full controls (see annex) to 35%. Whilst this might be viewed

[7] We have taken the average IMD rank of the LSOAs within the MSOA, and split them into quintiles so some resolution is lost from the original IMD source.

[8] note that deprivation also becomes less statistically significant in the full model - note the width of the error bars, with the most deprived and 2nd quintiles different from the least deprived with 91% and 92% probability - 95% is the most common convention.

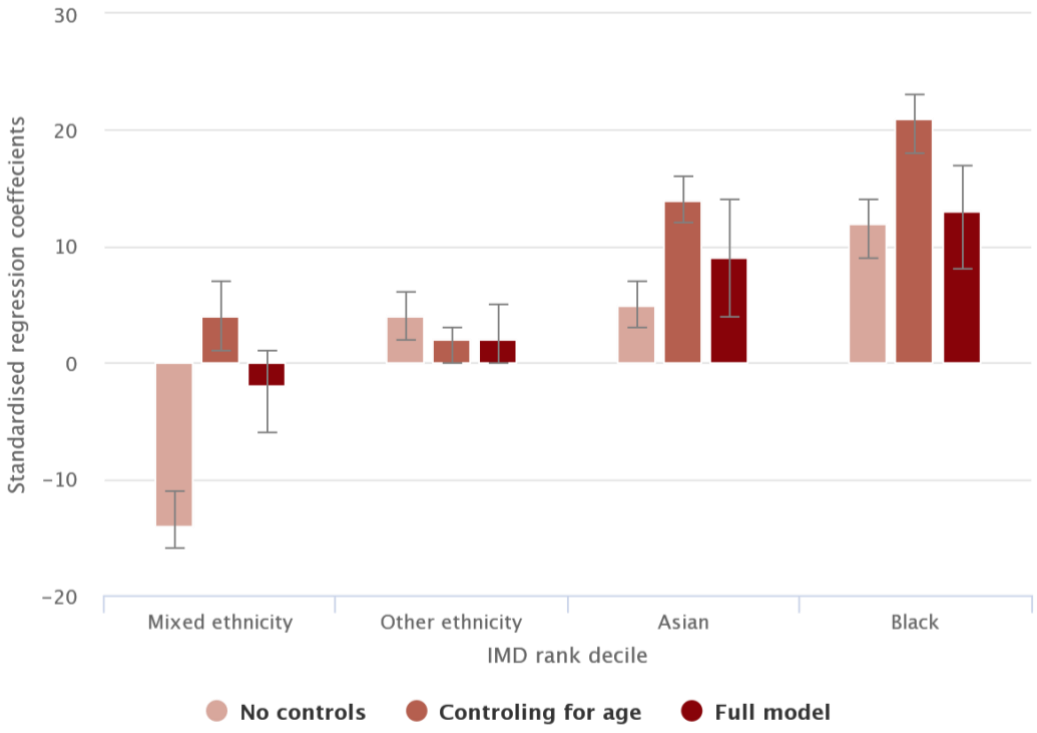
as a good result for an analysis of this sort, it still means that the vast majority (65%) of the differences are unexplained by factors we have not observed in our data.

Ethnicity

Ethnicity, and particularly being of either Black or Asian descent has also been found by several pieces of recent research to be a major risk factor for COVID-19.

We looked at this at the neighbourhood level in a similar way as for deprivation and can see that the effect on COVID-19 mortality of having a high proportion of Black or Asian people in a MSOA is somewhat underestimated if we do not control for age (and/or everything else) at the same time.

Figure 2. COVID-19 mortality regression coefficients for high compared to low Ethnicity counts (MSOA level)



Sources: Census 2011; Deaths involving COVID-19 by local area and deprivation, ONS

We find that neighbourhoods with high Black or Asian populations suffered more COVID-19 deaths than those with low populations - and the effect was still true or more pronounced when we control for other factors.

The results of the ethnicity analysis here need slightly different interpretation as they are based on changes in the proportion of people in each neighbourhood who identified as a given ethnicity (from Census 2011). So the coefficients tell us the change in COVID-19 deaths we would expect if the proportions of each ethnicity were to increase by one standard deviation (a statistical measure equating to around 66% of the spread of values). In other words, we could say the difference between neighbourhoods with low proportions of that ethnicity to those that have high numbers (in a statistical sense).

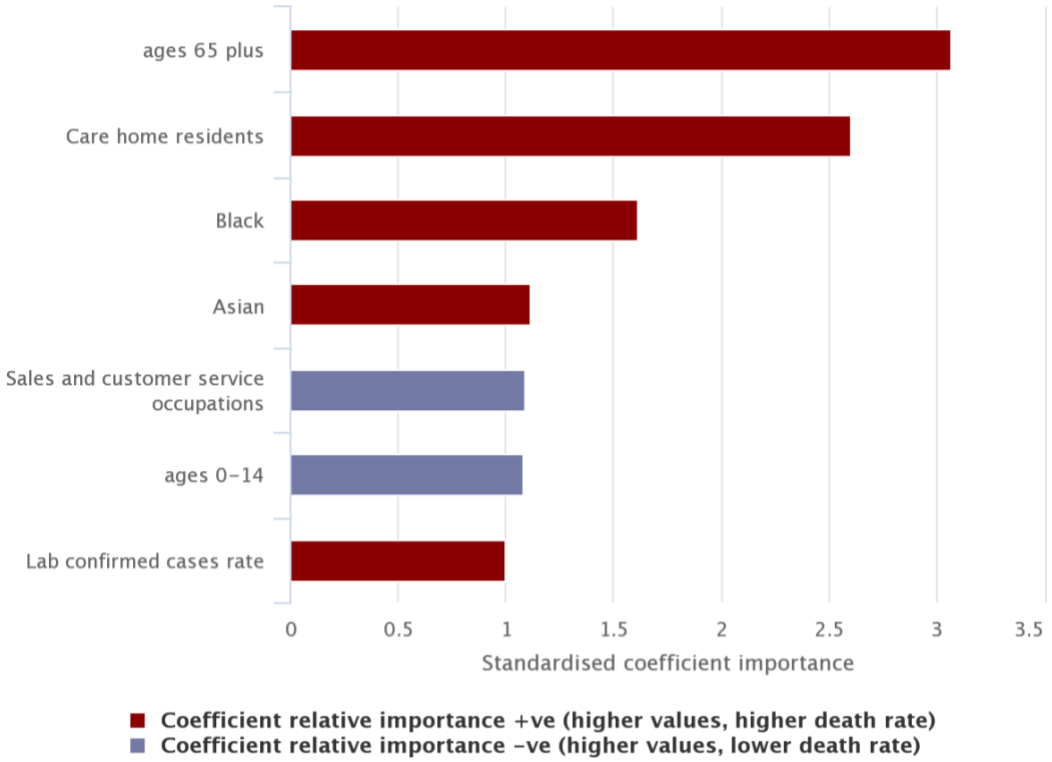
Full model results

The sections above have shown that it is not helpful to consider simple correlations between one particular neighbourhood characteristic (age, deprivation, ethnic makeup) and COVID-19 mortality. The complex nature of neighbourhoods and the interlinked nature of many of these factors, suggests that all of these factors should be taken account of simultaneously. The full results of this analysis are presented below.

Figure 3 shows the results of the analysis presented in a way that allows us to understand the relative importance of each factor in explaining COVID-19 mortality at a neighbourhood level. We have retained here just the statistically significant factors, and scaled the regression results (the standardised coefficients for those more technically minded) so that they are relative to the smallest significant factor (lab confirmed case rate).

Here we see that having a high number of people in a neighbourhood aged 65 plus is the most potent factor, being nearly 3 times as important as having a high rate of lab confirmed cases in predicting COVID-19 deaths. High numbers of care home residents were not far behind just over 2.5 times, and having high numbers of Black people was around half as important as high numbers of older people. In yellow we see two factors that had a negative association with COVID-19 mortality - so areas with high counts of these groups (people working in sales and customer service occupations, and children aged 0-14) had fewer deaths per 100,00 from COVID-19.

Figure 3. Importance of significant model inputs relative to the smallest (lab confirmed cases rate = 1)



Sources: See annex table A1

In more tangible terms, the table below shows the impact that changes in each of the characteristics has in terms of COVID-19 mortality at a neighbourhood level.

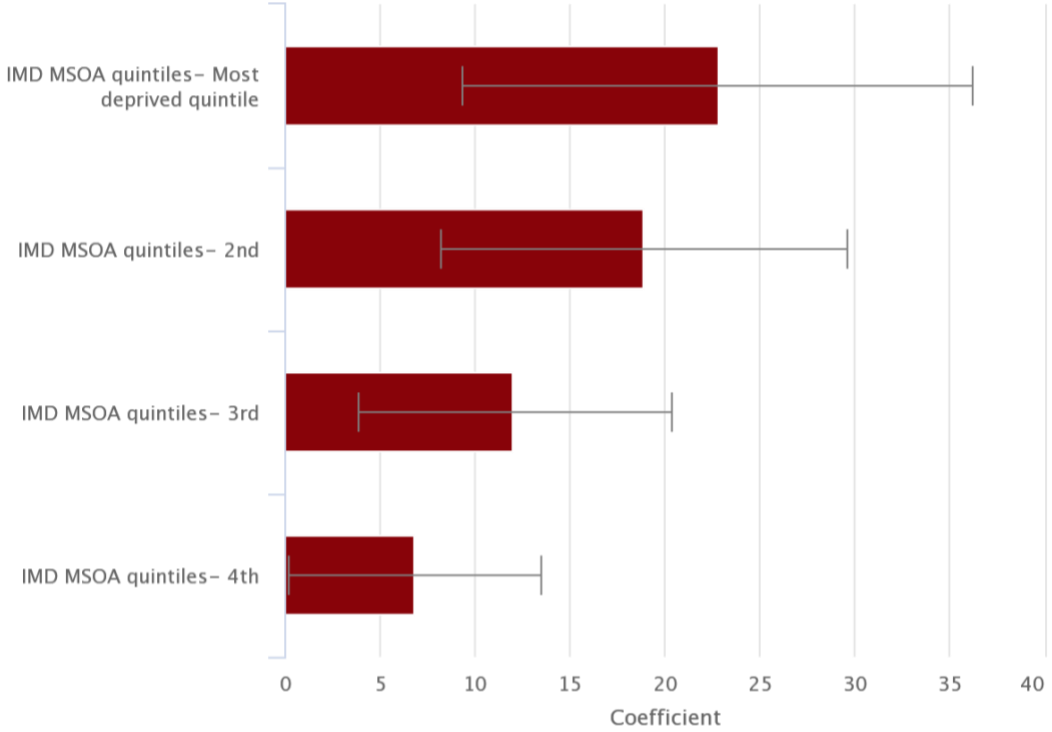
Table 2. Impact of significant model inputs

Characteristic	This change in the characteristic	Leads to this change in COVID-19 mortality per 100,000 population
Care home residents	Increasing by 100 residents	47 increase
Lab confirmed cases rate	Increasing by 100 cases	12 increase
ages 65 plus	Increasing by 100 persons	6 increase
Black	Increasing by 100 persons	1 increase
Asian	Increasing by 100 persons	1 increase
ages 0-14	Increasing by 100 persons	-2 decrease
Sales and customer service occupations	Increasing by 100 persons	-8 decrease

Sources: See annex table A1

The following two charts show the impact of our 'contrast variables'. These are groups in the data that are compared against a reference category. So for the deprivation graph, it shows the difference in the number of COVID-19 deaths per 100,000 (our outcome variable) associated with the change between the least deprived quintile (our reference category) and each of the others. So we would expect 23 additional COVID-19 deaths per 100,000 if we could change a 'least deprived' quintile into a 'most deprived quintile' holding other things in the regression constant (or taking the error into consideration, between 9 and 36).

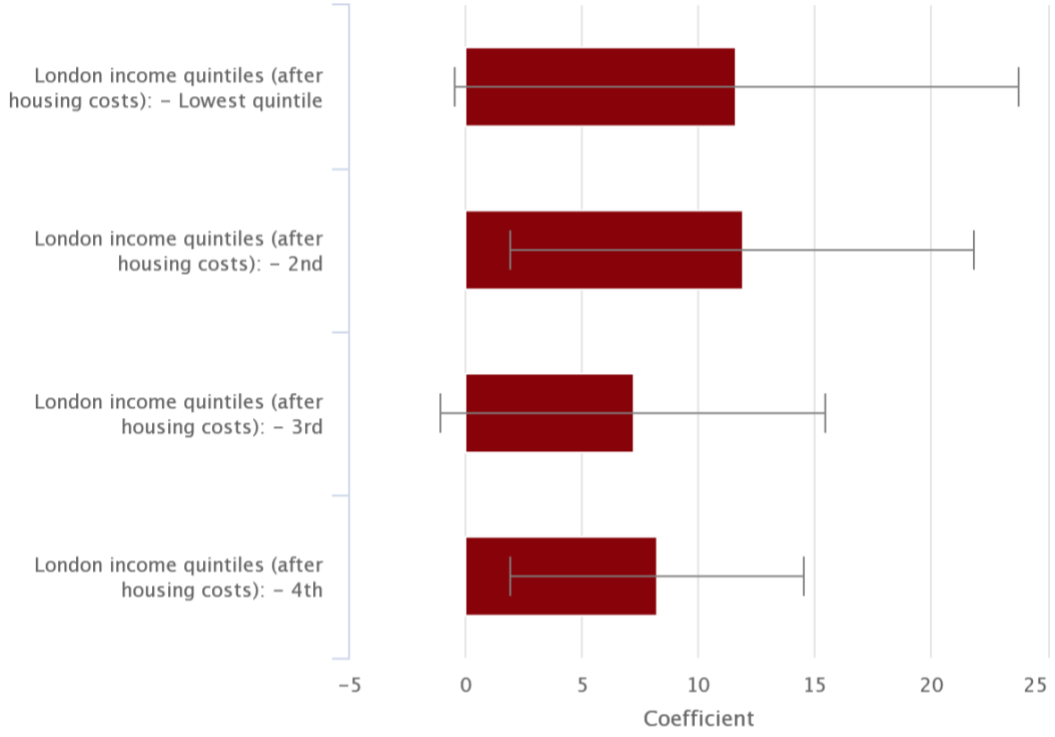
Figure 5. Change in COVID-19 deaths per 100,000 relative to 'least deprived quintile'



Sources: See annex table A1

Income quintiles were less robust statistically, but for completeness they are presented below.

Figure 5. Change in COVID-19 deaths per 100,000 relative to 'highest earning quintile' , after housing costs (AHC)



Sources: See annex table A1

Conclusion

The evidence from this brief analysis shows the importance of neighbourhood age profiles, deprivation (and not income), and ethnic mix in understanding the differences observed in COVID-19 mortality rates at a neighbourhood level in London.

Whilst this analysis cannot tell us about whether there are direct causal links between these factors it does provide important insights for policymakers and those providing frontline services about what may be happening with COVID-19 deaths, deprivation and ethnicity in particular.

Perhaps most importantly, it shows the need for researchers to consider all of these factors together and alongside other characteristics of neighbourhoods. Failing to do so ignores the complex and interrelated nature of poverty, inequality, health and a wide range of neighbourhood characteristics. Worst of all, it can lead to seriously misleading results.

ANNEX

Full model summary

We conducted a linear regression at the middle layer super output area level (MSOA - also referred to as neighbourhoods in this article).

The independent variables (inputs) used were as follows:

Table A1.

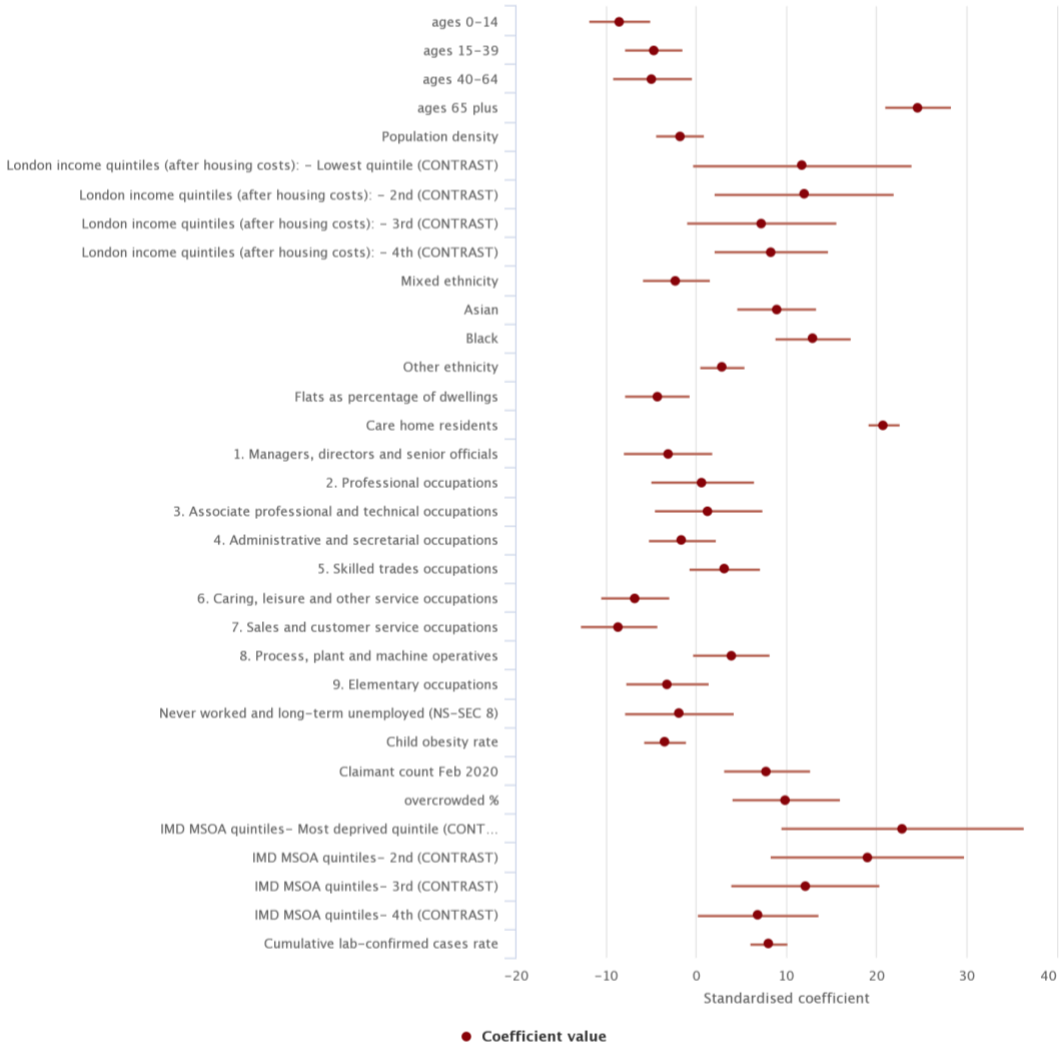
Independent variable (Inputs)	Description and source
Age	Counts of individuals in the MSOA aged 0-14, 15-39, 40-64 and 65+ calculated from small area mid-year population estimates (2018), ONS.
Population density	Population per hectare from Census 2011. ONS.
London income quintiles (after housing costs)	Income estimates for small areas in England and Wales (2018), ONS. Quintiles calculated for London only. Contrast compared to "Highest income quintile"
Mixed ethnicity	Counts of self-reported ethnicity from Census 2011 , ONS.
Asian	Counts of self-reported ethnicity from Census 2011 , ONS.
Black	Counts of self-reported ethnicity from Census 2011 , ONS.
Other ethnicity	Counts of self-reported ethnicity from Census 2011 , ONS.
Flats as percentage of dwellings	Flats, maisonettes or apartments as a proportion of all dwellings. Census 2011, ONS.
Care home residents	Number of care home residents in Medical and care establishments: with or without nursing. Census 2011, ONS.
Social occupation classification (SOC 2010)	Counts of people belonging to each of 9 groups as separate IV variables. Census 2011, ONS.
Never worked and long term unemployed	NS-SEC group 8 Census 2011, ONS.
Child obesity rate	National child measurement programme proportion of reception age children classified as obese in 2015/16 to 2017/18. Public Health England.
Claimant count	Alternative claimant count DWP, Feb 2020.
Overcrowding	Proportion of people in the MSOA living in dwellings with 1.5 people per bedroom or greater - Census 2011, ONS
Indices of multiple deprivation	Population weighted average rank for the LSOAs in the MSOA cut into quintiles. MHCLG 2019.
Cumulative lab-confirmed cases rate	Number of CV-19 infection cases registered in total over March to May 2020.

The dependent variable (outcome) was the number of **COVID-19 deaths per 100,000** population in each MSOA.

Table A2. Model summary statistics

Statistic	Value
Observations	938
Dependant variable	COVID-19 deaths per 100,000 population
F	14.36
F df Numerator	38
F df Denominator	899
F p value	0.00
r squared	0.38
Adjusted r squared	0.35

Figure A1. Comparison of all regression inputs



Sources: see table A1

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