A year of COVID-19 in the North: Regional inequalities in health and economic outcomes

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The COVID-19 pandemic has hit the country unevenly with a disproportionate effect on the North of England - increasing regional health and economic divides.

The Northern Health Science Alliance commissioned this report to understand the impact of the first year of the COVID-19 pandemic on health and productivity in the North and identify the opportunities for 'levelling up' regional health and productivity.

The report shows the unequal health and economic impacts of COVID-19 on the North with higher rates of COVID-19 related mortality and unemployment.

As it develops its post-COVID-19 'levelling up' strategy, central government should pay particular attention to the importance of supporting the physical and mental health and development of the North as a route to increased prosperity.

Key findings

Mortality

- On average, the rates of mortality attributable to COVID-19 during the first 13 months of the pandemic (March 2020 to March 2021) were higher in the North than in the rest of the country

  - 29.4 more people per 100,000 (95% CI: 10.7 to 48.0) died of COVID-19 in the North (204.1 per 100,000) compared to the rest of England (174.4 per 100,000)

  - This represents a **17% higher mortality rate in the North** compared to the rest of England

- On average, the rates of mortality attributable to all-causes during the first 13 months of the pandemic (March 2020 to March 2021) were higher in the North than in the rest of the country

  - 145.8 more people per 100,000 (95% CI: 106.8 to 184.9) died of all-causes in the North (1190.2 per 100,000) compared to the rest of England (1044.4 per 100,000)

  - This represents a **14% higher mortality rate in the North** compared to the rest of England

- About half of the increased COVID-19 mortality in the North (or 15 deaths per 100,000) and two-thirds of the increased all-cause mortality

(or 99 deaths per 100,000) were explained by higher deprivation and worse pre-pandemic health in the North, which are potentially preventable

- On average in care homes, the rates of mortality attributable to COVID-19 during the pandemic (March 2020 to March 2021) were higher in the North than in the rest of the country

  - 1.2 more people per 1,000 care home beds (95% CI: 0.7 to 1.8) died of COVID-19 in the North (5.9 per 1,000 beds) compared to the rest of England (4.7 per 1,000 beds)

  - The North's care home COVID-19 mortality was therefore 26% higher than the rest of England

- On average in care homes, the rates of mortality attributable to all-causes were also higher in the North than in the rest of the country

  - 2.1 more people per 1,000 care home beds (95% CI: 0.6 to 3.5) died of all-causes in the North (22.4 per 1,000 beds) compared to the rest of England (20.3 per 1,000 beds)

  - The North's care home all-cause mortality was therefore 10% higher than the rest of England

204.1 per 100,000

died of COVID-19 in the North compared to

174.4 per 100,000

in the rest of England

Hospital pressure

- Hospital pressure due to COVID-19 was higher in the North. On average, in the North, 11% of hospital beds were occupied by COVID-19 patients over the year, compared to 10% in the rest of England. This is equivalent to:

  - 10% more hospital beds occupied by COVID patients in the North than in the rest of England over a year period (95% CI: 9% to 11%) in relative terms

  - 1.0 percentage point more hospital beds occupied by COVID-19 patients in the North compared to the rest of England (95% CI: 0.9 to 1.1) in absolute terms

10%+

more hospital beds occupied by COVID patients in the North than in the rest of England

Vaccinations

28.9

extra people were vaccinated per 10,000 in the North compared to the rest of England

- During the first six months of roll out, COVID-19 vaccination rates were higher in the North than in the rest of the country.

  - An extra 28.9 extra people were vaccinated per 10,000 (95% CI: 1.1 to 56.4) in the North (549.2 per 100,000) compared to the rest of England (520.3 per 100,000)

  - This represents an extra 6% of the population being vaccinated in the North, in relative terms.

Lockdowns and mental health

- On average people living in the North experienced more days in higher levels of lockdowns and fewer days in the lower levels of lockdown compared to the rest of England

  - People in the North spent 54.6% of the time in the two most restrictive tiers of lockdowns, compared to 46.3% in the rest of the country

  - This means that, on average, people in the North had 41 more days of the harshest restrictions than people in the rest of the country.

- The North experienced a larger drop in mental wellbeing, more loneliness, and higher rates of antidepressant prescriptions:

  - There was a 55% increase in the presence of minor psychiatric disorders – such as anxiety and depression – in the North (an increase from 19.2% in 2018/19 to 29.7% in 2020) compared to a 50% increase in the rest of England (an increase from 16.2% in 2018/19 to 24.2% in 2020).

People in the North spent

54.6%

of the time in the two most restrictive tiers of lockdowns, compared to

46.3%

in the rest of the country

Economic outcomes

- Throughout the pandemic, the average unemployment rate in the North was 6.3% compared to 5.3% in the rest of the country. The unemployment rate in the North was therefore one percentage point (95% CI: 0.49 to 1.40), or 19% in relative terms, higher than the rest of England

- Wages in the North were lower than the rest of England before the pandemic and these fell further during the COVID-19 pandemic (from

£543.90 to £541.30 per week) whereas wages increased in the rest of the country (from £600.80 to £604.00 per week).

- We estimate that the increased mortality in the North of England could cost the national economy up to £7.3bn in lost productivity. This will likely to be a conservative underestimate given the North's economy has also been hardest hit.

Policy Recommendations

Short-term

1
Continue place-focused vaccination programmes targeted at vulnerable populations in the North of England.

2
Increase NHS and local authority resources and service provision for mental health in the North Invest in research into mental health interventions in the North.

3
Invest in increasing capacity in Northern hospitals to help them catch-up on non-COVID-19 health care.

4
Make health a key part of an integrated Levelling Up strategy.

Medium-term

1
Recommit to ending child poverty. Increase child benefit, increase the child element of universal credit by £20 per week, extend provision of free childcares, remove the benefit cap and the two-child limit and extend provision of free school meals. Invest in children's services by increasing government grants to local authorities in the North.

2
Maintain and increase the additional £1,000 extra funding of universal credit.

3
Provide additional resource to local authorities and the NHS in the North by increasing the existing NHS health inequalities weighting within the NHS funding formula in its reset and restore plans.

4
Deliver a £1bn fund ring-fenced to tackle health inequalities at a regional level and increase local authority public health funding to address the higher levels of deprivation and public health need in the North.

Long-term

1
Create northern 'Health for Life' centres offering a life-long programme of health and wellbeing advice and support services from pre-natal to healthy ageing programmes. Targeted to the most deprived areas in the North they will take a preventative approach to health directly into the communities which need it the most.

2
Deliver health and mental health promotion interventions together with industry and employer, targeted at employee mental and physical health.

3
Level up investment in health R&D in the North of England to create high value jobs and support local health and drive the economy. Invest in North's testing and diagnostics infrastructure.

4
Build resilience in the North's population through developing a national strategy for action on the social determinants of health with the aim of reducing inequalities in health, with a key focus on children.

5
Develop a place-based pandemic preparedness plan which safeguards vulnerable groups such as those in care homes, with disabilities and those with chronic ill health.

Introduction

There is a productivity gap between the local authorities in the North and the rest of England of £4 per person per hour. There is also a large gap in health between the North and the rest of England, with life expectancy at birth 2 years lower in the North.[1,2]

In our 2018 'Health for Wealth' report, the NHSA estimated that: improving health in the North would reduce the regional gap in productivity by 30% or £1.20 per-person per-hour, generating an additional £13.2 billion in UK GDP.[3]

However, since 2020, the COVID-19 pandemic has vastly changed the regional context. In November 2020, the NHSA published a report from four of its university members (Newcastle, Manchester, Liverpool, and York) to investigate the impact of the first wave of the COVID-19 pandemic on health and productivity in the North. That first report ("COVID-19 and the Northern Powerhouse")[4] found large regional inequalities in the health and economic impacts of COVID-19 on the North including:

- Mortality rates during the first wave (March to July 2020) were higher in the North than the rest of England

    - An extra 12.4 more people per 100,000 died in the North than the rest of England due to COVID-19

    - An extra 57.7 more people per 100,000 died in the North than the rest of England due to all-causes

- These extra 57.7 deaths per 100,000 could cost the UK Economy an additional £6.86bn in lost productivity, measured by Gross Value Added (GVA)

- Economic outcomes, particularly unemployment rates, were hardest hit in the North

- Mental and financial well-being was hardest hit in the North, and there were greater increases in loneliness

- Reductions in mental well-being in the North could cost the UK economy up to £5 billion in reduced productivity (measured by GVA)

- Austerity disproportionately affected the North, particularly its areas of high deprivation: reductions in the core spending power of local authorities in the North by £1 per-head cost £3.17 per-head in lost productivity (measured by GVA), equivalent to around a £2bn loss in GDP per-year and around £16bn between 2011 and 2018

- Child health, a key predictor of life-long health and economic productivity, was poor and deteriorating even before the pandemic. Since the onset of COVID-19, adverse trends in poverty, education, employment and mental health for children and young people have been exacerbated

- The productivity gap between the North and the rest of the country is likely to worsen for subsequent generations without a COVID-19 recovery strategy that prioritises families with children

This new report "A year of COVID-19 in the North: Regional inequalities in health and economic outcomes" extends our original analysis and reviews the impact of the first thirteen months of the COVID-19 pandemic (from March 2020 through to March 2021) on health and productivity in the North compared to the rest of England. It examines health and economic impacts across eight chapters.[5]

We will be releasing a separate report later in the year specifically focussing on the impact that the pandemic has had on children living in the North of England. Chapter 5 of our 2020 report "COVID-19 and the Northern Powerhouse" was also dedicated to the inequalities experienced by children living in the North of England.

Throughout the report we compare the North (defined as the North East, the North West, and Yorkshire and the Humber regions) with the rest of England. As London is unusual in terms of its sociodemographic and economic profile – for example, having better health outcomes relative to its measured levels of deprivation – and as severity and spread of COVID-19 differed in London compared to other areas of England, we additionally conducted analyses for the rest of England excluding London and include this in an appendix. In each chapter, the North did worse than the rest of the country.

Chapter 1: COVID-19 and mortality in the North

This chapter examines regional inequalities in mortality rates in the period March 2020 to March 2021. In particular, it focuses on differences between the North and the rest of England in terms of mortality attributable to COVID-19 and all-cause mortality. We show that **the North experienced significantly higher mortality rates, in both COVID-19 and all-cause deaths, than the rest of England during this period of the pandemic.**

These regional inequalities persist even after we account for underlying deprivation, age structure, ethnic composition of the populations and high-risk individuals shielding. This paints a worrying picture for the North, as higher rates of deprivation alone do not entirely explain the differences, and there appear to be other factors that make the North more susceptible to the pandemic.

About half (51%) of the increased COVID-19 mortality in the North (or 15 deaths per 100,000) and about two thirds (68%) of the increased all-cause mortality (or 99 deaths per 100,000) were explained by higher deprivation and worse pre-pandemic health in the North, which are potentially preventable.

Based on our previous work showing that higher mortality is associated with productivity losses, we estimate that this increased mortality in the North of England could cost the national economy up to £7.3bn in lost productivity.

Chapter 2: Care home mortality rates in the North

This chapter examines regional inequalities in care home mortality rates in the period March 2020 to March 2021. In particular, it focuses on differences between the North and the rest of England in terms of care home mortality attributable to COVID-19 and all-cause care home mortality. We show that **the North experienced higher care home**

mortality rates, in both COVID-19 and all cause deaths, than the rest of England during the pandemic (up to March 2021).

After we account for care home bed availability, as well as the underlying deprivation, age structure, ethnic composition, and proportion of high risk individuals shielding of the populations the care homes serve, these regional differences vary depending on the outcome and period of the COVID-19 pandemic.

Chapter 3: Hospital pressure in the North

This chapter examines regional inequalities in hospital activity involving COVID-19. In particular, it focuses on differences between the North and the rest of England in the proportion of hospital beds occupied by COVID-19 patients. We show that **the North experienced significantly higher bed occupation of COVID-19 patients than the rest of England during the pandemic.**

These regional inequalities persist even after we account for underlying deprivation, age structure, and ethnic composition of the populations.

Chapter 4: Testing rates in the North

This chapter examines regional inequalities in positive COVID-19 test results. In particular, it focuses on differences between the North and the rest of England in terms of the proportion of positive COVID-19 test results per head of population.

We show that **the North experienced significantly higher positive COVID-19 test results than the rest of England during the pandemic** (defined here as May 2020 to March 2021). These regional inequalities persist even after we account for underlying deprivation, age structure, and ethnic composition of the populations.

Chapter 5: COVID-19 vaccination rates in the North

This chapter examines regional inequalities in COVID-19 vaccination rates. In particular, it focuses on differences between the North and the rest of England in terms of the COVID-19 vaccination rates.

We show that **during the first six months of roll out, COVID-19**

vaccination rates were higher in the North than in the rest of the country** (28.90 extra people were vaccinated per 10,000 in the North compared to the rest of England).

Chapter 6: Local lockdowns in the North

This chapter examines regional differences in the levels of lockdown regulations. In particular, it focuses on differences between the North and the rest of England, in terms of lockdown tiers implemented by the government. We show that **those living in the North experienced more days in the higher levels of lockdown** where stricter rules applied.

Chapter 7: Mental well-being in the North

This chapter examines regional inequalities in mental wellbeing. We show that **people living in the North experienced a larger drop in mental wellbeing** (particularly the North East and Yorkshire and the Humber). Northern residents also reported higher rates of loneliness during the pandemic as well as higher increases from pre-pandemic levels, particularly in the North East.
A greater number of antidepressants were prescribed over the past three years in the North and this remained the case during the COVID-19 pandemic. In general, the results were most pronounced when London was excluded from the rest of England.

Chapter 8: Economic impact on the North
This chapter examines regional inequalities in the economic impact of the pandemic. In particular, it focuses on differences between the North and the rest of England in terms of the unemployment, furlough, and wages.

We show that **the North experienced higher rates of unemployment and lower rates of furloughed employment** during the COVID-19 pandemic compared to the rest of England. Wages in the North fell more during the COVID-19 pandemic leading to increased regional economic inequalities.

Conclusion and Recommendations
The report concludes by setting out recommendations for the short, medium and longer term for levelling up the North.

Chapter 1:
COVID-19 and mortality in the North

Summary

This chapter examines regional inequalities in mortality rates during the first 13 months of the pandemic. In particular, it focuses on differences between the North and the rest of England in terms of mortality attributable to COVID-19 and all-cause mortality.[6,7,8,9]

We provide descriptive analysis of differences in mortality rates before examining the association with deprivation. We then go on to implement linear regression models where we account for factors known to be associated with increased mortality.

We first add in known confounders and then potential mediators and examine the attenuation in the 'north' effect to see what percentage of the difference in mortality between the North and rest of England is potentially preventable as it is attributable to modifiable factors, such as deprivation/poverty and worse pre-pandemic health.

We show that the North experienced significantly higher mortality rates, in both COVID-19 and all-cause, than the rest of England across the whole 13 months of the pandemic.

These regional inequalities persist even after we account for the age structure and ethnic composition of the populations, underlying deprivation, and the proportion of high-risk individuals shielding (as a proxy for underlying health status).

This paints a worrying picture for the North, as typically deprivation alone cannot explain away the differences in mortality rates between the North and rest of England.

Even after accounting for higher prevalence of deprivation and worse underlying health, other underlying differences remain making the North more susceptible to adverse health shocks such as pandemics.

Key findings:

- On average, the rates of mortality attributable to COVID-19 during the first 13 months of the pandemic (March 2020 to March 2021) were higher in the North than in the rest of the country
  - 29.4 more people per 100,000 (95% CI: 10.7 to 48.0) died of COVID-19 in the North (204.1 per 100,000) compared to the rest of England including London (174.4 per 100,000)
  - This represents a 17% higher mortality rate in the North compared to the rest of England

- On average, the rates of mortality attributable to all-causes during the first 13 months of the pandemic (March 2020 to March 2021) were higher in the North than in the rest of the country
  - 145.8 more people per 100,000 (95% CI: 106.8 to 184.9) died of all-causes in the North (1190.2 per 100,000) compared to the rest of England including London (1044.4 per 100,000)
  - This represents a 14% higher mortality rate in the North compared to the rest of England
- The increased mortality rates in the North remain statistically significantly higher after deprivation, ethnicity, the age-structure of the population and high risk individuals shielding are taken into account using statistical regressions models

- 51% of the increased COVID-19 mortality in the North (or 15 deaths per 100,000) and 68% of the increased all-cause mortality (or 99 deaths per 100,000) were explained by higher deprivation and worse pre-pandemic health in the North, which are potentially preventable
- There was higher 'excess' mortality in Northern regions too as well as more years of life lost during the pandemic
- The increased mortality in the North could cost the UK Economy an additional £7.3bn in lost productivity (measured by GVA)

The maps below show the age standardised mortality rates for each Local Authority District for mortality attributable to: (i) all-causes; (ii) COVID-19; and (iii) other causes (non-COVID-19). In each case, regional differences appear, with hotspots of high mortality typically clustered in the North (and in London for COVID-19). The remainder of this chapter seeks to explore these regional differences.

Regional differences in mortality rates

We start by presenting information on unadjusted age standardised mortality rates by government office region ('region' here-on-in). England is broken down into nine regions: North East, North West, Yorkshire and the Humber, East Midlands, West Midlands, East of England, London, South West, and South East. We further present information on differences between the North and the rest of England. We obtained the local authority mortality rates attributable to COVID-19 and all causes from the Office for National Statistics (ONS) for the period March 2020 to March 2021. Each local authority was then mapped to its region using look-up tables.[10]

COVID-19 mortality rates

Regionally during the pandemic, the **North West** (233.7 per 100,000) and **North East** (212.8 per 100,000) had the second and fourth highest COVID-19 mortality rates, respectively (Figure 1.2). **Yorkshire and The Humber** had the fifth COVID-19 mortality rate (194.9 per 100,000). London had the highest COVID-19 mortality rate (264.8 per 100,000). The **South West** (100.0 per 100,000) and the **South East** (171.8 per 100,000) have the lowest and second lowest COVID-19 mortality rates, respectively.

Regionally the COVID-19 mortality rate in:

- The North West was 39.8 per 100,000, or 21%, higher than the English average
- The North East was 18.9 per 100,000, or 10%, higher than the English average
- Yorkshire and the Humber was 1.0 per 100,000, or 1%, higher than the English average

Almost all counties and metropolitan counties in the North had higher mortality than the national average (Figure 1.3). COVID-19 mortality in:
- Greater Manchester was 67.1 per 100,000, or 35%, higher than the English average
- Merseyside was 53.4 per 100,000, or 28%, higher than the English average
- South Yorkshire was 45.5 per 100,000, or 24%, higher than the English average
- County Durham was 35.9 per 100,000, or 19%, higher than the

Figure 1.1: Heat maps of mortality, by cause (March 2020 to March 2021)

All-cause   COVID-19   Other causes

4: Highest 25%
3
2
1: Lowest 25%

English average
- Tyne and Wear was 25.6 per 100,000, or 13%, higher than the English average
- West Yorkshire was 19.2 per 100,000, or 10%, higher than the English average
- Lancashire was 17.0 per 100,000, or 9%, higher than the English average

However, in Cumbria (2.8 per 100,000 fewer deaths, or 1% lower) and North Yorkshire (77.5 per 100,000 fewer deaths, or 40% lower) COVID-19 mortality was lower than the national average.

All-cause mortality rates

Regionally during the pandemic, the North East (1221.1 per 100,000) and the North West (1214.7 per 100,000) had the highest and second highest all-cause mortality rates, respectively (Figure 1.4 and Table A1.2) and Yorkshire and the Humber (1146.2 per 100,000) had the fourth highest. Again, the South West (947.6 per 100,000) and the South East (993.2 per 100,000) had the lowest and second lowest mortality rates, respectively.
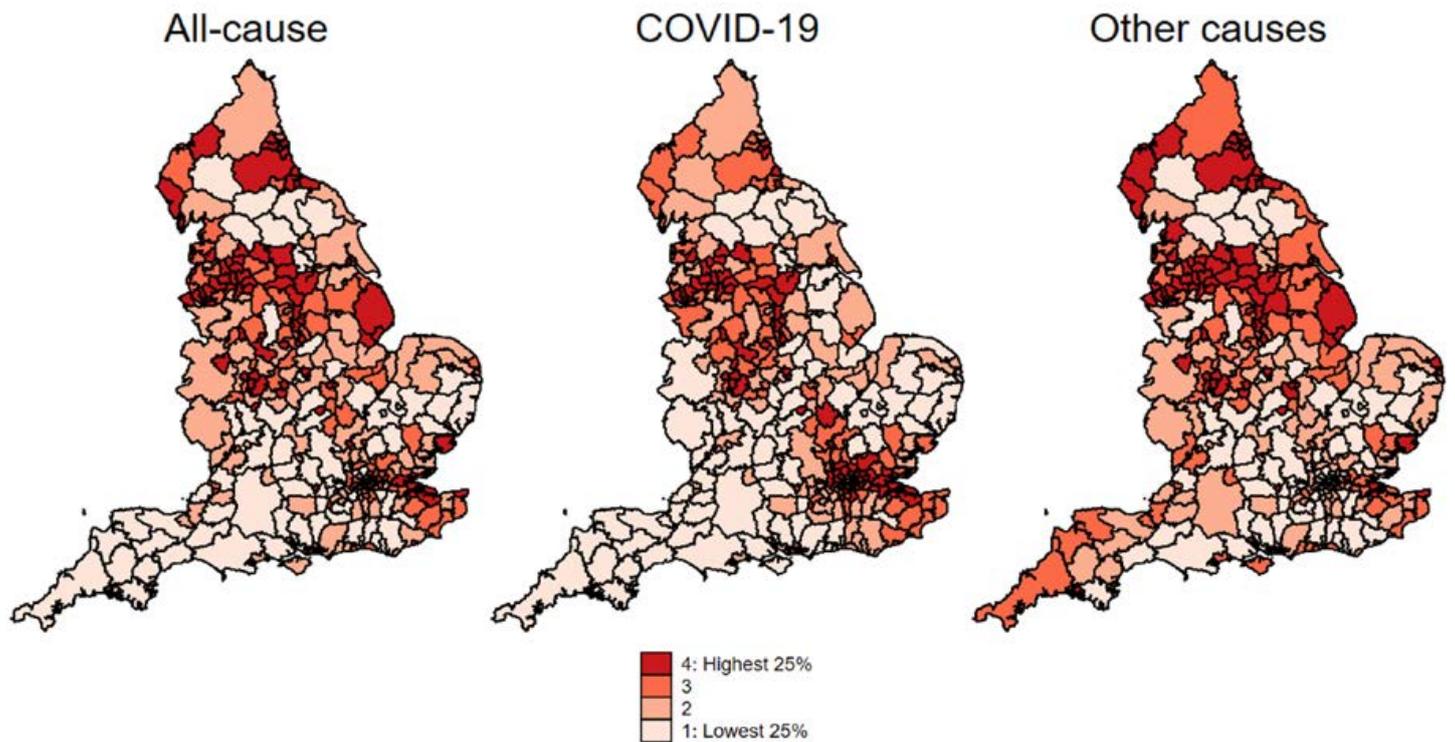
Regionally the all-cause mortality rate in:

- The North East was 138.6 per 100,000, or 13%, higher than the English average
- The North West was 132.2 per 100,000, or 12%, higher than the English average
- Yorkshire and the Humber was 63.7 per 100,000, or 6%, higher than the English average

Almost all counties and metropolitan counties in the North had higher mortality than the national average (Figure 1.5). All-cause mortality in:

- Merseyside was 212.2 per 100,000, or 20%, higher than the English average
- County Durham was 192.5 per 100,000, or 18%, higher than the English average
- Greater Manchester was 188.8 per 100,000, or 17%, higher than the English average
- Tyne and Wear was 159.2 per 100,000, or 15%, higher than the English average

Figure 1.2: Regional COVID-19 mortality rates per 100,000 (March 2020 to March 2021)

Region	COVID-19 mortality rate, per 100,000
South West	100.0
South East	171.8
East of England	185.6
East Midlands	193.4
England	193.9
Yorkshire and the Humber	194.9
North East	212.8
West Midlands	214.0
North West	233.7
London	264.8

Note: The three regions in the North are coloured pink. The remaining nine regions in the rest of England are coloured grey. The English average in shown as a blue bar.

Figure 1.3: COVID-19 mortality rates per 100,000 in selected Northern areas (March 2020 to March 2021)

Area	COVID-19 mortality rate, per 100,000
North Yorkshire	116.4
Cumbria	191.1
ENGLAND	193.9
Lancashire	210.9
West Yorkshire	213.1
Tyne and Wear	219.5
County Durham	229.8
South Yorkshire	239.4
Merseyside	247.3
Greater Manchester	261.0

Note: The English average in shown as a blue bar. The bars coloured red indicate mortality rates above the English average. The bars coloured green indicate mortality rates below the English average.

Figure 1.4: **Regional all-cause mortality rates per 100,000 (March 2020 to March 2021)**

Region	Rate
South West	947.6
South East	993.2
East of England	1027.2
London	1052.9
England	1082.5
East Midlands	1115.4
Yorkshire and the Humber	1146.2
West Midlands	1164.4
North West	1214.7
North East	1221.1

All-cause mortality rate, per 100,000

Note: The three regions in the North are coloured pink. The remaining nine regions in the rest of England are coloured grey. The English average in shown as a blue bar.

- South Yorkshire was 144.7 per 100,000, or 13%, higher than the English average
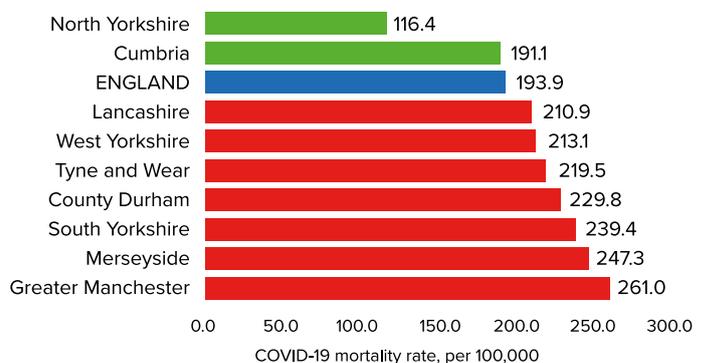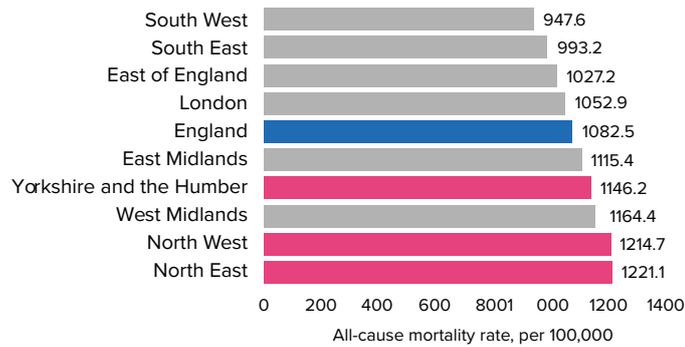- West Yorkshire was 118.4 per 100,000, or 11%, higher than the English average
- Lancashire was 82.2 per 100,000, or 8%, higher than the English average
- Cumbria was 45.8 per 100,000, or 4%, higher than the English average

However, in North Yorkshire all-cause mortality was lower than the national average (162.0 per 100,000 fewer deaths, or 15% lower).

Mortality rates and deprivation – preliminary investigation

We next present scatter plots of mortality rates (for COVID-19 and all-cause) against the rank of the LAD by the index of multiple deprivation (higher scores = more deprived) to analyse the strength of association between mortality rates and deprivation.

We show these associations in the North and the rest of England by using different symbols (Figures 1.6 and 1.7). For both COVID-19 and all-cause mortality, there is a clear positive association between deprivation and mortality, indicating that more deprived areas were likely to suffer higher mortality rates. The gradient of the line of best fit is steeper in the North than it is in the rest of England.

In Figure 1.6, the strength of the association between IMD rank and COVID-19 mortality rates is stronger in the North (coefficient=0.58; 95% CI: 0.46 to 0.70) than it is in the rest of England (coefficient=0.44; 95% CI: 0.34 to 0.54). The variation explained by the model is also higher in the North (R^2 = 0.58) than it is in the rest of England (R^2 = 0.27).
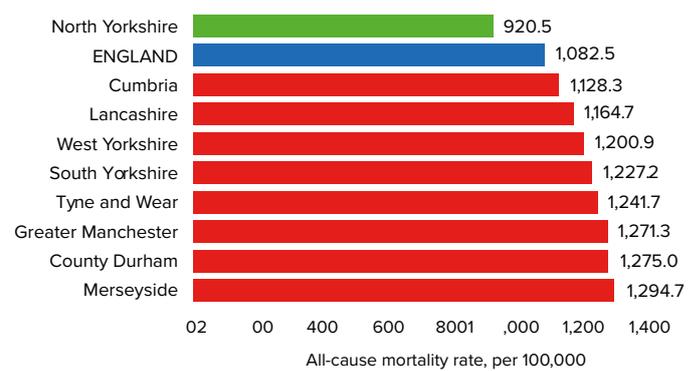
In Figure 1.7, the strength of the association between IMD rank and all-cause mortality rates is stronger in the North (coefficient=1.83; 95% CI: 1.61 to 2.06) than it is in the rest of England (coefficient=1.25; 95% CI: 1.09 to 1.41). The variation explained by the model is also higher in the North (R^2 = 0.79) than it is in the rest of England (R^2 = 0.54).

In Figure 1.8 (COVID-19) and Figure 1.9 (all-cause), we show the number of Local Authority Districts (LADs) in the North and the rest of England in each of the four quadrants (high/low deprivation and high/low mortality). The North East quadrant (most deprivation and high mortality rates) can be thought of as being the 'worst' quadrant to be in, whereas the South West quadrant (least deprivation and low mortality rates) can be thought of as being the 'best' quadrant to be in.[11]

For COVID-19 (Figure 1.8), in the North, 58% of LADs are in the worst quadrant (i.e. have higher than average deprivation and higher than average COVID-19 mortality) compared to 27% of LADs in the rest of England. Conversely, 42% of LADs in the rest of England are in the best quadrant (i.e. have lower than average deprivation and lower than average COVID-19 mortality), compared to 24% of LADs in the North.

For all-cause mortality (Figure 1.9), in the North, 68% of LADs are in the worst quadrant (i.e. have higher than average deprivation and higher

Figure 1.5: **All-cause mortality rates per 100,000 in selected Northern areas (March 2020 to March 2021)**

Area	Rate
North Yorkshire	920.5
ENGLAND	1,082.5
Cumbria	1,128.3
Lancashire	1,164.7
West Yorkshire	1,200.9
South Yorkshire	1,227.2
Tyne and Wear	1,241.7
Greater Manchester	1,271.3
County Durham	1,275.0
Merseyside	1,294.7

All-cause mortality rate, per 100,000

Note: The English average in shown as a blue bar. The bars coloured red indicate mortality rates above the English average. The bars coloured green indicate mortality rates below the English average.

Figure 1.6: **COVID-19 mortality rate (Mar 2020 to Mar 2021) and area deprivation for Local Authority Districts in England**

Figure 1.7: **All-cause mortality rate (Mar 2020 to Mar 2021) and area deprivation for Local Authority Districts in England**

than average all-cause mortality) compared to 32% of LADs in the rest of England. Conversely, 46% of LADs is the rest of England are in the best quadrant (i.e. have lower than average deprivation and lower than average all-cause mortality), compared to 21% of LADs in the North.

From Figures 1.8 and 1.9, it can be seen that there was, on average, higher mortality and higher deprivation in the North compared to the

Figure 1.8: The relationship between the 13-month COVID-19 mortality rate and deprivation in the North and the Rest of England

High COVID-19 mortality

Lower than average deprivation AND higher than average COVID-19 mortality

The North: 2.7% (2 LADs)
Rest of England: 13.0% (28 LADs)

Higher than average deprivation AND higher than average COVID-19 mortality

The North: 58.3% (42 LADs)
Rest of England: 27.3% (59 LADs)

Low deprivation — High deprivation

Lower than average deprivation AND lower than average COVID-19 mortality

The North: 23.6% (17 LADs)
Rest of England: 42.1% (91 LADs)

Higher than average deprivation AND lower than average COVID-19 mortality

The North: 15.3% (11 LADs)
Rest of England: 17.6% (38 LADs)

Low COVID-19 mortality

Figure 1.9: The relationship between the 13-month all-cause mortality rate and deprivation in the North and the Rest of England

High all-cause mortality

Lower than average deprivation AND higher than average all-cause mortality

The North: 5.5% (4 LADs)
Rest of England: 8.8% (19 LADs)

Higher than average deprivation AND higher than average all-cause mortality

The North: 68.1% (49 LADs)
Rest of England: 32.4% (70 LADs)

Low deprivation — High deprivation

Lower than average deprivation AND lower than average all-cause mortality

The North: 20.8% (15 LADs)
Rest of England: 46.3% (100 LADs)

Higher than average deprivation AND lower than average all-cause mortality

The North: 5.5% (4 LADs)
Rest of England: 12.5% (27 LADs)

Low all-cause mortality

rest of England. Deprivation is a known predictor of higher mortality rates, and that again came through during the COVID-19 pandemic.

To help 'level-up' there needs to be a concerted effort to reduce levels of deprivation in the North, as if not Northern local authorities are likely to remain in the North East quadrant.

Statistical analysis of the geographical difference in mortality rates

The above univariate analysis showed that there was, on average, higher mortality and higher deprivation in the North, compared to the rest of England.

However, it is not clear from the above what percentage of the increased mortality suffered in the North was attributable to deprivation and what percentage was attributable to other factors, such as different populations. In this subsection, we aim to analyse the relationship between mortality rates and population characteristics, as well as modifiable factors such as deprivation and the underlying health status of the population.

The main hypothesis being tested is that mortality rates will be higher in the North, but that this 'northern excess mortality' should become smaller when population characteristics are included, and smaller still when deprivation and health status are included.

To test these hypotheses, we estimate a number of models informed by a directed acyclic graph (DAG), shown in Figure A1.1 in the appendix. In the DAG, the key exposure is 'live in the North' and the key outcomes are those related to COVID-19. In the analysis in this chapter, the outcomes are specifically mortality rates attributable to COVID-19 and all-causes.

Age and ethnicity are control variables, known to be associated with both living in the North and worse outcomes. However, deprivation/ poverty and worse health pre-COVID-19 are potential mediators – i.e. they could potentially explain the mechanisms by which through living in the north can lead to worse COVID-19 outcomes.

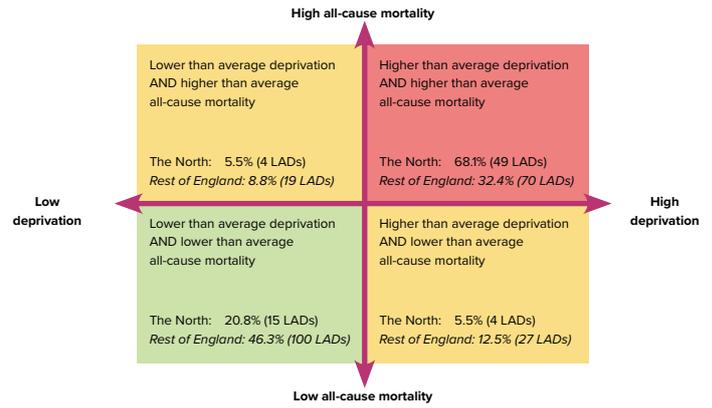To obtain estimates for the above DAG, we run four models (also given in Appendix Figure A1.2).

Model 1
$\text{Outcome}_i = \beta(\text{The North}_i) + \varepsilon_i$
Model 2
$\text{Outcome}_i = \beta(\text{The North}_i) + \gamma(\text{Age structure}_i) + \varepsilon_i$
Model 3
$\text{Outcome}_i = \beta(\text{The North}_i) + \gamma(\text{Age structure}_i) + \lambda(\text{Ethnic structure}_i) + \varepsilon_i$
Model 4
$\text{Outcome}_i = \beta(\text{The North}_i) + \gamma(\text{Age structure}_i) + \lambda(\text{Ethnic structure}_i) + \delta(\text{IMD quintile}_i) + \mu(\text{Patient shielding rate}_i) + \varepsilon_i$

Where:

- Subscript l refers to each unique local authority district
- 'Outcome' is one of the two outcomes we consider:
  1. COVID-19 age standardised mortality rates (March 2020 to March 2021), per 100,000
  2. All-cause age standardised mortality rates (March 2020 to March 2021), per 100,000
- 'The North' is a binary variable that takes the value 1 if a local authority is in the North region and 0 otherwise (i.e. if a local authority is in the rest of England)
- 'Age structure' is a series of variables indicating what percentage of the local authority's population is in pre-defined age-groups. This data was taken from the 2011 Census to avoid issues associated with extrapolating to non-Census years. The base (omitted) category is the percentage of people less than 18 years of age.
- 'Ethnic structure' is a series of variables indicating what percentage

of the local authority's population belong to pre-defined ethic-groups. This data was taken from the 2011 Census to avoid issues associated with extrapolating to non-Census years. The base (omitted) category is the percentage of people who are white.
- 'IMD quintile' is a categorical variable indicating the relative deprivation of the local authority.
- 'Patient shielding rate' is variables indicating the rate of patient shielding per 10,000 in the local authority. This can be thought of as a measure of the underlying health status of the population.[12]

The key parameter in each model is β; it tells us if the mortality rates are statistically different in the North when compared to the rest of England. The later models tell us if this difference persists even after we account for known factors that are associated with mortality rates. We perform all four models with the comparison group between the North and the rest of England.

If we assume that the attenuation of the β coefficient for the North on addition of deprivation is indicative of mediation, then this suggests that X% of the excess deaths may be explained by the higher levels of deprivation in the North, which are potentially avoidable.
That is, to examine the extent to which the higher mortality rates in the North were potentially avoidable, we compare the size of β in model 3 to model 4.

Ethnicity may also be thought of as a potential mediator, rather than a confounder, and hence we estimate models where ethnicity can be thought of as either a confounder (model 3) or as solely a mediator (model 4). We therefore additionally compare the β term in model 2 to model 4.

Results of the statistical analysis

To ease interpretation, we present the results of the statistical models as graphics. In each case, the size of the bar represents the magnitude of the estimated coefficient β. The lines represent the 95% confidence intervals. If these confidence interval lines do not cross zero, there is evidence that the effect is statistically significance (p<0.05).

COVID-19 Mortality Rates

Figure 1.10 presents the results for the COVID-19 mortality during the pandemic. The full results are contained in Table A1.3. **During the pandemic, the COVID-19 mortality rate in the North is always statistically significantly higher than in the rest of England**. This is true even after accounting for the full set of variables listed above. The results when local authorities in London are excluded are larger in magnitude, as expected, and these are presented in the Appendix. In the unadjusted model (Model 1):

- 29.4 more people per 100,000 (95% CI: 10.7 to 48.0) died of COVID-19 in the North than in the rest of England (204.1 compared to 174.7 per 100,000, an increase of 17%)
  - 41.9 more people per 100,000 (95% CI: 24.6 to 59.2) died of COVID-19 in the North than in the rest of England excluding London (204.1 compared to 162.2, an increase of 26%)
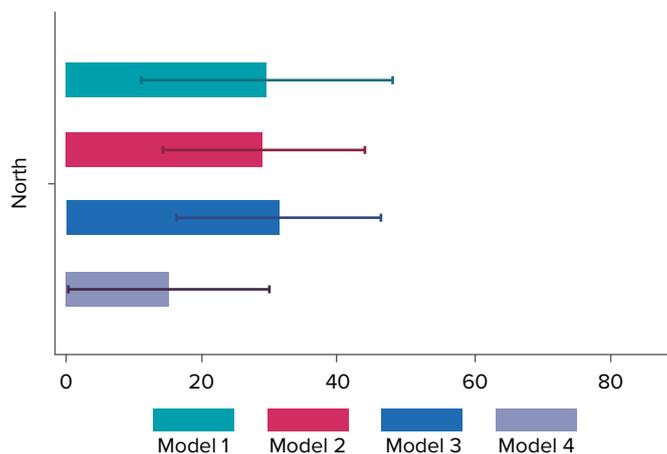
When we account for factors known to be associated with higher mortality:

- In Model 3, where we account for the age and ethnic composition of the populations 31.3 more people per 100,000 (95% CI: 16.2 to 46.3) died of COVID-19 in the North than in the rest of England.
- In Model 4, when we added in the mediating variables (deprivation and the proportion of people shielding), 15.2 more people per 100,000 (95% CI: 0.3 to 30.0) died of COVID-19 in the North than in the rest of England.

Even after accounting for age, ethnicity, deprivation and the rate of people shielding the COVID-19 mortality rate is higher in the North and this difference is statistically significant.

The attenuation between Model 1 and Model 4 is 48% , therefore 48%

Model 1 Model 2 Model 3 Model 4

Models 1-4 as defined in the Appendix

of the increased COVID-19 mortality in the North can be explained by observable factors and 52% remains unexplained.[13]

When we compare the estimates between Model 3 and Model 4, the attenuation is 51%. Given the DAG reported in the Appendix, we infer here that after ethnicity and age have been accounted for, the remaining 51% of increased mortality in the North was potentially preventable.

If deprivation and health in the North were similar to that in the rest of England, 51% of the increased northern COVID-19 mortality – or 15 COVID-19 deaths per 100,000 – could have been prevented.

As well as looking at the data by wave, we analysed each month separately using model 4. Of the 11 monthly mortality rates:[14,15]

- Six (April 2020, May 2020, June 2020, July 2020, October 2020, and November 2020) were higher in the North than in the rest of England (both including and excluding London)
- Three (January 2021, February 2021, and March 2021) were smaller in the North than in the rest of England (but only when including London in the rest of England)
- Two (March 2020 and December 2020) were not significantly different in the North than the rest of England (both including and excluding London)

All-cause Mortality Rates
Figure 1.11 presents the results for all-cause mortality during the pandemic. The full results are contained in Table A1.4. During the pandemic the all-cause mortality rate in the North is always statistically significantly higher than in the rest of England. This is true even after accounting for the full set of variables listed above. The results when

local authorities in London are excluded are larger in magnitude, as expected, and these are presented in the Appendix. In the unadjusted model (Model 1):

- 145.8 more people per 100,000 (95% CI: 106.8 to 184.9) died of COVID-19 in the North than in the rest of England (1190.2 compared to 1044.4 per 100,000, an increase of 14%)
  - 148.0 more people per 100,000 (95% CI: 108.3 to 187.7) died of COVID-19 in the North than in the rest of England excluding London (1190.2 compared to 1042.2, an increase of 14%)

When we account for factors known to be associated with higher mortality:

- In Model 3, where we account for the age and ethnic composition of the populations 95.1 more people per 100,000 (95% CI: 59.8 to 130.1) died of all-causes in the North than in the rest of England.
- In Model 4, when we added in the mediating variables (deprivation and the proportion of people shielding), 30.7 more people per 100,000 (95% CI: 1.9 to 59.5) died of COVID-19 in the North than in the rest of England.

Even after accounting for age, ethnicity, deprivation and shielding rate, there are higher all-cause mortality rates in the North and this difference is statistically significant.

The attenuation between Model 1 and Model 4 is 79%, therefore 79% of the increased COVID-19 mortality in the North can be explained by observable factors and 21% remains unexplained.[16]

When we compare the estimates between Model 3 and Model 4, the attenuation is 68%. Given the DAG reported in the Appendix, we infer here that after ethnicity and age have been accounted for, the remaining 68% of increased mortality in the North was potentially preventable. If deprivation and health in the North was similar to that in the rest of England, 68% of the increased northern all-cause mortality – or 99 deaths per 100,000 – could have been prevented.

As well as looking at the data by wave, we analysed each month separately. Of the 13 monthly mortality rates:

- Nine (March 2020, April 2020, May 2020, June 2020, July 2020, August 2020, September 2020, October 2020, and November 2020) were higher in the North than in the rest of England (both including and excluding London)
- Two (January 2021 and February 2021) were smaller in the North than in the rest of England (but only when including London in the rest of England)
- Two (December 2020 and March 2021) were not significantly different in the North than the rest of England (both including and
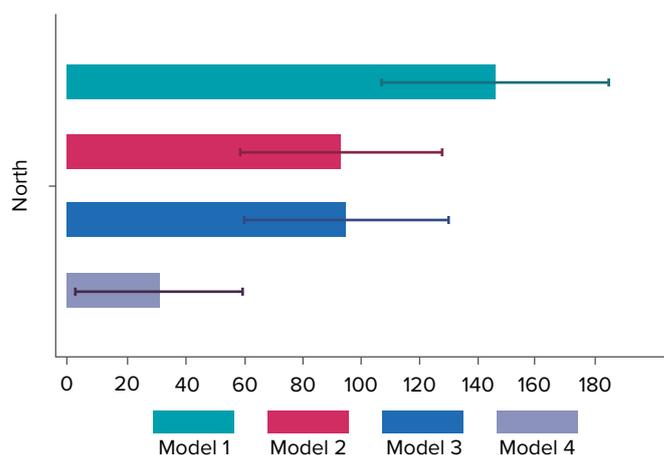
Excess mortality

As well as looking at differences in mortality rates, colleagues looked at the 'excess' mortality during the first 30 weeks of the pandemic. Excess mortality is defined as the difference in observed mortality compared to an 'expected' level of mortality. They showed that excess mortality was unequally geographically distributed.[17,18]

The North West (excess mortality rate = 95 per 100,000) and the North East (excess mortality rate = 94 per 100,000) had the highest and second highest rates of direct COVID-19 or other respiratory disease mortality. The value in Yorkshire and the Humber was 79 per 100,000. The English average was 77 per 100,000. All three Northern regions were above the national average (Figure 1.12).

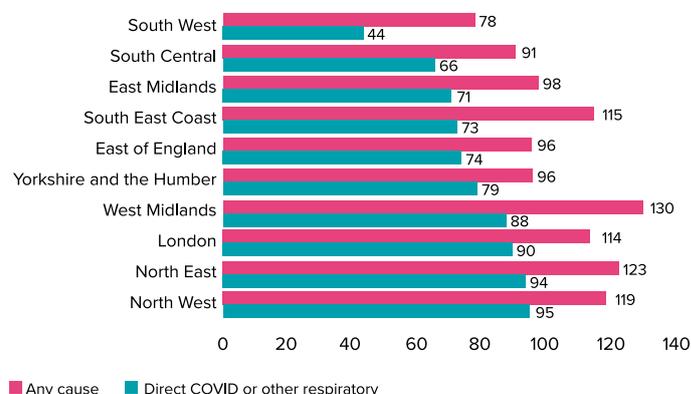**The percentage difference from the national average were:**

- North West: 23% higher
- North East: 22% higher
- Yorkshire and the Humber: 3% higher.

Figure 1.11: **Additional all-cause mortality (March 2020 to March 2021) in the North, per 100,000**

Models 1-4 as defined in the Appendix

Figure 1.12: **Excess mortality across the first 30 weeks of the pandemic, by Region**

Source: https://www.sciencedirect.com/science/article/pii/S2666776221001216

Figure 1.13: **Excess years of life lost (YLL) between March 7 and December 25, 2020, by Region**

Source: https://www.medrxiv.org/content/10.1101/2021.07.05.21259786v1.full.pdf+html

The authors also examined any cause excess mortality. The England (and Wales) average was 104 per 100,000. The values in the North were:

- North West: 119 per 100,000 (14% higher)
- North East: 123 per 100,000 (18% higher)
- Yorkshire and the Humber: 96 per 100,000 (8% lower)

Excess years of life lost (YLL)

Colleagues have also examined excess years of life lost (YLL) during

the period 7th March 2020 to 25th December 2020, relative to the same period in earlier years. YLL were calculated using 2019 year sex-specific life tables. Again, they showed that excess YLL was unequally geographically distributed.[19]

The English average for YLL attributable to direct COVID-19 or other respiratory disease was 1,043 years per 100,000 population. The North West had the highest regional value; 1,529 years of life lost per 100,000 population (Figure 1.13). Yorkshire and the Humber had the fourth highest amount (1,265 years per 100,000 population) and the North East had the fifth highest amount of years of life lost (1,214 per 100,000 population). All three Northern regions were above the national average.

The percentage difference from the national average were:

- North West: 47% higher
- Yorkshire and the Humber: 21% higher
- North East: 16% higher

The authors also considered excess YLL for all-cause deaths. The English average was 1,144 years per 100,000 population. The North West had the highest regional value; 1,550 years of life lost per 100,000 population (Figure 1.13). The North East had the second highest regional value (1,519 years per 100,000 population) and Yorkshire and the Humber had fifth highest regional value (1,347 year per 100,000 population). All three Northern regions were above the national average.

The percentage difference from the national average were:

- North West: 35% higher
- North East: 33% higher
- Yorkshire and the Humber: 18% higher

The potential effect of increased excess mortality on future productivity

The original Heath for Wealth report showed that around 30% of the productivity gap between the North and the rest of England was attributable to poorer health in the North. This 30% figure was comprised of 17.1% attributable to higher morbidity (ill-health) and 12.8% attributable to higher mortality.[20]

In the original Health for Wealth report, the unadjusted difference in all-cause mortality (per-year) between the North and the rest of England was 112 extra deaths per 100,000 population per-year.

During the first year of the pandemic, the unadjusted difference in all-cause mortality between the North and the rest of England (including London, to be consistent) was an extra 145.8 deaths per 100,000 population (Table A1.4).

Assuming linearity, if an additional 112 deaths per 100,000 population contributed 12.8% to the productivity gap, it can be inferred that an additional 145.8 deaths per 100,000 population will contribute 16.7% to this productivity gap. **16.7% of the productivity gap (of £44bn) between the North and the rest of England equates to a potential loss of £7.3bn in GDP brought about by unequal mortality rates in the North and the rest of England.** This figure is likely to be an underestimate, however, and should be re-evaluated at the end of the pandemic.

It is also worth acknowledging here that other macroeconomic factors have changed since the original Health for Wealth report, but these are likely to exacerbate the gap in productivity between the North and the rest of England.

Conclusion

This chapter has presented evidence that the mortality rates – both for COVID-19 and for all cause – were statistically significantly higher in the North compared to the rest of England. This remained even after other factors known to be associated with mortality were accounted for.

On average, local authorities in the North experienced:

- Higher mortality attributable to COVID-19 during the pandemic.
- Higher mortality attributable to all-causes during the pandemic.

We estimated that 51% of the increased COVID-19 mortality in the North (or 15 deaths per 100,000) and 68% of the increased all-cause mortality (or 99 deaths per 100,000) were explained by higher deprivation and worse pre-pandemic health in the North, which are potentially preventable.
This increased all-cause mortality could cost the UK Economy an additional £7.3bn in lost productivity (measured by GVA).

Chapter 2:
Care home mortality rates in the North

Summary

This chapter examines regional inequalities in care home mortality rates across the pandemic. In particular, it focuses on differences between the North and the rest of England in terms of care home mortality attributable to COVID-19 and all-cause care home mortality. We show that the North experienced higher mortality rates in care homes, for both COVID-19 and all cause, than the rest of England across the pandemic to date.

We divide deaths in care homes by the number of care home beds in a local authority to account for the unequal geographic distribution of care home beds across the country. Our key outcomes are therefore deaths per care home beds. We then apply similar methods to those used in the previous chapter to analyse the statistical relationships between confounders, mediators, and outcomes.

After we account for underlying deprivation, age structure, ethnic composition of the populations and high risk individuals shielding these regional differences vary depending and are less clear cut than the mortality in all settings discussed in the previous chapter.

Key findings:

- On average in care homes, the rates of mortality attributable to COVID-19 during the pandemic (March 2020 to March 2021) were higher in the North than in the rest of the country
  - 1.24 more people per 1,000 care home beds (95% CI: 0.7 to 1.8) died of COVID-19 in the North (5.93 per 1,000 beds) compared to the rest of England (4.69 per 1,000 beds)
  - The North's care home COVID-19 mortality was therefore 26% higher than the rest of England
- On average in care homes, the rates of mortality attributable to all-causes were also higher in the North than in the rest of the country
  - 2.06 more people per 1,000 care home beds (95% CI: 0.6 to 3.5) died of all-causes in the North (22.4 per 1,000 beds) compared to the rest of England (20.3 per 1,000 beds)
  - The North's care home all-cause mortality was therefore 10% higher than the rest of England

Regional differences in mortality rates

We derived care home mortality rates per 1,000 beds attributable to COVID-19 and all-cause using number of deaths in care homes from the Office for National Statistics (ONS) for the period April 2020 March 2021. Data on the number of care home beds was available from the Care Quality Commission.[21]

We use number of care home beds as the denominator – as opposed to population estimates – as there is an unequal geographical spread of care home beds throughout England.
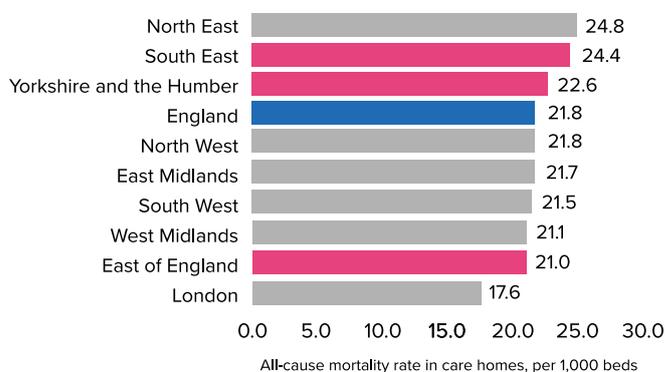
Care home COVID-19 mortality rates

Regionally during the pandemic, the North East (7.2 per 1,000 care home beds) and Yorkshire and The Humber (5.6 per 1,000 care home beds) had the highest and third highest care home COVID-19 mortality rates, respectively (Figure 2.1 and Table A2.1). The North West (5.4 per

Figure 2.1: **Care home COVID-19 mortality rates per 1,000 care home beds**

Region	Rate
North East	7.2
South East	5.6
Yorkshire and the Humber	5.6
North West	5.4
East Midlands	5.4
England	5.3
South West	5.3
West Midlands	5.0
East of England	4.5
London	4.0

COVID-19 mortality rate in care homes, per 1,000 beds

Note: The three regions in the North are coloured pink. The remaining nine regions in the rest of England are coloured grey. The English average in shown as a blue bar.

Figure 2.2: **Care home all-cause mortality rates per 1,000 care home beds**

Region	Rate
North East	24.8
South East	24.4
Yorkshire and the Humber	22.6
England	21.8
North West	21.8
East Midlands	21.7
South West	21.5
West Midlands	21.1
East of England	21.0
London	17.6

All-cause mortality rate in care homes, per 1,000 beds

Note: The three regions in the North are coloured pink. The remaining nine regions in the rest of England are coloured grey. The English average in shown as a blue bar.

1,000 care home beds) had the fourth highest. London (4.0 per 1,000 care home beds) and the South West (5.3 per 1000 care home beds) had the lowest mortality rates, respectively.

The English average COVID-19 mortality rate in care homes was 5.3 per 1,000 beds. Therefore the mortality rate in the:

- North East was 36% higher than the national average
- Yorkshire and the Humber was 6% higher than the national average
- North West was 2% higher than the national average

Care home all-cause mortality rates

Regionally during the pandemic, the North East (24.4 per 1000 care home beds) and Yorkshire and The Humber (22.6 per 1000 care home beds) had the second and third highest care home all-cause mortality rates, respectively (Figure 2.2 and Table A2.2). The North West (21.1 per 1000 care home beds) had the second lowest care home all-cause mortality rates.

The English average all-cause mortality rate in care homes was 21.8 per 1,000 beds. Therefore the mortality rate in the:

- North East was 12% higher than the national average
- Yorkshire and the Humber was 4% higher than the national average
- North West was 4% lower than the national average

Statistical analysis of the geographical difference in outcomes

To examine if there are differential effects of the two outcomes considered in the North compared to the rest of England, we use the same analytical model and DAG to inform the same four models as in the previous chapter (also described in Appendix Figure A1.1).

The 'Outcome' being one of the two outcomes we consider:

1. Care home COVID-19 mortality rates (March 2020 to March 2021), per 1,000 care home beds
2. Care home all-cause mortality rates (March 2020 to March 2021), per 1,000 care home beds

Results of the statistical analysis

Care home COVID-19 Mortality Rates

Figure 2.3 presents the results for the COVID-19 mortality in care homes during the pandemic. The full results are contained in Table A2.3. During the pandemic, the care home COVID-19 mortality rate in the North is always higher than in the rest of England.

In the unadjusted model (Model 1):
- 1.2 more people per 1,000 beds (95% CI: 0.7 to 1.7) died of COVID-19 in the North than in the rest of England (5.93 compared to 4.7 per 1,000 beds, an increase of 26%)

After accounting for age, ethnicity, deprivation and shielding rate the adjusted care home COVID-19 mortality rate is higher in the North, however it is not statistically significant.

Hence we cannot be confident that the true effect is no difference between the North and the rest of England.

Care home all-cause Mortality Rates

Figure 2.4 presents the results for all-cause care home mortality during the pandemic. The full results are contained in Table A2.4.

In the unadjusted model (Model 1):
- 2.1 more people per 1,000 beds (95% CI: 0.6 to 3.5) died of COVID-19 in the North than in the rest of England (22.4 compared to 20.3 per 1,000 beds, an increase of 10%)

After accounting for age, ethnicity, deprivation and shielding rate the adjusted care home all-cause mortality rate is not statistically different from the rest of England.

Conclusion

This chapter has presented evidence that the North was hit the hardest by the COVID-19 pandemic in terms of increased mortality in care homes.

On average, local authorities in the North experienced:
- Higher care home mortality attributable to COVID-19 during the pandemic.
- Higher care home mortality attributable to all-causes during the pandemic.
- However, these effects did not remain when we accounted for the higher deprivation in the North.

Figure 2.3: **Additional COVID-19 mortality (March 2020 to March 2021) in the North in care homes, per 1,000 care home beds**
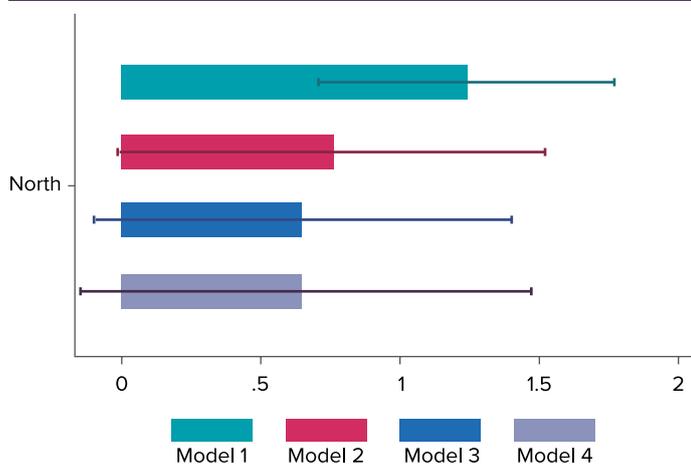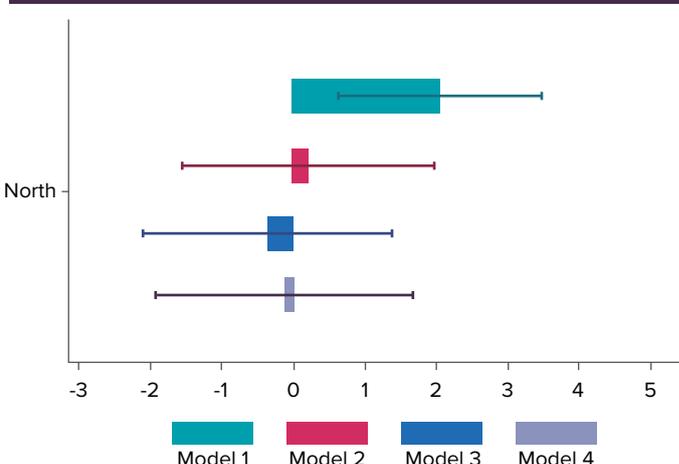

Models 1-4 as defined in the Appendix

Figure 2.4: **Additional all-cause mortality (March 2020 to March 2021) in the North in care homes, per 1,000 care home beds**

Models 1-4 as defined in the Appendix

Chapter 3:
Hospital pressure in the North

Summary

This chapter examines regional inequalities in hospital activity involving COVID-19. In particular, it focuses on differences between the North and the rest of England in terms of the proportion of hospital beds occupied by COVID-19 patients.

We show that the North experienced significantly higher bed occupation of COVID-19 patients than the rest of England. These regional differences persist even after we account for underlying deprivation, age structure, and ethnic composition of the populations. These findings paint a worrying picture for the North.

Key findings:

On average during the pandemic (defined here as April 2020 to March 2021 due to data availability) the proportion of hospital beds occupied by COVID-19 patients were higher in the North than in the rest of the country.

- In the North, 11% of hospital beds were occupied by COVID-19 patients over the year, compared to 10% in the rest of England
  - This is equivalent to:
    - 10% more hospital beds occupied by COVID patients in the North than in the rest of England over a year period (95% CI: 9% to 11%)
    - 1.0 percentage point more hospital beds occupied by COVID-19 patients in the North compared to the rest of England (95% CI: 0.9 to 1.1)
- The higher proportion of hospital beds occupied COVID-19 patients in the North remains statistically significant and increased in magnitude after deprivation, ethnicity, and the age-structure of the population are taken into account using linear models

We also summarise the regional data provided by the Institute of Fiscal Studies (IFS) that shows – on average – there was greater reductions in non-COVID-19 hospital activity in the North than in the rest of the country during 2020 compared to 2019.
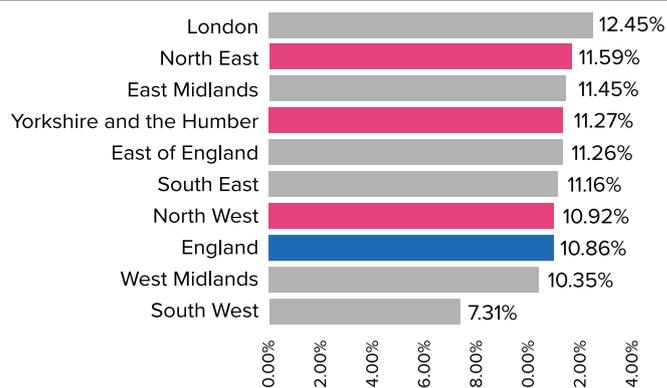
Regional differences in hospital activity

We obtained the number of hospital beds occupied by COVID-19 patients in NHS Trusts from the COVID-19 NHS Situation Report for the periods of April 2020 to March 2021. The number of beds occupied by COVID-19 patients was calculated into a proportion of the total number of beds. Each NHS Trust was then mapped to a local authority based of the hospital location and then mapped to its region using look-up tables, as well as to the North or the rest of England using look-up tables.[22]
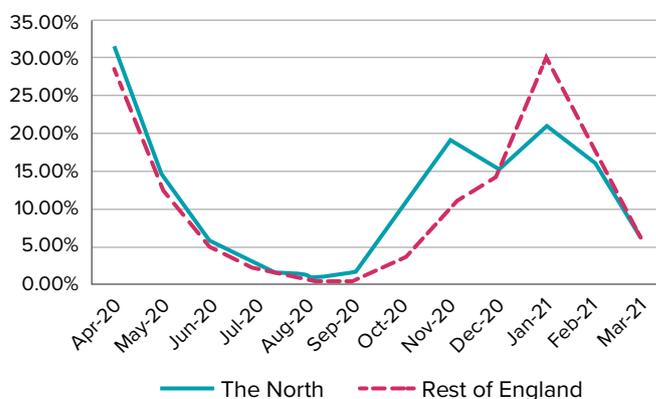
COVID-19 hospital bed occupancy

Regionally during the pandemic, the North East (11.59%) and Yorkshire and The Humber (11.27%) had the second and fourth highest percentage of beds occupied COVID-19 patients, respectively (Figure 3.1 and Table A3.1). London had highest percentage of beds occupied COVID-19 patients (12.45%). The North West (10.92%) had the third lowest percentage of beds occupied COVID-19 patients.

Figure 3.1: **Percentage of beds occupied by COVID-19 patients (April 2020 to March 2021)**

Note: The three regions in the North are coloured pink. The remaining nine regions in the rest of England are coloured grey. The English average in shown as a blue bar.

Figure 3.2: **Trends in the percentage of beds occupied COVID-19 patients (April 2020 to March 2021)**
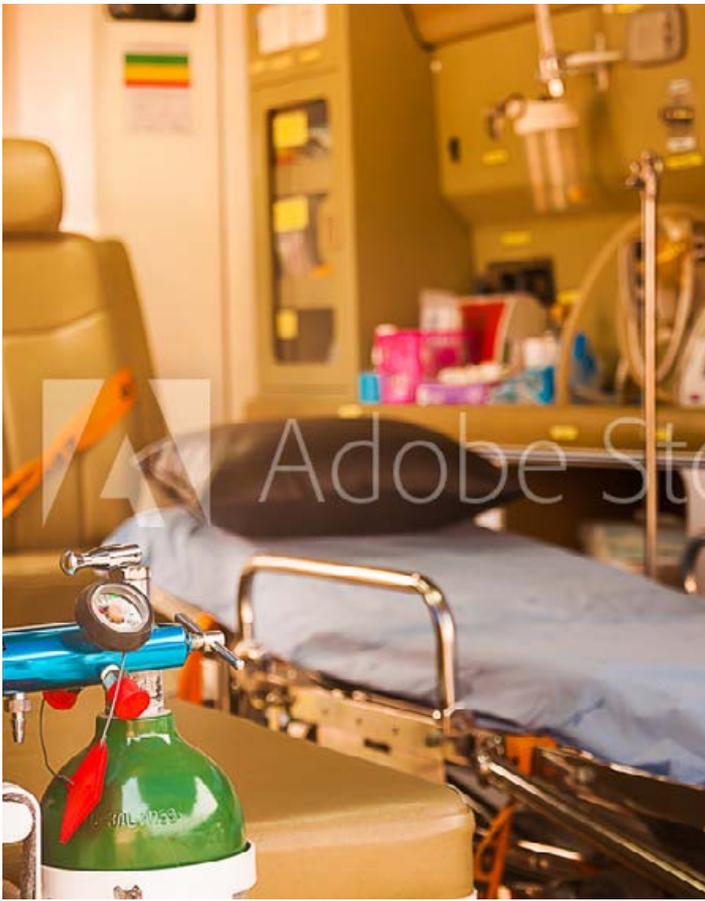
The English average all-cause mortality rate in care homes was 10.86%. Therefore the percentage of beds occupied by COVID-19 patients in the:

- North East was 0.73 percentage points, or 7%, higher than the national average
- Yorkshire and the Humber was 0.41 percentage points, or 4% higher than the national average
- North West was 0.06 percentage points, or 0.6%, higher than the national average

Figure 3.2 shows trends over time in the percentage of beds occupied by COVID-19 patients in the North and the rest of England. The North had higher rates in 2020 although the rest of England – driven by London – had higher rates in 2021.

Statistical analysis of the geographical difference in outcomes

To examine if there are differential effects of the outcome considered in the North compared to the rest of England, we use models 1 to 4 from

Models 1-4 as defined in the Appendix

Note: the graphical display has been multiplied by 100. The coefficients reported in Table A3.2 are proportions, where the coefficients displayed here are percentages.

Figure 3.4: Percentage difference in elective inpatient procedures; 2019 to 2020

Note: The three regions in the North are coloured pink. The remaining nine regions in the rest of England are coloured grey. The English average in shown as a blue bar.

Source: IFS 2021

Figure 3.5: Percentage difference in emergency inpatient procedures; 2019 to 2020

Figure 3.6: Percentage difference in outpatient procedures; 2019 to 2020

Note: The three regions in the North are coloured pink. The remaining nine regions in the rest of England are coloured grey. The English average in shown as a blue bar.

Source: IFS 2021

the previous chapters (Appendix: Figure A1.1).

'Outcome' is the proportion of hospital beds occupied by COVID-19 patients during the pandemic (April 2020 to March 2021).

Results of the statistical analysis

To ease interpretation, we present the results of the statistical models as graphics in proportions and state the coefficients as percentage point increases.

COVID-19 hospital bed occupancy

Figure 3.3 presents the results for the proportion of hospital beds occupied by COVID-19 patients during the pandemic. The full results are contained in Table A3.2. During the pandemic, the percentage of hospital beds occupied by COVID-19 patients in the North is statistically significantly higher than in the rest of England.
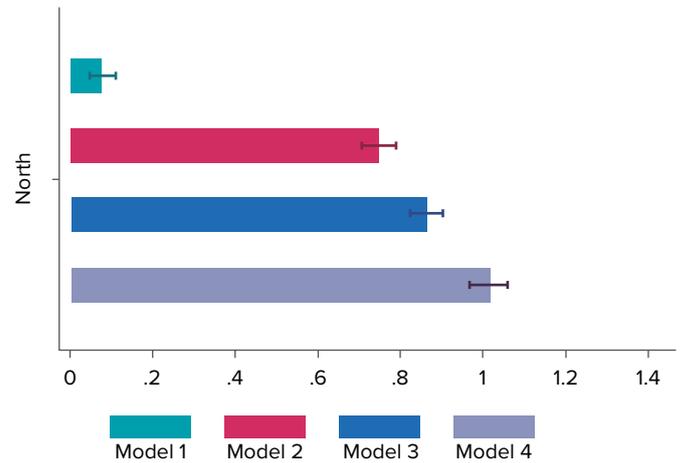
Even after accounting for age, ethnicity, deprivation the percentage of hospital beds occupied by COVID-19 patients is higher and statistically significant. In these 12 months of the pandemic the adjusted percentage of hospital beds occupied by COVID-19 patients in the North is higher:

- 1.0 percentage point more hospital beds occupied by COVID-19 patients in the North compared to the rest of England, including London (95% CI: 1.0 to 1.1)
  - This is equivalent to 10% more hospital beds occupied by COVID patients in the North than in the rest of England

Other hospital activity during the COVID-19 pandemic

The Institute for Fiscal Studies (IFS) recently published a report examining what happened to English NHS hospital activity during the COVID-19 pandemic. They showed that between March and December 2020, there were 2.9 million (34.4%) fewer elective (planned) inpatient admissions, 1.2 million (21.4%) fewer non-COVID-19 emergency inpatient admissions, and 17.1 million (21.8%) fewer outpatient appointments compared with the same period in 2019.[23]
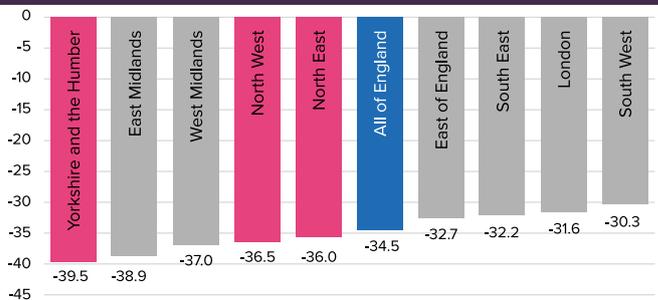
They additionally showed that these reductions were not uniformly spread across the country, with some regions seeing larger reductions than others. In general, the Northern regions experienced larger reductions than the national average (with the exception of the North East for emergency inpatient procedures).

Specifically, for elective inpatient procedures (Figure 3.4):

- Yorkshire and the Humber experienced a 5 percentage point (or 14.5%) larger reduction than the national average
- The North West experienced a 2 percentage point (or 5.8%) larger reduction than the national average
- The North East experienced a 1.5 percentage point (or 4.3%) larger reduction than the national average

For emergency inpatient procedures (Figure 3.5):

- Yorkshire and the Humber experienced a 2.7 percentage point (or 12.7%) larger reduction than the national average
- The North West experienced a 2 percentage point (or 9.4%) larger reduction than the national average
- The North East experienced a 0.5 percentage point (or 2.4%) smaller reduction than the national average

For outpatient procedures (Figure 3.6):

- Yorkshire and the Humber experienced a 2.1 percentage point (or 9.6%) larger reduction than the national average
- The North West experienced a 1.2 percentage point (or 5.5%) larger reduction than the national average
- The North East experienced a 0.6 percentage point (or 2.8%) larger reduction than the national average

Conclusion

This chapter has presented evidence that the North was hit the hardest in terms of hospital bed occupancy due to COVID-19. It also experienced larger reduction in elective inpatient, emergency inpatient, and outpatient procedures. This will lead to large unmet medical care needs in the North, which will require urgently addressing to prevent even larger backlogs.

On average, local authorities in the North experienced:

- A higher proportion of hospital beds occupied by COVID-19 patients during the pandemic. These differences are statistically significant
- A larger reduction in non-COVID-19 hospital activity in the period March 2020 to December 2020 relative to the same period in 2019.

Chapter 4:
Testing rates in the North

Summary

This chapter examines regional inequalities in positive COVID-19 test results. In particular, it focuses on differences between the North and the rest of England in terms of the proportion of positive COVID-19 test results per capita. We show that the North experienced significantly higher positive COVID-19 test results than the rest of England across the pandemic. These regional differences persist even after we account for underlying deprivation, age structure, and ethnic composition of the populations. These facts paint a worrying picture for the North.[24]

Key findings:

- On average, the percentage of positive COVID-19 test results during the pandemic (May 2020 to March 2021) were higher in the North than in the rest of the country.
- During the pandemic, the percentage of positive COVID-19 test results in the North were 0.3 percentage points – or 50% in relative terms – higher compared to the rest of England
- The higher percentage of positive COVID-19 test results in the North remains statistically significant after deprivation, ethnicity, and the age-structure of the population is taken into account using linear models

Regional differences in positive COVID-19 test results

We obtained the percentages of positive COVID-19 test (nose and throat swabs) results in regions from the Office for National Statistics (ONS) for the periods of May 2020 to March 2021. Data on testing was only made available from May 2020, hence we cannot include March or April.[25]

Positive COVID-19 test results

Regionally during the pandemic, the North West (1.00%) and North East (0.84%) had the highest and second highest percentage of positive COVID-19 test results per capita, within a month (Figure 4.1 and Table A4.1). London had the second highest percentage of positive COVID-19 test results per capita (0.88%). The South West (0.41%) and East of England (0.57%) have the lowest and second lowest percentage of positive COVID-19 test results, respectively.

Statistical analysis of the geographical difference in outcomes

To examine if there are differential effects of the outcome considered in the North compared to the rest of England, we use the models 1 to 4 from the previous chapters (Appendix Figure A1.1).
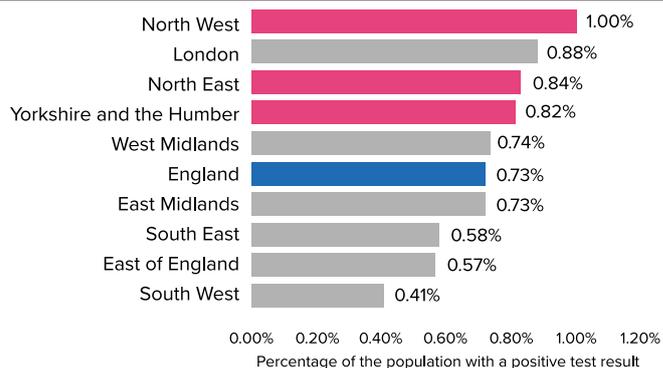
With 'Outcome' being the percentage of positive COVID-19 test results during the pandemic (May 2020 to March 2021).

Results of the statistical analysis

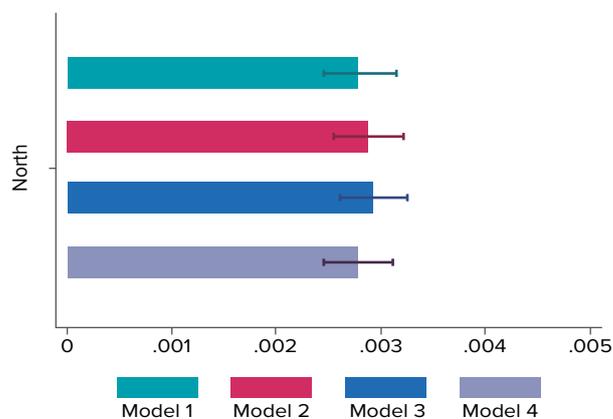**Percentage of positive COVID-19 test results**
Figure 4.2 presents the results for the percentage of positive COVID-19 test results during the pandemic. The full results are contained in Table A4.2. **During the pandemic, the percentage of positive COVID-19 test results per capita in the North is statistically significantly higher than in the rest of England.**

Figure 4.1: **Percentage of positive COVID-19 test results per capita**

Note: The three regions in the North are coloured pink. The remaining nine regions in the rest of England are coloured grey. The English average in shown as a blue bar.

Figure 4.2: **11-month percentage of positive COVID-19 test results**

Models 1-4 as defined in the Appendix

Even after accounting for age, ethnicity, deprivation the percentage of positive COVID-19 test results per capita is larger and statistically significant. In these 11 months of the pandemic, the adjusted percentage of positive COVID-19 test results in the North is higher:

- 0.3 percentage points higher positive COVID-19 test results in the North compared to the rest of England, including London (95% CI: 0.25 to 0.31)
- 0.3 percentage points higher positive COVID-19 test results in the North compared to the rest of England, excluding London (95% CI: 0.29 to 0.34)

Conclusion
This chapter has presented evidence that the North was hit the hardest by the COVID-19 pandemic in terms of positive test results per capita.

On average, local authorities in the North experienced:

- A higher proportion of positive COVID-19 test results. These differences are statistically significant

Chapter 5:
COVID-19 vaccination rates in the North

Summary

This chapter examines regional inequalities in COVID-19 vaccination rates. In particular, it focuses on differences between the North and the rest of England in terms of the COVID-19 vaccination rates. We show that there was variability in vaccination rates between the North and the rest of England during the first six months of the vaccination roll out (December 2020 to May 2021).

Key findings:

- During the first six months of roll out, COVID-19 vaccination rates were higher in the North than in the rest of the country.
  - An extra 28.9 extra people were vaccinated per 10,000 (95% CI: 1.1 to 56.4) in the North (549.2 per 100,000) compared to the rest of England (520.3 per 100,000)
  - This represents an extra 6% of the population being vaccinated in the North, in relative terms.
- During the six-month period, the vaccination rates were higher in the North than the rest of England, four out of the six months
- The higher vaccination rates in the North remains statistically significant after deprivation, ethnicity, and the age-structure of the population is taken into account using linear models

Regional differences in COVID-19 vaccination rates

We obtained the number of COVID-19 vaccinations in regions and by local authority (where available) from the NHS for the periods of December 2020 to May 2021. The number COVID-19 vaccinations is then calculated into a rate per 10,000 using population estimates of the area. Each local authority was then mapped to its region using look-up tables. Data was only available incrementally, as time went on more vaccinations were given out by age group.[26]

COVID-19 vaccination rates

Regionally across the six month vaccination period, the North West (556.9 per 10,000) and Yorkshire and The Humber (548.7 per 10,000) had the second and fifth highest vaccination rate respectively (Figure 5.1 and Table A5.1). London (385.4 per 10,000) and the North East (527.4 per 10,000) had the lowest and third lowest vaccination rate, respectively. The South West (590.7 per 10,000) had the highest vaccination rate. Figure 5.2 shows that the North had a higher vaccination rate than the rest of England between February 2021 and April 2021.

Statistical analysis of the geographical difference in outcomes

To examine if there are differential effects of the three outcomes considered in the North compared to the rest of England, we use the models 1 to 4 (Appendix Figure A1.1).

With 'Outcome' being considered being six month mean COVID-19 vaccination rates (December 2020 to May 2021)

Results of the statistical analysis

COVID-19 vaccination rates
Figure 5.3 presents the results for the COVID-19 vaccination rates across the six month period. The full results are contained in Table A5.2.

Figure 5.1: **Mean COVID-19 vaccination rates between December 2020 and May 2021**

Note: The three regions in the North are coloured pink. The remaining nine regions in the rest of England are coloured grey. The English average in shown as a blue bar.

Figure 5.2: **Time trend of vaccination rates per 10,000 between December 2020 and May 2021 between the North and the rest of England**

Figure 5.3: **Mean COVID-19 vaccination rates regression**

Models 1-4 as defined in the Appendix

In the six months of COVID-19 vaccination efforts, the rate of COVID-19 vaccination in the North is statistically significantly higher than in the rest of England.
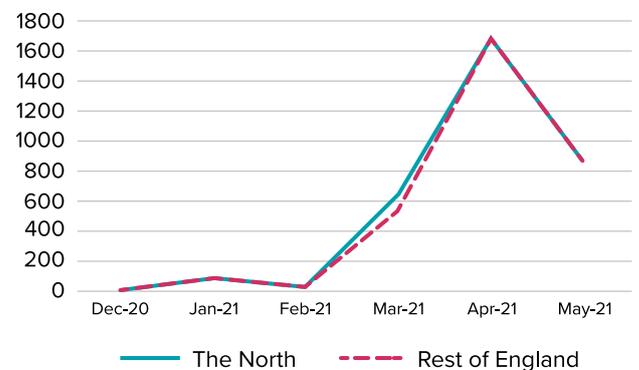
Even after accounting for age, ethnicity, and deprivation – all measures of 'need' for the vaccine – COVID-19 vaccination rates are higher in the North:

■ 14.5 more vaccinations per 10,000 people in the North compared to the rest of England, including London (95% CI: 0.8 to 28.2)

Figure A5.2 (in the appendix) presents the results for COVID-19 vaccination rates broken down by month.
The results show a fluctuation between the North having higher rates than the rest of England. In the months of February and May the North had statistically lower rates of vaccination even after accounting for age, ethnicity and deprivation.

Conclusion

Vaccination rates fluctuated in the six month period, with the North having more vaccines per-10,000 in some months and less in others. This is likely linked to underlying need and the emergence of localised 'hotspots'.

However, over the full period, the North had more vaccines per 10,000 population.

Chapter 6:
Local lockdowns in the North

Summary

This chapter examines regional differences in the levels of lockdown regulations. In particular, it focuses on differences between the North and the rest of England, in terms of lockdown tiers proposed by the government. We show that those living in the North experienced more days in the higher levels of lockdown where stricter rules applied.

Key findings:

- On average people living in the North experienced more days in higher levels of lockdowns and fewer days in the lower levels of lockdown compared to the rest of England
- People in the North spent 54.6% of the time in the two most restrictive tiers of lockdowns, compared to 46.3% in the rest of the country
- This means that, on average, people in the North had 41 more days of the harshest restrictions than people in the rest of the country.
- This disparity was particularly large in the North West.

National Lockdown

On the 23rd March 2020 the government announced a national lockdown, which would remain in place until July 2020 when the rules were eased. The national lockdown was then reintroduced again on 4th January 2021 through to 12th April.

With the introduction of the initial lockdown in March 2020, the rules set out required everyone to "stay at home", with allowances to leave their homes for: shopping for basic necessities, one form of exercise a day, any medical needs, to provide care or help to vulnerable persons and travelling to and from work if necessary. Non-essential shops, gyms and schools were closed. The national lockdown in January 2021 saw closure at the same level, however, schools remained open.

Local Lockdown

Outside the periods of a national lockdown, areas with a high number of COVID-19 cases were assessed and local lockdown restrictions were applied. The level of restrictions were relative to the rise of COVID-19 cases. In October a tiered approach was implemented by the government, where local authorities would be assigned a level:

Level 1 – medium alert (least restrictive):

- Meetings of groups up to 6 people indoor or outdoor
- Travel to be limited
- All shops to open including the hospitality sector
- Gyms and leisure facilities to open
- Sporting events to open to public with a maximum capacity of 4000 outdoors or 2000 indoors

Level 2 – high alert:

- Meetings of groups up to 6 people outdoor and only indoor if within support bubble
- Travel but avoiding travel to areas in other tiers
- All shops to open including the hospitality sector only if a substantial meal is served

- Gyms and leisure facilities to open
- Sporting events to open to public with a maximum capacity of 2000 outdoors or 1000 indoors

Level 3 – very high alert:

- Only meeting with those in support bubble
- No travel outside area
- Shops to open but the hospitality sector closed
- Gyms and leisure facilities to open

Level 4 – "stay at home":

- Stay at home as much as possible and not meet others
- No travel
- Only essential shops open

The introduction of local lockdowns introduced differing levels of localised lockdown restrictions throughout the country. To explore the differences, we retrospectively applied the tiered approach that came into force in October 2020 to assign a lockdown level to each Local Authority. We used data available from government briefings to assign a lockdown level to each day from the 23rd March 2020 to the 12th April 2021.

Regional differences in local lockdowns

Across the period of the pandemic, where a national lockdown was not in place, the North experienced greater levels in higher tiers of lockdown (Figure 6.1). In particular, during the summer months of July to September the North was in a higher level of lockdown. Regionally, on average, people in the North West (87.5 days) experienced the fewest number of days in the lowest tier of lockdown, tier 1 (Figure 6.2). For the mean number of days in tier 2, people in the North East (54.0 days) and the North West (69.5) experienced the least and second least number of days, respectively (Figure 6.3).

In contrast, people in the North West (77.3 days) and North East (67.3 days) experienced the most number of days in very high alert, tier 3 (Figure 6.4). People in the North West (151.7 days) experienced the most number of days in the highest level of lockdown, tier 4 (Figure 6.5). When comparing those in the North to the rest of England, we see that a higher percentage of days were spent in higher levels of lockdown (Figure 6.7).

People in the North spent 54.6% of the time in the two most restrictive tiers of lockdowns, compared to 46.3% in the rest of the country. This means that, on average, people in the North had 41 more days of the harshest restrictions than people in the rest of the country. This was even worse in the North West, who spent 59.3% of the time under the strictest lockdown, compared to 41.1% of the time in the South West. People in the North West therefore had 70 more days in the top two tiers.

Conclusion

People in the North, particularly the North West, spent more days in the most two restrictive tiers of lockdowns.

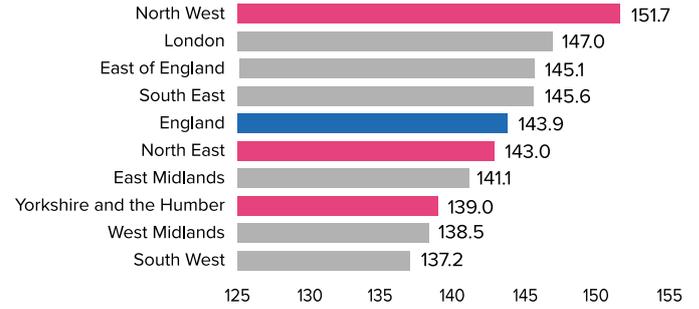## Figure 6.1: Mean lockdown level by month between the North and the rest of England
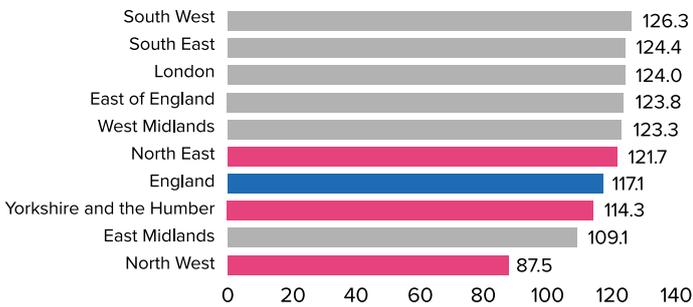

Note: Level 1 = medium alert, Level 2 = high alert, level 3 = very high alert and Level 4 = stay at home.

Figure 6.2: Mean number of days in tier 1 lockdown by region

Region	Days
South West	126.3
South East	124.4
London	124.0
East of England	123.8
West Midlands	123.3
North East	121.7
England	117.1
Yorkshire and the Humber	114.3
East Midlands	109.1
North West	87.5

Note: The three regions in the North are coloured pink. The remaining nine regions in the rest of England are coloured grey. The English average in shown as a blue bar.

Figure 6.3: Mean number of days in tier 2 lockdown by region

Region	Days
South West	99.6
South East	93.2
East of England	92.9
England	82.4
Yorkshire and the Humber	78.4
West Midlands	77.3
London	76.0
East Midlands	71.8
North West	69.5
North East	54.0

Note: The three regions in the North are coloured pink. The remaining nine regions in the rest of England are coloured grey. The English average in shown as a blue bar.

Figure 6.4: Mean number of days in tier 3 lockdown by region

Region	Days
North West	77.3
North East	67.3
East Midlands	64.1
Yorkshire and the Humber	54.3
West Midlands	46.9
England	42.5
London	39.0
East of England	23.6
South East	22.7
South West	22.3

Note: The three regions in the North are coloured pink. The remaining nine regions in the rest of England are coloured grey. The English average in shown as a blue bar.

Figure 6.5: Mean number of days in tier 4 lockdown by region

Region	Days
North West	151.7
London	147.0
East of England	145.1
South East	145.6
England	143.9
North East	143.0
East Midlands	141.1
Yorkshire and the Humber	139.0
West Midlands	138.5
South West	137.2

Note: The three regions in the North are coloured pink. The remaining nine regions in the rest of England are coloured grey. The English average in shown as a blue bar.

Figure 6.6: Percentage of time spent in each tier of lockdown, by region (Tier 1 is the lowest level of restrictions and Tier 4 is the highest level of restrictions)
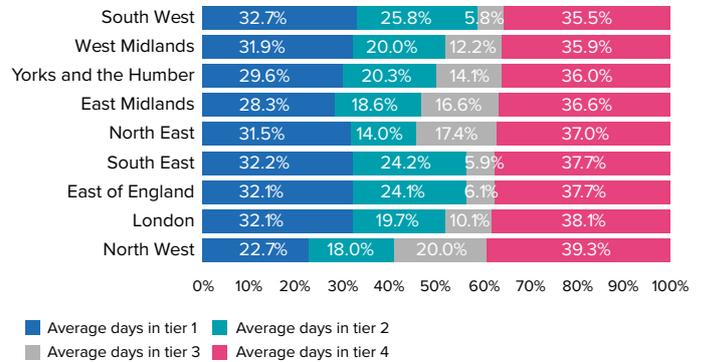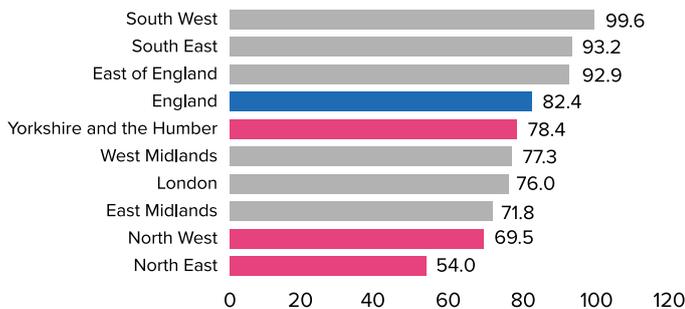

Region	Tier 1	Tier 2	Tier 3	Tier 4
South West	32.7%	25.8%	5.8%	35.5%
West Midlands	31.9%	20.0%	12.2%	35.9%
Yorks and the Humber	29.6%	20.3%	14.1%	36.0%
East Midlands	28.3%	18.6%	16.6%	36.6%
North East	31.5%	14.0%	17.4%	37.0%
South East	32.2%	24.2%	5.9%	37.7%
East of England	32.1%	24.1%	6.1%	37.7%
London	32.1%	19.7%	10.1%	38.1%
North West	22.7%	18.0%	20.0%	39.3%

- Average days in tier 1
- Average days in tier 2
- Average days in tier 3
- Average days in tier 4

Figure 6.7: Percentage of time spent in each tier of lockdown, (Tier 1 is the lowest level of restrictions and Tier 4 is the highest level of restrictions) between the North and the Rest of England
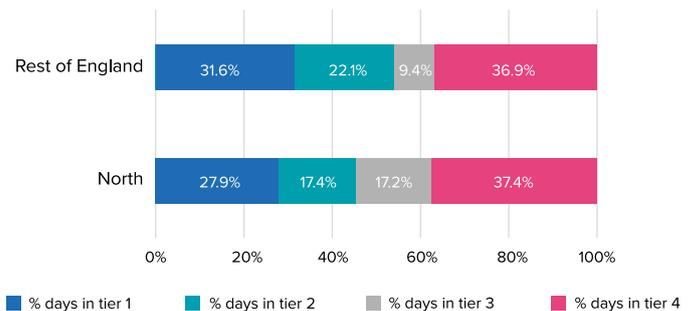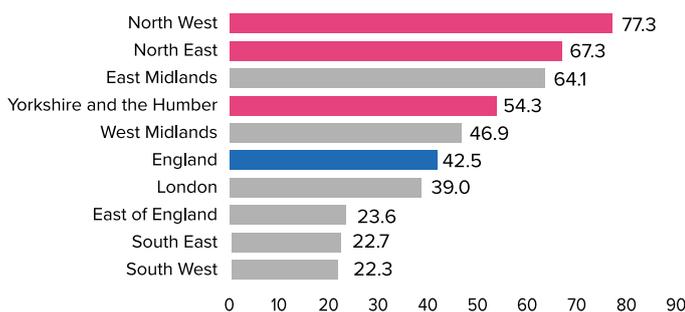

Region	Tier 1	Tier 2	Tier 3	Tier 4
Rest of England	31.6%	22.1%	9.4%	36.9%
North	27.9%	17.4%	17.2%	37.4%

- % days in tier 1
- % days in tier 2
- % days in tier 3
- % days in tier 4

Chapter 7:
Mental well-being in the North

Summary

This chapter examines regional inequalities in mental wellbeing. We show that people living in the North experienced a large drop in mental wellbeing. In general, the results were most pronounced when London was excluded from the rest of England.

In summary we found that individuals living in the North:

- Experienced a large drop in mental wellbeing (particularly the North East and Yorkshire and the Humber)
- Self-reported mental health fell by, on average, 4.4% in the North (compared to a reduction of 3.9%)
- There was a 55% increase in the presence of minor psychiatric disorders in the North (an increase from 19.2% in 2018/19 to 29.7% in 2020) compared to a 50% increase in the rest of England (an increase from 16.2% in 2018/19 to 24.2% in 2020).
- Experienced more loneliness, particularly in the North East
- A greater number of antidepressant prescribed over the past three years and this remained the case during the COVID-19 pandemic

Introduction

As well as considering mortality rates, it is important to consider other factors known to be affected by COVID-19. In this chapter, we consider outcomes of mental wellbeing linked to COVID-19. We use prescribing data from NHS Business Services Authority and mental well-being data from the UK Household Longitudinal Study (UKHLS: Understanding Society). UKHLS is a nationally representative sample of around 80,000 – 100,000 people from around 50,000 households in the UK.

Individuals are followed every year (from 2009 onwards) and a rich set of data is collected relating to almost every aspect of their lives. During the COVID-19 pandemic, a subset of around 42,000 eligible UKHLS respondents were invited to partake in monthly (from April onwards) short web-based survey to get real-time information about their experiences of COVID-19 . In April, a total of 16,379 people responded and the monthly sample sizes since have fluctuated around the 15,000 mark. The major advantage of these data are that they can be linked back to pre-COVID-19 data and hence we can isolate changes within individuals.[27]

Self-reported Mental Wellbeing

We measure mental wellbeing using the General Health Questionnaire (GHQ) ; a screening device for identifying minor psychiatric disorders such as anxiety and depression in the general population and within community or non-psychiatric clinical settings such as primary care or general medical out-patients. It assesses the respondent's current state and asks if that differs from his or her usual state. It is therefore sensitive to short-term psychiatric disorders but not too long-standing attributes of the respondent.[28]

The GHQ is used to create a variable on a 0 – 36 Likert scale, where lower scores refer to better mental wellbeing. To ease interpretation, we reverse code the GHQ here so higher scores relate to better mental wellbeing. As well as the Likert scale, responses to the GHQ score can be used to create a Caseness scale, which in turn can be used to create

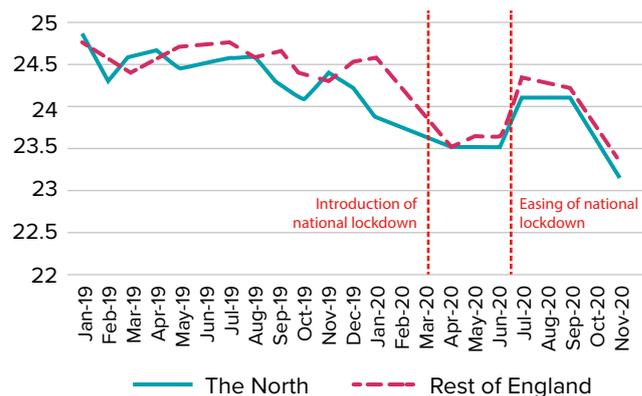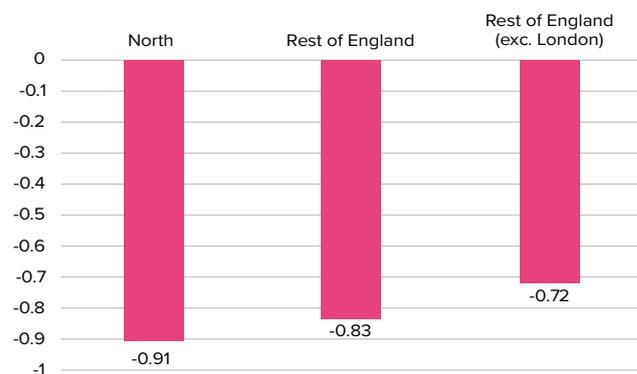Figure 7.1a: **Trends in self-reported metal health (General health Questionnaire) in 2019 and 2020**

Figure 7.1b: **Changes in self-reported metal health (General Health Questionnaire) from 2019 to 2021**

a binary indicator for the presence of presence of minor psychiatric disorders. A response of 4 or more on the Caseness scale is used as the threshold, such that individuals with a score of 4 or more are classified as having a minor psychiatric disorder.

Trends in the GHQ Likert scale are reported in Figure 7.1a. We report the trend for the North and the rest of England. In 2019, pre-pandemic, people living in the North reported lower levels of mental health, on average. This maintained into the pandemic, with the North having the lowest levels of health in every period during the pandemic.

We then look at the average within-person change in the responses to this variable for the North and the rest of England (Figure 7.1b). The change is defined as the difference in scores from the 2019 wave of UKHLS to pooled data from 2020. For both years, we take a weighted average of the mental health score in each of the areas considered. The reduction in self-reported mental health was largest in the North. The reduction in the rest of the country was smaller when London was excluded, as London also saw large reductions in mental health in 2020.

The percentage change in self-reported mental health was:

- A reduction of 4.4% in the North
- A reduction of 3.9% in the rest of England

Figure 7.2 reports the increases in the presence of minor psychiatric disorders between 2019 and 2020. These incidences are based on GHQ Caseness scores or four or more. In the North, the incidence increased from 19.2% to 29.7%, whereas in the rest of England the incidence increased from 16.2% to 24.2%.

The percentage increase in the presence of minor psychiatric disorders was:

- An increase of 55% in the North
- An increase of 50% in the rest of England

Loneliness

Additionally in the COVID-19 module of UKHLS, respondents were asked "In the last 4 weeks, how often did you feel lonely?" and they could respond "Hardly ever or never", "Some of the time", "Often". We used this variable to construct a measure of loneliness which took the value 0 if a person responded "Hardly ever or never" and 1 otherwise. Figure 7.3 shows trends in this variable over time. Throughout the pandemic, the North has experienced more loneliness, particularly in the summer months when it was subject to more stringent lockdown measures than other parts of the country.

Antidepressant prescribing

We use antidepressant prescribing data as an indicator for depressive disorders. We use data coded in the BNF directory as an antidepressant: Tricyclic and related antidepressant drugs, monoamine-oxidase inhibitors, selective serotonin re-uptake inhibitors and other antidepressant drugs. Total quantity of prescriptions and population sizes in CCGs were used to calculate the rate of prescription per person. Each CCG was then mapped to its region using look-up tables. In line with previous years, throughout the pandemic the North has had greater volumes of antidepressants prescribed per person (Figure 7.5 & Figure 7.6). Across the 12 month period of the COVID-19 pandemic the North East (5.82 per person) and North West (5.19 per person) had the highest number of antidepressants prescribed (Figure 7.4). With London (2.21 per person) and West Midlands (4.09 per person) having the lowest number of antidepressants prescribed.[29]

Conclusion

In addition to the area-level effects we document in Chapter 1 (higher mortality rates), we show here that a similar picture is obtained when using individual-level data. People living in the North were more likely to report a large reduction in mental wellbeing.

In summary, at an individual level, our results indicate that COVID-19 is having a disproportionate effect on people living within the North region. This is additionally picked up in the anti-depressant prescription data.

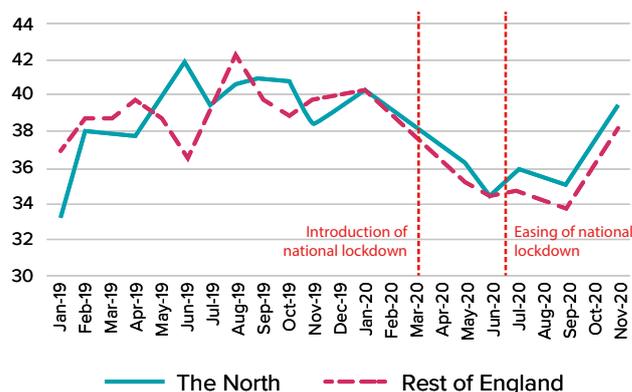Figure 7.3: **Trends in self-reported loneliness in 2019 and 2020**

Figure 7.4: **Mean antidepressant prescribed per person during the 12 month period of the COIVD-19 pandemic (March 2020 to February 2021) by region**

Figure 7.5: **Time trend of antidepressants prescribed per person in the North the rest of England between 2018 and 2021**
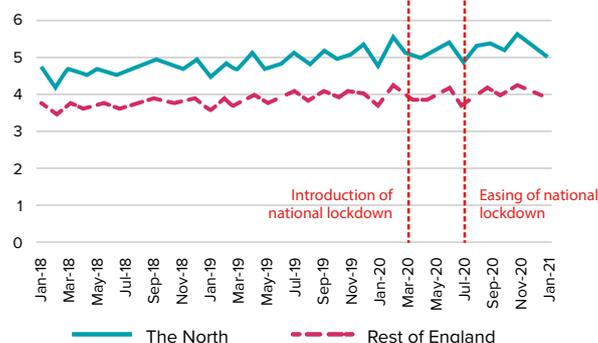

Figure 7.2: **The presence of minor psychiatric disorders in 2019 and 2020, based on a GHQ Caseness score of 4 or more**

Figure 7.6: **Time trend of antidepressants prescribed per person in the North the rest of England between 2020 and 2021**

Chapter 8:
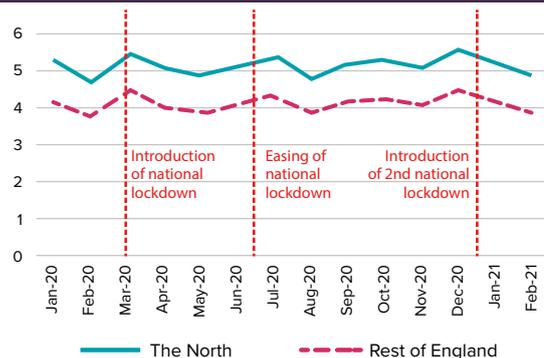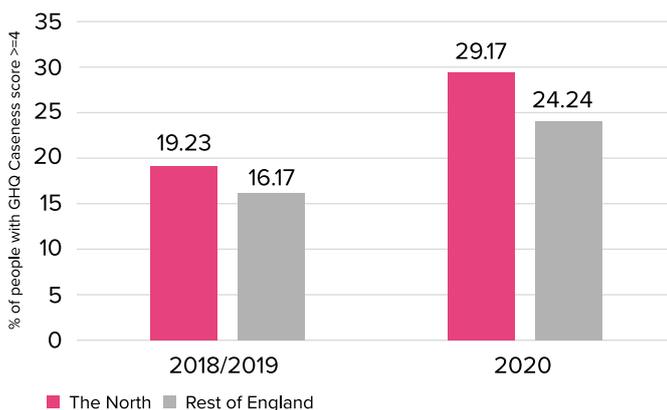# Economic impact on the North

Summary

This chapter examines regional inequalities in economic outcomes. In particular, it focuses on differences between the North and the rest of England in terms of unemployment, furlough, and wages. We show that the North experienced higher rates of unemployment but lower rates of furloughed employments during the COVID-19 pandemic compare to the rest of England.

Key findings:

- Throughout the pandemic, the average unemployment rate in the North was 6.3% compared to 5.3% in the rest of the country. The unemployment rate in the North was therefore one percentage point (95% CI: 0.49 to 1.40), or 19% in relative terms, higher than the rest of England
- Furlough rates in the North are similar to the rest of England but lowest in the North East
- Wages in the North were lower than the rest of England before the pandemic and these further fell during the COVID-19 pandemic (from £543.90 to £541.30 per week) whereas wages slightly increased in the rest of the country.

Unemployment Rates

COVID-19 has affected lots of areas of people's lives, including their employment opportunities. To investigate how COVID-19 has impacted on these areas, we use data on the local authority Claimant Count, published by the ONS, as a proxy for unemployment rates.[30]

The mean claimant count rates across the 14 months of the pandemic (March 2020 to April 2021) are shown in Figure 8.1 (and expressed in Table A8.1). The North East (7.4%) and the North West (6.3%) experienced the highest and third highest claimant count, respectively (Figure 8.1 and Table A8.1). Yorkshire and The Humber (5.6%) experienced the fifth highest claimant count. The South West (4.7%) and East Midlands (4.8%) had the lowest and second lowest claimant count, respectively.

Figure 8.1: **Mean unemployment rate (%) across 14 month period of COVID-19 pandemic (March 2020 to April 2021) by region**

Note: The three regions in the North are coloured pink. The remaining nine regions in the rest of England are coloured grey. The English average in shown as a blue bar.

Figure 8.2 plots trends over time in the unemployment rate, and the North consistently has a higher unemployment rate than the rest of the country.

Statistical analysis of the geographical difference in unemployment outcomes

To examine if there are differential effects of the unemployment outcomes considered in the North compared to the rest of England, we use the models 1 to 4 from the previous chapters (Appendix Figure A1.1). The 'Outcome' in these models is the mean claimant count during the pandemic (March 2020 to April 2021).

Results of the statistical analysis

Figure 8.3 presents the results for the unemployment rates during the pandemic. The full results are contained in Table A8.4. During the pandemic, the unemployment rates in the North is statistically significantly higher than in the rest of England.

In the unadjusted model (Model 1):

- The unemployment rate in the North (6.3%) was an additional one percentage point higher (95% CI: 0.49 to 1.40) compared to the rest of England (5.3%). In relative terms, the unemployment rate in the North was 19% higher than in the rest of England, on average, during the pandemic.

Even after accounting for age, ethnicity, deprivation unemployment rates are higher in the North (Model 4):

- An additional increase of 0.35 percentage points in the North compared to the rest of England, including London (95% CI: 0.11 to 0.60)

Furlough rates

In late March 2020, the government announced that they would introduce a furlough scheme to help mitigate against the threat of mass

Figure 8.2: **The North vs rest of England time trend of unemployment rate (%) between March 2020 and March 2021**

unemployment. This scheme enabled employers to temporarily stop paying their workforce and the government would pay 80% of their usual wage. We used furlough uptake data from the Job Retention Scheme Statistics to investigate the regional inequalities in furlough rates.[31]

Figure 8.6 shows the variability in the furlough rates between the North and rest of England between the months of May 2020 and April 2021.

Across the 11 month period the North East (14.1%), Yorkshire and the Humber (14.8%) and the North West (15.2%) had the lowest, third and fifth lowest furlough rates (Figure 8.4 and Table A8.5)

A time trend of the uptake of furlough is shown in Figure 8.5, where on average there is very little difference between the North and the rest of England.

Wages
We obtained information on weekly gross pay from NOMIS in 2019 and 2020. Figure 8.6 plots this for the North, the Rest of England and the rest of England, excluding London. It is clear that wages in the North, on average, are much lower than the rest of the country, even when London is excluded.[32]

Also, during the pandemic wages in the North fell slightly (from £543.9 to £541.3) whereas it very slightly increased in the rest of the country (from £600.80 to £604.00).

Conclusion
In addition to the worse health outcomes in the North, economic outcomes were worse there too.

Unemployment rates were higher, and remained higher throughout the pandemic and median wages actually fell.

Figure 8.3: Mean claimant count during the pandemic (March 2020 to March 2021)
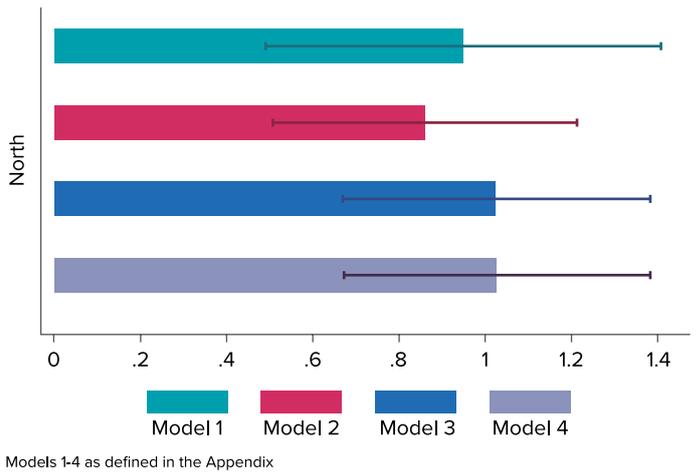
Model 1   Model 2   Model 3   Model 4

Models 1-4 as defined in the Appendix

Figure 8.4: Mean furlough uptake rates across 11 month period (May 2020 to March 2021) by region

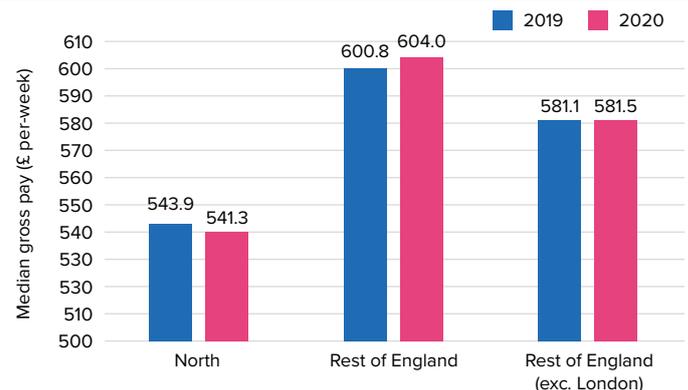| Region	Rate
South West	17.51%
London	15.49%
West Midlands	15.49%
South East	15.40%
England	15.30%
North West	15.24%
East of England	15.13%
Yorks and the Humber	14.78%
East Midlands	14.47%
North East	14.15%

Note: The three regions in the North are coloured pink. The remaining nine regions in the rest of England are coloured grey. The English average in shown as a blue bar.

Figure 8.5: The North vs rest of England time trend of furlough uptake rate between May 2020 and March 2021

The North   Rest of England

Figure 8.6: Median pay in 2019 and 2020, by area

2019   2020

Conclusion and Recommendations

The COVID-19 pandemic has hit the North of England hard in its first year. People in the region are more likely to die from the virus than those elsewhere and suffer from health and economic factors related to the pandemic.

Health inequalities account for a large number of the reasons why the North has suffered most and the impact of the pandemic means that a large number of the societal factors which has seen it hit so hard are getting worse. Post-pandemic the North is less resilient than it was pre-pandemic and it was already in a poor state.

The country is in a pivotal position where it can use the learnings of the past year to build a stronger, healthier society across the whole of the country. The country united in lockdowns to prevent the vulnerable, it united together for the NHS and together against seeing its children go hungry. Its health research system has worked together to create and adopt lifesaving vaccines and diagnostics.

But the country is also in danger of ignoring the factors which have led to the devastating impact of COVID-19 in the North of England and allow it to sink further behind the rest of the country.

These recommendations offer the opportunity here to build a stronger country through impactful change tackling its health inequalities.

Policy Recommendations

Short-term
Continue place-focused vaccination programmes targeted at vulnerable populations in the North of England.

Increase NHS and local authority resources and service provision for mental health in the North Invest in research into mental health interventions in the North.

Invest in increasing capacity in Northern hospitals to help them catch-up on non-COVID-19 healthcare.

Make health a key part of an integrated Levelling Up strategy,

Medium-term
Recommit to ending child poverty. Increase child benefit, increase the child element of universal credit by £20 per week, extend provision of free childcare, remove the benefit cap and the two-child limit and extend provision of free school meals. Invest in children's services by increasing government grants to local authorities in the North.

Maintain and increase the additional £1,000 extra funding of universal credit.

Provide additional resource to local authorities and the NHS in the North by increasing the existing NHS health inequalities weighting within the NHS funding formula in its reset and restore plans.

Deliver a £1bn fund ring-fenced to tackle health inequalities at a regional level and increase local authority public health funding to address the higher levels of deprivation and public health need in the North.

Long-term
Create northern 'Health for Life' centres offering a life-long programme of health and wellbeing advice and support services from pre-natal to healthy ageing programmes. Targeted to the most deprived areas in the North they will take a preventative approach to health directly into the communities which need it the most.

Deliver health and mental health promotion interventions together with industry and employer, targeted at employee mental and physical health.

Level up investment in health R&D in the North of England to create high value jobs and support local health and drive the economy. Invest in North's testing and diagnostics infrastructure.

Build resilience in the North's population through developing a national strategy for action on the social determinants of health with the aim of reducing inequalities in health, with a key focus on children.

Develop a place-based pandemic preparedness plan which safeguards vulnerable groups such as those in care homes, with disabilities and those with chronic ill health.

Appendix

Table A1.1. COVID-19 mortality rates

	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Mar-20 to Mar-21
North East	17.5	676.8	381.6	105.5	13.7	4.5	25.4	162.7	314.3	284.1	398.7	313	83.9	212.8
North West	31.6	745.4	310.7	111.1	31.2	18.6	28.8	184.5	371.7	259.4	459	403.3	101	233.7
Yorks and the Humber	11	550.6	313.5	107.6	29.7	9.7	18.2	101.1	384.5	321.4	334.8	268.7	92.5	194.9
East Midlands	16.6	491.7	257.9	108.7	30.6	7.9	12.3	54.7	247.5	315.7	462	404	118.9	193.4
West Midlands	42.9	712.1	261.4	77.6	19.7	6.4	15.2	54.7	212.9	286	543.1	464.2	103.8	214
East	17.5	520.9	223.7	72.2	25	5	4.8	23.4	91.9	179.1	700.2	477.1	91.3	185.6
London	126.5	1206.3	214.9	42.6	15.3	5.4	11.1	36.7	109.8	241.1	900.6	465.5	93.5	264.8
South East	24.7	488.9	216.2	64.3	22.1	7.1	7.3	17.4	73.8	190	648.7	406.1	80.3	171.8
South West	11.8	308.9	130.1	30.2	4.4	2.7	4.2	15.2	80.5	123	295.6	258.5	45.7	100

Table A1.2. Table A1.2. All-cause mortality rates

	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Mar-20 to Mar-21
North East	1102.1	1984.5	1347	1016.4	972.8	853.2	1019.2	1111.7	1301.3	1346.6	1411.6	1341.2	1094.4	1221.1
North West	1126.8	2131.4	1194.2	1014.3	911.7	821.3	962.4	1151.7	1345.6	1249.6	1422	1411	1089.3	1214.7
Yorks and the Humber	1040.7	1834.5	1231.3	981.6	853.7	776.9	965.4	1050.9	1333.2	1282.3	1311.3	1225.2	1041.4	1146.2
East Midlands	1014.9	1709.8	1106.4	973.6	876.5	768.7	901.1	950.5	1148.1	1270.6	1375.1	1384.1	1053.1	1115.4
West Midlands	1052	2091.1	1112.4	959.6	870.8	786.3	940.8	980.7	1138.9	1239.7	1526.1	1436.9	1046.6	1164.4
East	928.2	1748	1016.5	792.7	791.3	702.2	814.3	850.1	901.5	1003.8	1584.2	1355	898.9	1027.2
London	997.1	2453.2	920.4	745.7	705.8	667.3	753	762.7	859.6	1005.1	1767.8	1266.2	824.8	1052.9
South East	953.5	1597.2	970.3	805.1	757	713.6	848.4	800	859.1	997.4	1512.4	1242.4	881.2	993.2
South West	919.6	1398.6	919	831.7	782.5	707.1	841.5	848.3	917.7	979.4	1164	1125.5	907.6	947.6

Figure A1.2: Statistical models estimated

Model 1
$$\text{Outcome}_i = \beta(\text{The North}_i) + \varepsilon_i$$
Model 2
$$\text{Outcome}_i = \beta(\text{The North}_i) + \gamma(\text{Age structure}_i) + \varepsilon_i$$
Model 3
$$\text{Outcome}_i = \beta(\text{The North}_i) + \gamma(\text{Age structure}_i) + \lambda(\text{Ethnic structure}_i) + \varepsilon_i$$
Model 4
$$\text{Outcome}_i = \beta(\text{The North}_i) + \gamma(\text{Age structure}_i) + \lambda(\text{Ethnic structure}_i) + \delta(\text{IMD quintile}_i) + \mu(\text{Patient shielding rate}) + \varepsilon_i$$

Where:
- Subscript l refers to each unique local authority district
- 'Outcome' is one of the two outcomes we consider:
  3. COVID-19 age standardised mortality rates (March 2020 to March 2021), per 100,000
  4. All-cause age standardised mortality rates (March 2020 to March 2021), per 100,000
- 'The North' is a binary variable that takes the value 1 if a local authority is in the North region and 0 otherwise (i.e. if a local authority is in the rest of England)
- 'Age structure' is a series of variables indicating what percentage of the local authority's population is in pre-defined age-groups. This data was taken from the 2011 Census to avoid issues associated with extrapolating to non-Census years. The base (omitted) category is the percentage of people less than 18 years of age.
- 'Ethnic structure' is a series of variables indicating what percentage of the local authority's population belong to pre-defined ethic-

groups. This data was taken from the 2011 Census to avoid issues associated with extrapolating to non-Census years. The base (omitted) category is the percentage of people who are white.
- 'IMD quintile' is a categorical variable indicating the relative deprivation of the local authority.
- 'Patient shielding rate' is variables indicating the rate of patient shielding per 10,000 in the local authority. This can be thought of as a measure of the underlying health status of the population.[33]

The key parameter in each model is β; it tells us if the mortality rates are statistically different in the North when compared to the rest of England. The later models tell us if this difference persists even after we account for known factors that are associated with mortality rates. We perform all four models with the comparison group between the North and the rest of England.

Figure A1.1: Directed Acyclic Graph (DAG) outing potential channels though which key relationships might operate
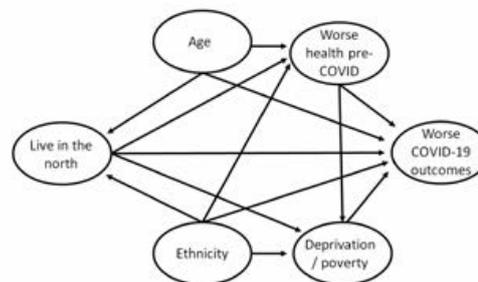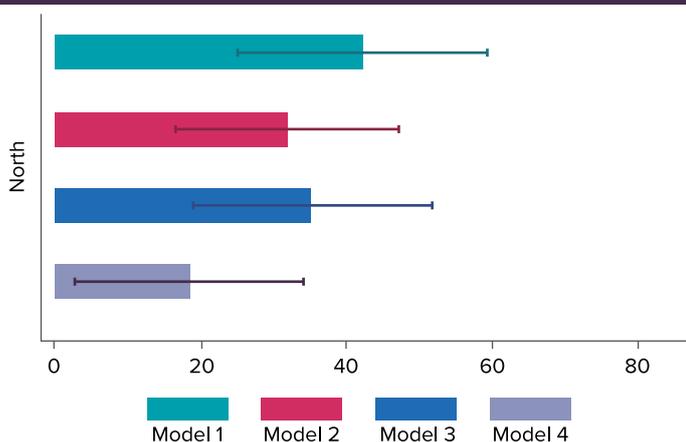
Table A1.3: Additional COVID-19 mortality (March 2020 to March 2021) in the North, per 100,000
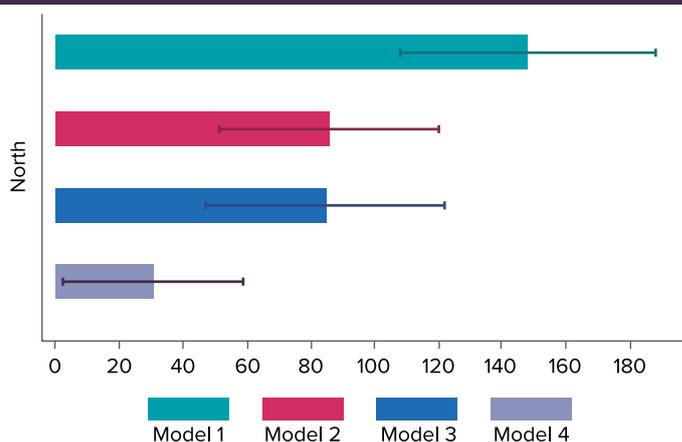
Column1	(1) RoE inc. London	(2) RoE exc. London	(3) RoE inc. London	(4) RoE exc. London	(5) RoE inc. London	(6) RoE exc. London	(7) RoE inc. London	(8) RoE exc. London
The North	29.35**	41.91***	29.07***	31.88***	31.26***	35.11***	15.16*	18.51*
	(10.74 to 47.96)	(24.63 to 59.20)	(14.28 to 43.86)	(16.37 to 47.39)	(16.24 to 46.28)	(18.67 to 51.55)	(0.30 to 30.02)	(2.97 to 34.06)
Age 18 to 19			-25.05	-17.35	-20.55	-12.63	-9.47	4.53
			(-52.20 to 2.10)	(-47.94 to 13.23)	(-47.57 to 6.46)	(-43.39 to 18.13)	(-35.44 to 16.50)	(-24.41 to 33.46)
Age 20 to 24			-14.72*	-14.15	-10.34	-12.84	-4.67	-4.45
			(-27.83 to -1.60)	(-28.60 to 0.29)	(-23.79 to 3.10)	(-28.62 to 2.94)	(-17.66 to 8.31)	(-19.22 to 10.32)
Age 25 to 29			-10.04	-11.80	-11.39*	-9.65	-18.57**	-26.11**
			(-21.32 to 1.24)	(-28.37 to 4.77)	(-22.76 to -0.01)	(-26.64 to 7.33)	(-29.66 to -7.48)	(-42.66 to -9.56)
Age 30 to 44			-17.34***	-13.87**	-13.79**	-11.31*	1.30	10.49
			(-24.56 to -10.13)	(-23.77 to -3.98)	(-22.47 to -5.12)	(-22.10 to -0.52)	(-8.28 to 10.89)	(-1.10 to 22.07)
Age 45 to 59			-29.43***	-29.21***	-23.98***	-22.87***	-13.62*	-10.15
			(-38.85 to -20.02)	(-39.96 to -18.46)	(-34.26 to -13.71)	(-35.22 to -10.51)	(-24.05 to -3.20)	(-22.10 to 1.80)
Age 60 to 64			-23.41	-18.28	-10.82	-10.73	-10.35	-8.79
			(-47.49 to 0.67)	(-44.57 to 8.01)	(-35.72 to 14.07)	(-37.53 to 16.06)	(-34.13 to 13.43)	(-33.75 to 16.17)
Age 65 to 74			-15.86	-14.26	-16.93	-11.93	-14.08	-8.77
			(-32.78 to 1.06)	(-32.85 to 4.32)	(-34.10 to 0.25)	(-30.69 to 6.82)	(-30.23 to 2.08)	(-25.86 to 8.31)
Age 75 to 84			11.55	13.61	15.02	12.81	16.85	16.31
			(-11.96 to 35.06)	(-11.78 to 39.01)	(-8.63 to 38.66)	(-13.05 to 38.67)	(-5.88 to 39.58)	(-7.81 to 40.43)
Age 85 to 89			-41.45	-49.87	-35.06	-45.73	-32.37	-39.82
			(-114.89 to 32.00)	(-128.34 to 28.60)	(-108.62 to 38.51)	(-124.90 to 33.44)	(-101.49 to 36.75)	(-111.90 to 32.26)
Age 90 and over			-109.49**	-100.77*	-113.14**	-94.40*	-63.64	-36.44
			(-191.32 to -27.66)	(-189.74 to -11.81)	(-195.41 to -30.86)	(-184.21 to -4.59)	(-142.24 to 14.96)	(-119.40 to 46.52)
Mixed/multiple ethnicity					1.00	0.52	-0.46	-2.67
					(-11.16 to 13.16)	(-16.02 to 17.07)	(-11.89 to 10.97)	(-17.86 to 12.53)
Asian or British Asian ethnicity					1.30*	0.39	2.06***	0.90
					(0.09 to 2.51)	(-1.56 to 2.34)	(0.87 to 3.24)	(-0.93 to 2.73)
Black ethnicity					2.44	5.51	1.68	7.43*
					(-0.28 to 5.15)	(-2.01 to 13.03)	(-0.86 to 4.22)	(0.31 to 14.55)
Other ethnicity					-1.19	6.90	-4.65	5.17
					(-9.52 to 7.15)	(-20.27 to 34.08)	(-12.61 to 3.30)	(-19.63 to 29.96)
IMD quintile 1 (least deprived; base category)							0.00	0.00
							(0.00 to 0.00)	(0.00 to 0.00)
IMD quintile 2							23.00**	26.28**
							(5.75 to 40.25)	(8.02 to 44.53)
IMD quintile 3							31.25**	34.07***
							(12.59 to 49.90)	(14.06 to 54.08)
IMD quintile 4							36.09**	47.39***
							(14.64 to 57.54)	(24.07 to 70.71)
IMD quintile 5 (most deprived)							70.87***	91.78***
							(45.64 to 96.10)	(63.77 to 119.79)
Rate of people shielding							0.09*	0.09
							(0.02 to 0.16)	(-0.00 to 0.17)
Constant	174.75***	162.18***	1708.84***	1566.80***	1386.58***	1263.51***	712.61**	392.70
	(165.75 to 183.74)	(153.37 to 171.00)	(1388.48 to 2029.20)	(1092.21 to 2041.40)	(968.90 to 1804.26)	(693.08 to 1833.95)	(256.68 to 1168.54)	(-188.83 to 974.23)
Observations	308	277	303	272	303	272	303	272

Figure A1.3: **Additional COVID-19 mortality (March 2020 to March 2021) in the North, per 100,000, excluding London**

Models 1-4 as defined in the Appendix

Figure A1.4: **Additional all-cause mortality (March 2020 to March 2021) in the North, per 100,000, excluding London**

Models 1-4 as defined in the Appendix

Table A1.4: Additional all-cause mortality (March 2020 to March 2021) in the North, per 100,000

Column1	(1) RoE inc. London	(2) RoE exc. London	(3) RoE inc. London	(4) RoE exc. London	(5) RoE inc. London	(6) RoE exc. London	(7) RoE inc. London	(8) RoE exc. London
The North	145.82***	148.02***	93.42***	85.59***	95.08***	85.04***	30.68*	30.40*
	(106.78 to 184.87)	(108.33 to 187.70)	(58.65 to 128.18)	(50.90 to 120.29)	(59.81 to 130.35)	(47.76 to 122.32)	(1.88 to 59.48)	(1.71 to 59.10)
Age 18 to 19			-47.41	-39.62	-47.56	-38.96	-6.26	17.21
			(-111.21 to 16.40)	(-108.03 to 28.79)	(-110.99 to 15.87)	(-108.69 to 30.77)	(-56.60 to 44.09)	(-36.19 to 70.61)
Age 20 to 24			-20.48	-27.28	-25.79	-26.10	4.96	11.02
			(-51.30 to 10.35)	(-59.58 to 5.02)	(-57.36 to 5.78)	(-61.87 to 9.67)	(-20.21 to 30.13)	(-16.25 to 38.29)
Age 25 to 29			-0.54	46.74*	5.34	47.39*	-27.36*	-15.95
			(-27.05 to 25.97)	(9.68 to 83.80)	(-21.37 to 32.05)	(8.87 to 85.90)	(-48.86 to -5.86)	(-46.49 to 14.60)
Age 30 to 44			-66.95***	-55.88***	-66.06***	-54.53***	2.93	28.68**
			(-83.89 to -50.00)	(-78.02 to -33.75)	(-86.43 to -45.70)	(-78.99 to -30.07)	(-15.65 to 21.50)	(7.30 to 50.07)
Age 45 to 59			-50.78***	-41.43***	-57.96***	-39.06**	-6.96	13.59
			(-72.91 to -28.64)	(-65.48 to -17.38)	(-82.08 to -33.84)	(-67.07 to -11.05)	(-27.16 to 13.25)	(-8.46 to 35.64)
Age 60 to 64			-43.17	-47.08	-58.66*	-44.91	-55.73*	-37.20
			(-99.76 to 13.41)	(-105.87 to 11.72)	(-117.11 to -0.21)	(-105.65 to 15.83)	(-101.82 to -9.64)	(-83.27 to 8.86)
Age 65 to 74			-16.39	10.59	-10.12	11.25	1.68	23.40
			(-56.15 to 23.38)	(-30.97 to 52.16)	(-50.46 to 30.21)	(-31.27 to 53.76)	(-29.63 to 32.99)	(-8.14 to 54.93)
Age 75 to 84			-13.20	-4.68	-9.72	-4.62	12.18	17.05
			(-68.45 to 42.05)	(-61.48 to 52.11)	(-65.23 to 45.80)	(-63.24 to 54.00)	(-31.88 to 56.24)	(-27.47 to 61.56)
Age 85 to 89			20.28	-70.98	-29.44	-67.56	-26.93	-54.52
			(-152.32 to 192.88)	(-246.48 to 104.52)	(-202.18 to 143.31)	(-247.03 to 111.92)	(-160.91 to 107.04)	(-187.56 to 78.51)
Age 90 and over			-396.79***	-275.22**	-346.29***	-274.35**	-134.49	-56.70
			(-589.11 to -204.47)	(-474.19 to -76.25)	(-539.49 to -153.09)	(-477.94 to -70.75)	(-286.85 to 17.87)	(-209.82 to 96.42)
Mixed/multiple ethnicity					6.10	-3.01	-2.06	-12.56
					(-22.46 to 34.66)	(-40.52 to 34.50)	(-24.22 to 20.09)	(-40.60 to 15.47)
Asian or British Asian ethnicity					-1.90	0.41	2.10	2.62
					(-4.74 to 0.94)	(-4.00 to 4.82)	(-0.20 to 4.40)	(-0.76 to 6.00)
Black ethnicity					-1.40	1.48	-4.11	8.68
					(-7.76 to 4.97)	(-15.57 to 18.54)	(-9.05 to 0.82)	(-4.46 to 21.82)
Other ethnicity					-22.68*	4.12	-37.68***	-1.59
					(-42.25 to -3.11)	(-57.49 to 65.73)	(-53.11 to -22.25)	(-47.36 to 44.18)
IMD quintile 1 (least deprived; base category)							0.00	0.00
							(0.00 to 0.00)	(0.00 to 0.00)
IMD quintile 2							84.13***	80.18***
							(50.70 to 117.56)	(46.49 to 113.87)
IMD quintile 3							134.49***	135.73***
							(98.34 to 170.65)	(98.80 to 172.66)
IMD quintile 4							202.79***	214.23***
							(161.21 to 244.37)	(171.20 to 257.26)
IMD quintile 5 (most deprived)							313.67***	344.09***
							(264.77 to 362.58)	(292.40 to 395.78)
Rate of people shielding							0.16*	0.14
							(0.02 to 0.30)	(-0.02 to 0.29)
Constant	1044.41***	1042.22***	4459.88***	3565.14***	4658.12***	3450.15***	1545.25***	68.29
	(1025.53 to 1063.29)	(1021.99 to 1062.45)	(3706.99 to 5212.78)	(2503.70 to 4626.58)	(3677.32 to 5638.93)	(2156.95 to 4743.36)	(661.49 to 2429.00)	(-1004.99 to 1141.57)
Observations	308	277	303	272	303	272	303	272

Table A2.1: Care home COVID-19 mortality rates

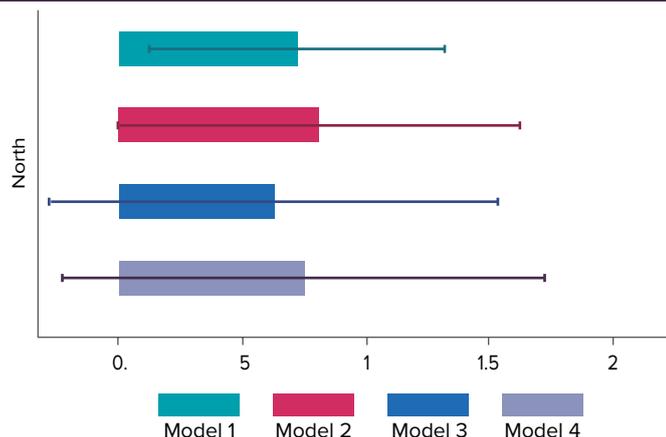| Region	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Wave 1	Wave 2	12 months
East Midlands	11.40	13.52	3.40	0.75	0.43	0.11	0.21	6.73	2.84	10.95	12.68	1.52	7.27	4.43	5.38
East of England	10.97	7.62	4.35	0.75	0.79	0.67	1.86	2.56	4.39	11.44	6.93	1.69	5.92	3.79	4.50
London	21.83	7.89	1.27	0.35	0.16	0.30	0.08	0.70	2.08	7.92	4.12	0.97	7.84	2.04	3.97
North East	20.96	20.03	4.89	0.80	0.29	0.85	5.83	8.40	7.68	9.93	5.71	1.19	11.67	4.98	7.21
North West	22.81	13.96	3.96	0.69	0.26	0.52	2.10	5.35	3.54	5.71	4.57	1.19	10.36	2.91	5.39
South East	23.57	11.54	1.76	0.19	0.63	0.06	0.22	1.65	6.15	13.11	7.39	1.35	9.26	3.82	5.63
South West	16.85	11.45	2.21	0.20	0.27	0.63	0.98	2.49	3.15	12.34	11.15	1.56	7.68	4.07	5.27
West Midlands	16.76	12.54	2.37	0.89	0.19	0.25	0.80	2.53	4.24	10.23	7.44	1.73	8.14	3.43	5.00
Yorks and The Humber	14.61	14.92	3.84	0.79	0.23	0.45	2.07	10.83	7.78	6.57	4.41	1.11	8.54	4.18	5.63

Region	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Wave 1	Wave 2	12 months
East Midlands	11.40	13.52	3.40	0.75	0.43	0.11	0.21	6.73	2.84	10.95	12.68	1.52	7.27	4.43	5.38
East of England	10.97	7.62	4.35	0.75	0.79	0.67	1.86	2.56	4.39	11.44	6.93	1.69	5.92	3.79	4.50
London	21.83	7.89	1.27	0.35	0.16	0.30	0.08	0.70	2.08	7.92	4.12	0.97	7.84	2.04	3.97
North East	20.96	20.03	4.89	0.80	0.29	0.85	5.83	8.40	7.68	9.93	5.71	1.19	11.67	4.98	7.21
North West	22.81	13.96	3.96	0.69	0.26	0.52	2.10	5.35	3.54	5.71	4.57	1.19	10.36	2.91	5.39
South East	23.57	11.54	1.76	0.19	0.63	0.06	0.22	1.65	6.15	13.11	7.39	1.35	9.26	3.82	5.63
South West	16.85	11.45	2.21	0.20	0.27	0.63	0.98	2.49	3.15	12.34	11.15	1.56	7.68	4.07	5.27
West Midlands	16.76	12.54	2.37	0.89	0.19	0.25	0.80	2.53	4.24	10.23	7.44	1.73	8.14	3.43	5.00
Yorks and The Humber	14.61	14.92	3.84	0.79	0.23	0.45	2.07	10.83	7.78	6.57	4.41	1.11	8.54	4.18	5.63

Table A2.3: Additional COVID-19 mortality (March 2020 to March 2021) in the North in care homes, per 1,000 care home beds
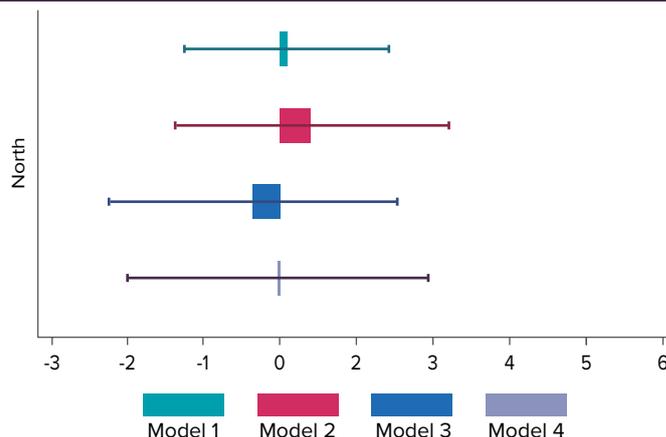
Column1	(1) RoE inc. London	(2) RoE exc. London	(3) RoE inc. London	(4) RoE exc. London	(5) RoE inc. London	(6) RoE exc. London	(7) RoE inc. London	(8) RoE exc. London
The North	1.24***	0.72*	0.75	0.81	0.65	0.63	0.61	0.64
	(0.71 to 1.77)	(0.13 to 1.32)	(-0.01 to 1.52)	(-0.01 to 1.62)	(-0.10 to 1.40)	(-0.28 to 1.54)	(-0.20 to 1.41)	(-0.34 to 1.62)
Age 18 to 19			0.50	1.57	0.17	1.65	0.18	1.34
			(-1.26 to 2.25)	(-0.92 to 4.06)	(-1.52 to 1.86)	(-0.93 to 4.24)	(-1.57 to 1.92)	(-1.35 to 4.03)
Age 20 to 24			0.12	-0.32	0.06	-0.42	0.02	-0.35
			(-0.66 to 0.90)	(-1.42 to 0.79)	(-0.70 to 0.82)	(-1.62 to 0.78)	(-0.75 to 0.79)	(-1.59 to 0.88)
Age 25 to 29			0.00	0.61	0.03	0.58	0.05	0.51
			(-0.60 to 0.61)	(-0.56 to 1.78)	(-0.55 to 0.61)	(-0.71 to 1.87)	(-0.54 to 0.64)	(-0.90 to 1.91)
Age 30 to 44			0.07	0.32	0.00	0.33	-0.04	0.25
			(-0.23 to 0.38)	(-0.16 to 0.80)	(-0.37 to 0.38)	(-0.23 to 0.89)	(-0.48 to 0.39)	(-0.42 to 0.92)
Age 45 to 59			0.02	0.46	0.14	0.26	0.10	0.25
			(-0.47 to 0.52)	(-0.18 to 1.11)	(-0.39 to 0.66)	(-0.56 to 1.08)	(-0.45 to 0.65)	(-0.61 to 1.12)
Age 60 to 64			0.44	-0.50	-1.00	-0.64	-1.09	-0.71
			(-0.96 to 1.83)	(-2.24 to 1.24)	(-2.51 to 0.51)	(-2.47 to 1.19)	(-2.63 to 0.44)	(-2.59 to 1.16)
Age 65 to 74			0.21	0.70	0.62	0.59	0.65	0.58
			(-0.75 to 1.17)	(-0.47 to 1.88)	(-0.34 to 1.58)	(-0.65 to 1.84)	(-0.34 to 1.65)	(-0.72 to 1.88)
Age 75 to 84			-0.46	-0.81	-0.97	-0.69	-1.04	-0.82
			(-1.79 to 0.87)	(-2.48 to 0.86)	(-2.28 to 0.34)	(-2.41 to 1.03)	(-2.40 to 0.32)	(-2.62 to 0.97)
Age 85 to 89			2.77	4.75	3.87	5.15	4.10	5.83*
			(-1.55 to 7.08)	(-0.33 to 9.83)	(-0.44 to 8.17)	(-0.13 to 10.43)	(-0.33 to 8.52)	(0.29 to 11.37)
Age 90 and over			-3.79	-4.45	-4.28	-5.32	-4.72	-6.52*
			(-8.49 to 0.91)	(-9.91 to 1.02)	(-8.90 to 0.33)	(-11.17 to 0.53)	(-9.73 to 0.29)	(-12.91 to -0.12)
Mixed/multiple ethnicity					0.00	-0.18	0.09	-0.05
					(-0.43 to 0.44)	(-0.85 to 0.49)	(-0.36 to 0.55)	(-0.77 to 0.67)
Asian or British Asian ethnicity					-0.02	-0.01	-0.02	-0.01
					(-0.06 to 0.03)	(-0.10 to 0.08)	(-0.06 to 0.03)	(-0.10 to 0.09)
Black ethnicity					-0.15**	-0.10	-0.17**	-0.14
					(-0.25 to -0.05)	(-0.41 to 0.21)	(-0.27 to -0.06)	(-0.48 to 0.20)
Other ethnicity					-0.02	0.02	-0.05	0.10
					(-0.28 to 0.25)	(-1.17 to 1.21)	(-0.33 to 0.23)	(-1.14 to 1.34)
IMD quintile 1 (least deprived; base category)							0.00	0.00
							(0.00 to 0.00)	(0.00 to 0.00)
IMD quintile 2							-0.37	-0.67
							(-1.40 to 0.66)	(-2.08 to 0.75)
IMD quintile 3							-0.08	-0.23
							(-1.05 to 0.89)	(-1.45 to 0.99)
IMD quintile 4							-0.07	0.01
							(-1.12 to 0.98)	(-1.39 to 1.41)
IMD quintile 5 (most deprived)							-0.45	-0.58
							(-1.67 to 0.77)	(-2.20 to 1.04)
Rate of people shielding							0.00	0.00
							(-0.00 to 0.01)	(-0.01 to 0.01)
Constant	4.69***	5.21***	-2.13	-18.68	5.32	-12.45	7.15	-8.88
	(4.36 to 5.02)	(4.78 to 5.64)	(-14.32 to 10.05)	(-40.67 to 3.31)	(-12.36 to 23.01)	(-45.08 to 20.17)	(-12.89 to 27.19)	(-43.70 to 25.94)
Observations	121	90	119	88	119	88	119	88

Figure A2.1: Additional COVID-19 mortality (March 2020 to March 2021) in the North in care homes, per 1,000 care home beds, excluding London

Models 1-4 as defined in the Appendix

Figure A2.2: Additional all-cause mortality (March 2020 to March 2021) in the North in care homes, per 1,000 care home beds, excluding London

Models 1-4 as defined in the Appendix

Table A2.4: Additional all-cause mortality (March 2020 to March 2021) in the North in care homes, per 1,000 care home beds

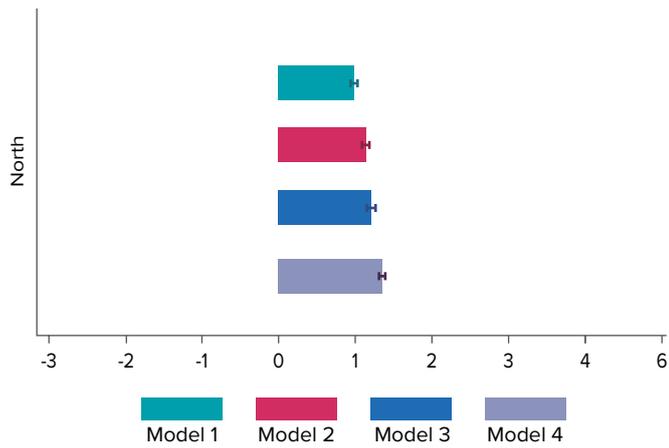| Column1	(1) RoE inc. London	(2) RoE exc. London	(3) RoE inc. London	(4) RoE exc. London	(5) RoE inc. London	(6) RoE exc. London	(7) RoE inc. London	(8) RoE exc. London
The North	2.06**	0.09	0.22	0.41	-0.36	-0.36	-0.17	-0.09
	(0.63 to 3.48)	(-1.25 to 1.44)	(-1.55 to 1.98)	(-1.39 to 2.21)	(-2.10 to 1.38)	(-2.26 to 1.54)	(-1.96 to 1.62)	(-2.06 to 1.89)
Age 18 to 19			3.04	3.74	2.63	4.21	2.17	3.06
			(-0.99 to 7.08)	(-1.76 to 9.24)	(-1.28 to 6.53)	(-1.20 to 9.62)	(-1.70 to 6.05)	(-2.39 to 8.52)
Age 20 to 24			-0.91	-1.12	-1.09	-1.32	-1.18	-1.26
			(-2.71 to 0.90)	(-3.56 to 1.32)	(-2.85 to 0.67)	(-3.83 to 1.18)	(-2.89 to 0.54)	(-3.76 to 1.24)
Age 25 to 29			0.54	1.42	0.47	1.25	0.41	1.29
			(-0.85 to 1.93)	(-1.16 to 4.01)	(-0.86 to 1.81)	(-1.45 to 3.95)	(-0.90 to 1.72)	(-1.55 to 4.14)
Age 30 to 44			-0.25	0.48	-0.28	0.75	-0.63	0.11
			(-0.95 to 0.45)	(-0.57 to 1.53)	(-1.15 to 0.60)	(-0.43 to 1.93)	(-1.59 to 0.33)	(-1.26 to 1.47)
Age 45 to 59			-0.18	0.26	-0.17	-0.51	-0.56	-0.64
			(-1.32 to 0.96)	(-1.17 to 1.69)	(-1.39 to 1.05)	(-2.22 to 1.21)	(-1.79 to 0.67)	(-2.40 to 1.11)
Age 60 to 64			2.21	1.03	-0.70	0.07	-1.04	-0.11
			(-1.01 to 5.42)	(-2.81 to 4.86)	(-4.19 to 2.78)	(-3.75 to 3.90)	(-4.45 to 2.37)	(-3.91 to 3.68)
Age 65 to 74			-0.36	0.86	0.21	0.56	0.23	0.24
			(-2.57 to 1.85)	(-1.74 to 3.46)	(-2.01 to 2.43)	(-2.04 to 3.16)	(-1.99 to 2.45)	(-2.38 to 2.87)
Age 75 to 84			-1.54	-1.45	-2.23	-0.62	-2.32	-0.89
			(-4.60 to 1.52)	(-5.13 to 2.23)	(-5.27 to 0.80)	(-4.21 to 2.98)	(-5.34 to 0.71)	(-4.52 to 2.74)
Age 85 to 89			9.45	7.66	11.06*	9.22	11.24*	11.31*
			(-0.48 to 19.38)	(-3.56 to 18.87)	(1.10 to 21.02)	(-1.81 to 20.25)	(1.41 to 21.07)	(0.09 to 22.53)
Age 90 and over			-6.01	-2.93	-6.39	-6.25	-9.29	-11.16
			(-16.82 to 4.80)	(-14.99 to 9.13)	(-17.08 to 4.30)	(-18.46 to 5.96)	(-20.42 to 1.84)	(-24.11 to 1.79)
Mixed/multiple ethnicity					-0.83	-1.11	-0.34	-0.61
					(-1.83 to 0.17)	(-2.52 to 0.29)	(-1.36 to 0.68)	(-2.07 to 0.85)
Asian or British Asian ethnicity					-0.06	0.03	-0.08	0.02
					(-0.17 to 0.04)	(-0.16 to 0.22)	(-0.19 to 0.02)	(-0.17 to 0.21)
Black ethnicity					-0.18	-0.32	-0.27*	-0.50
					(-0.40 to 0.04)	(-0.97 to 0.33)	(-0.49 to -0.04)	(-1.18 to 0.18)
Other ethnicity					0.14	-0.95	0.05	-0.56
					(-0.47 to 0.75)	(-3.43 to 1.52)	(-0.56 to 0.67)	(-3.08 to 1.95)
IMD quintile 1 (least deprived; base category)							0.00	0.00
							(0.00 to 0.00)	(0.00 to 0.00)
IMD quintile 2							-0.24	-0.89
							(-2.54 to 2.05)	(-3.76 to 1.98)
IMD quintile 3							-0.38	-0.72
							(-2.55 to 1.78)	(-3.19 to 1.74)
IMD quintile 4							-0.09	-0.25
							(-2.43 to 2.24)	(-3.09 to 2.58)
IMD quintile 5 (most deprived)							-2.71	-2.87
							(-5.42 to 0.00)	(-6.15 to 0.41)
Rate of people shielding							0.01	0.00
							(-0.00 to 0.02)	(-0.01 to 0.02)
Constant	20.30***	22.26***	14.20	-18.93	34.36	-0.82	53.32*	23.03
	(19.41 to 21.19)	(21.29 to 23.23)	(-13.83 to 42.24)	(-67.48 to 29.63)	(-6.59 to 75.32)	(-68.96 to 67.31)	(8.79 to 97.85)	(-47.49 to 93.56)
Observations	121	90	119	88	119	88	119	88

Table A3.1: Percentage of hospital beds occupied by COVID-19 patients

Region	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Wave 1	Wave 2	12 months
East Midlands	21.97%	11.58%	5.65%	2.18%	0.83%	1.12%	6.14%	15.91%	17.11%	27.18%	19.89%	7.58%	9.30%	12.25%	11.45%
East of England	32.11%	14.29%	5.42%	2.30%	0.96%	0.76%	2.84%	6.74%	13.80%	34.96%	20.89%	6.55%	12.06%	11.14%	11.26%
London	41.00%	14.04%	4.75%	2.01%	0.87%	0.94%	3.03%	7.05%	15.09%	37.56%	22.03%	7.16%	13.54%	12.20%	12.45%
North East	37.00%	16.52%	5.27%	1.41%	0.63%	2.13%	11.02%	19.28%	14.54%	22.37%	15.69%	5.10%	12.94%	11.69%	11.59%
North West	29.55%	13.48%	6.01%	2.12%	0.94%	1.91%	10.06%	17.39%	14.40%	21.04%	15.77%	5.86%	10.78%	11.00%	10.92%
South East	32.56%	12.48%	4.51%	1.76%	0.69%	0.69%	2.46%	6.94%	14.91%	34.97%	20.41%	6.45%	11.15%	11.24%	11.16%
South West	19.98%	7.74%	2.65%	0.71%	0.40%	0.42%	2.44%	10.09%	11.31%	20.28%	11.82%	3.19%	6.37%	7.64%	7.31%
West Midlands	23.09%	10.86%	4.87%	1.66%	0.84%	1.02%	4.14%	12.99%	14.81%	25.79%	18.14%	6.20%	9.46%	10.72%	10.35%
Yorkshire and The Humber	27.92%	13.09%	5.95%	2.27%	0.84%	1.54%	8.95%	20.79%	16.47%	19.94%	16.55%	7.00%	10.35%	11.74%	11.27%

Table A3.2: Proportion of hospital beds occupied by COVID-19 patients

Column1	(1) RoE inc. London	(2) RoE exc. London	(3) RoE inc. London	(4) RoE exc. London	(5) RoE inc. London	(6) RoE exc. London	(7) RoE inc. London	(8) RoE exc. London
The North	0.00076***	0.00992***	0.00749***	0.01139***	0.00864***	0.01222***	0.01016***	0.01360***
	(0.00110 to 0.00043)	(0.00956 to 0.01027)	(0.00708 to 0.00789)	(0.01098 to 0.01181)	(0.00823 to 0.00905)	(0.01179 to 0.01266)	(0.00971 to 0.01060)	(0.01314 to 0.01407)
Age 18 to 19			-0.00073	0.00275***	0.00110*	0.00546***	0.00101*	0.00601***
			(-0.00161 to 0.00014)	(0.00161 to 0.00389)	(0.00021 to 0.00199)	(0.00431 to 0.00661)	(0.00009 to 0.00192)	(0.00483 to 0.00720)
Age 20 to 24			-0.00261***	-0.00389***	-0.00207***	-0.00210***	-0.00267***	-0.00352***
			(-0.00301 to -0.00221)	(-0.00440 to -0.00337)	(-0.00248 to -0.00167)	(-0.00265 to -0.00155)	(-0.00307 to -0.00226)	(-0.00408 to -0.00295)
Age 25 to 29			-0.00349***	-0.00527***	-0.00321***	-0.00334***	-0.00278***	-0.00150***
			(-0.00379 to -0.00318)	(-0.00580 to -0.00475)	(-0.00351 to -0.00290)	(-0.00389 to -0.00278)	(-0.00309 to -0.00247)	(-0.00209 to -0.00092)
Age 30 to 44			0.00201***	0.00259***	0.00267***	0.00445***	0.00163***	0.00295***
			(0.00183 to 0.00218)	(0.00230 to 0.00287)	(0.00245 to 0.00289)	(0.00413 to 0.00478)	(0.00139 to 0.00188)	(0.00257 to 0.00333)
Age 45 to 59			-0.00282***	-0.00473***	-0.00175***	-0.00046*	-0.00300***	-0.00182***
			(-0.00307 to -0.00257)	(-0.00504 to -0.00442)	(-0.00202 to -0.00148)	(-0.00084 to -0.00008)	(-0.00330 to -0.00270)	(-0.00223 to -0.00141)
Age 60 to 64			-0.00626***	-0.00553***	-0.00147***	-0.00139***	-0.00074	-0.00044
			(-0.00692 to -0.00560)	(-0.00632 to -0.00475)	(-0.00221 to -0.00073)	(-0.00220 to -0.00057)	(-0.00149 to 0.00001)	(-0.00126 to 0.00037)
Age 65 to 74			0.00157***	0.00351***	0.00111***	0.00512***	0.00079**	0.00458***
			(0.00110 to 0.00204)	(0.00296 to 0.00406)	(0.00062 to 0.00161)	(0.00455 to 0.00568)	(0.00030 to 0.00128)	(0.00401 to 0.00514)
Age 75 to 84			-0.00032	-0.00133**	0.00076*	-0.00055	0.00075*	-0.00029
			(-0.00100 to 0.00035)	(-0.00214 to -0.00052)	(0.00007 to 0.00145)	(-0.00138 to 0.00029)	(0.00005 to 0.00145)	(-0.00112 to 0.00055)
Age 85 to 89			-0.01206***	-0.00279*	-0.01064***	-0.00189	-0.00878***	-0.00046
			(-0.01422 to -0.00991)	(-0.00534 to -0.00025)	(-0.01285 to -0.00843)	(-0.00449 to 0.00070)	(-0.01100 to -0.00656)	(-0.00306 to 0.00215)
Age 90 and over			0.00255*	-0.02844***	-0.00045	-0.02510***	-0.00873***	-0.03398***
			(0.00020 to 0.00489)	(-0.03128 to -0.02559)	(-0.00287 to 0.00198)	(-0.02802 to -0.02218)	(-0.01127 to -0.00620)	(-0.03703 to -0.03093)
Mixed/multiple ethnicity					0.00234***	0.00222***	0.00256***	0.00234***
					(0.00205 to 0.00262)	(0.00177 to 0.00266)	(0.00227 to 0.00286)	(0.00189 to 0.00280)
Asian or British Asian ethnicity					0.00029***	0.00071***	0.00023***	0.00066***
					(0.00026 to 0.00031)	(0.00066 to 0.00077)	(0.00020 to 0.00026)	(0.00061 to 0.00071)
Black ethnicity					0.00017***	0.00053***	0.00024***	0.00059***
					(0.00011 to 0.00023)	(0.00038 to 0.00068)	(0.00018 to 0.00030)	(0.00044 to 0.00074)
Other ethnicity					-0.00068***	-0.00136***	-0.00031***	-0.00136***
					(-0.00084 to -0.00052)	(-0.00187 to -0.00084)	(-0.00048 to -0.00015)	(-0.00187 to -0.00084)
IMD quintile 1 (least deprived; base category)							0.00000	0.00000
							(0.00000 to 0.00000)	(0.00000 to 0.00000)
IMD quintile 2							-0.00338***	-0.00604***
							(-0.00389 to -0.00287)	(-0.00665 to -0.00544)
IMD quintile 3							-0.00584***	-0.00613***
							(-0.00637 to -0.00531)	(-0.00678 to -0.00548)
IMD quintile 4							-0.00718***	-0.00751***
							(-0.00781 to -0.00656)	(-0.00825 to -0.00677)
IMD quintile 5 (most deprived)							-0.00744***	-0.00946***
							(-0.00820 to -0.00667)	(-0.01038 to -0.00853)
Constant	0.11200***	0.10132***	0.20596***	0.23196***	0.12293***	0.02111*	0.17580***	0.08195***
	(0.11183 to 0.11217)	(0.10110 to 0.10155)	(0.19853 to 0.21338)	(0.21975 to 0.24417)	(0.11258 to 0.13329)	(0.00404 to 0.03819)	(0.16392 to 0.18767)	(0.06292 to 0.10099)
Observations	438765	278696	438765	278696	438765	278696	438765	278696

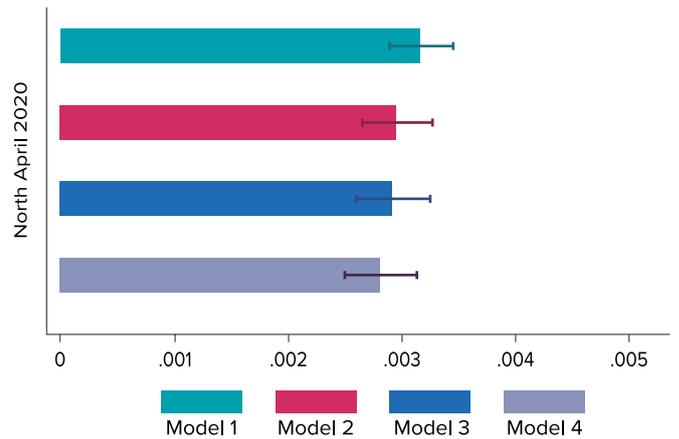## Figure A3.1: Proportion of hospital beds occupied by COVID-19 patients, excluding London

Model 1   Model 2   Model 3   Model 4

Models 1-4 as defined in the Appendix

Table A4.1: Percentage testing positive

Region	Wave 1	Wave 2	11 months
East Midlands	0.24%	0.95%	0.73%
East of England	0.08%	0.79%	0.57%
London	0.14%	1.21%	0.88%
North East	0.06%	1.18%	0.84%
North West	0.20%	1.36%	1.00%
South East	0.09%	0.80%	0.58%
South West	0.04%	0.57%	0.41%
West Midlands	0.10%	1.01%	0.74%
Yorkshire and The Humber	0.12%	1.12%	0.82%

Figure A4.1: Proportion testing positive regression excluding London

Model 1   Model 2   Model 3   Model 4

Models 1-4 as defined in the Appendix

Table A4.2: Proportion testing positive regression

Column1	(1) RoE inc. London	(2) RoE exc. London	(3) RoE inc. London	(4) RoE exc. London	(5) RoE inc. London	(6) RoE exc. London	(7) RoE inc. London	(8) RoE exc. London
The North	0.00279***	0.00317***	0.00289***	0.00296***	0.00292***	0.00292***	0.00276***	0.00279***
	(0.00246 to 0.00313)	(0.00290 to 0.00344)	(0.00256 to 0.00321)	(0.00266 to 0.00326)	(0.00261 to 0.00322)	(0.00261 to 0.00322)	(0.00244 to 0.00307)	(0.00247 to 0.00311)
Age 18 to 19			0.00037	0.00050	0.00036	0.00054	0.00041	0.00052
			(-0.00022 to 0.00096)	(-0.00008 to 0.00108)	(-0.00018 to 0.00091)	(-0.00002 to 0.00111)	(-0.00013 to 0.00095)	(-0.00005 to 0.00108)
Age 20 to 24			-0.00022	-0.00019	-0.00015	-0.00019	-0.00015	-0.00017
			(-0.00050 to 0.00006)	(-0.00046 to 0.00009)	(-0.00041 to 0.00012)	(-0.00046 to 0.00008)	(-0.00041 to 0.00010)	(-0.00044 to 0.00010)
Age 25 to 29			0.00013	-0.00005	0.00005	-0.00004	0.00001	-0.00010
			(-0.00011 to 0.00036)	(-0.00036 to 0.00027)	(-0.00018 to 0.00028)	(-0.00035 to 0.00026)	(-0.00022 to 0.00024)	(-0.00042 to 0.00021)
Age 30 to 44			0.00024**	0.00011	0.00016*	0.00009	0.00016*	0.00009
			(0.00008 to 0.00039)	(-0.00007 to 0.00030)	(0.00001 to 0.00031)	(-0.00009 to 0.00027)	(0.00002 to 0.00031)	(-0.00009 to 0.00027)
Age 45 to 59			-0.00014	-0.00014	-0.00007	-0.00013	-0.00009	-0.00014
			(-0.00033 to 0.00006)	(-0.00034 to 0.00006)	(-0.00025 to 0.00011)	(-0.00032 to 0.00007)	(-0.00027 to 0.00009)	(-0.00034 to 0.00005)
Age 60 to 64			-0.00033	-0.00018	-0.00025	-0.00015	-0.00025	-0.00017
			(-0.00085 to 0.00018)	(-0.00067 to 0.00031)	(-0.00072 to 0.00023)	(-0.00063 to 0.00034)	(-0.00072 to 0.00022)	(-0.00065 to 0.00031)
Age 65 to 74			0.00056**	0.00049**	0.00050**	0.00047**	0.00048**	0.00046*
			(0.00019 to 0.00093)	(0.00014 to 0.00084)	(0.00015 to 0.00085)	(0.00012 to 0.00082)	(0.00014 to 0.00083)	(0.00011 to 0.00080)
Age 75 to 84			-0.00002	-0.00014	-0.00003	-0.00013	0.00001	-0.00010
			(-0.00053 to 0.00049)	(-0.00062 to 0.00033)	(-0.00051 to 0.00045)	(-0.00061 to 0.00036)	(-0.00047 to 0.00049)	(-0.00059 to 0.00039)
Age 85 to 89			-0.00023	-0.00003	-0.00020	-0.00005	-0.00045	-0.00025
			(-0.00168 to 0.00122)	(-0.00136 to 0.00129)	(-0.00154 to 0.00114)	(-0.00135 to 0.00125)	(-0.00178 to 0.00088)	(-0.00155 to 0.00106)
Age 90 and over			-0.00186*	-0.00221**	-0.00209**	-0.00230**	-0.00180*	-0.00211**
			(-0.00344 to -0.00028)	(-0.00367 to -0.00076)	(-0.00355 to -0.00063)	(-0.00375 to -0.00085)	(-0.00326 to -0.00035)	(-0.00356 to -0.00066)
Mixed/multiple ethnicity					0.00014	0.00017	0.00012	0.00017
					(-0.00006 to 0.00035)	(-0.00010 to 0.00045)	(-0.00008 to 0.00032)	(-0.00011 to 0.00044)
Asian or British Asian ethnicity					0.00001	0.00003*	0.00001	0.00003*
					(-0.00001 to 0.00003)	(0.00000 to 0.00006)	(-0.00001 to 0.00003)	(0.00000 to 0.00006)
Black ethnicity					0.00002	-0.00007	0.00003	-0.00006
					(-0.00004 to 0.00007)	(-0.00020 to 0.00007)	(-0.00003 to 0.00008)	(-0.00019 to 0.00007)
Other ethnicity					0.00018*	-0.00028	0.00015*	-0.00025
					(0.00003 to 0.00033)	(-0.00071 to 0.00016)	(0.00000 to 0.00030)	(-0.00069 to 0.00018)
IMD quintile 1 (least deprived; base category)							0.00000	0.00000
							(0.00000 to 0.00000)	(0.00000 to 0.00000)
IMD quintile 2							0.00037*	0.00015
							(0.00003 to 0.00071)	(-0.00019 to 0.00049)
IMD quintile 3							0.00029	0.00014
							(-0.00006 to (0.00064)	(-0.00021 to 0.00049)
IMD quintile 4							0.00039*	0.00025
							(0.00004 to 0.00074)	(-0.00010 to 0.00059)
IMD quintile 5 (most deprived)							0.00065***	0.00047*
							(0.00028 to 0.00102)	(0.00010 to 0.00085)
Constant	0.00643***	0.00606***	0.00298	0.00616	0.00301	0.00601	0.00338	0.00691
	(0.00627 to 0.00659)	(0.00592 to 0.00619)	(-0.00343 to 0.00939)	(-0.00262 to 0.01494)	(-0.00295 to 0.00896)	(-0.00258 to 0.01460)	(-0.00252 to 0.00929)	(-0.00172 to 0.01553)
Observations	317	284	312	279	307	274	307	274

Table A5.1: Vaccination rates per 10,000 people

Region	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	6 months
East Midlands	2.7502	51.05972	31.72243	476.9477	1747.786	1006.803	552.3579
East of England	3.524123	94.46335	25.44242	461.3033	1782.647	844.3035	522.8262
London	1.002684	68.80654	23.09927	414.8468	1175.32	629.0914	385.3611
North East	4.667798	93.00068	22.47874	653.0446	1547.827	843.5413	527.4266
North West	4.463361	87.83756	15.98281	662.2216	1720.732	875.4835	556.9288
South East	1.495322	88.03498	24.74941	587.5458	1616.718	904.7328	529.8204
South West	1.930583	96.08743	28.01362	612.8885	1880.124	989.7633	590.7297
West Midlands	1.776864	70.5713	20.17013	605.7981	1725.661	937.0074	550.5092
Yorks and The Humber	0.947895	89.31029	25.29023	636.5325	1705.964	852.5171	548.7312

Table A5.2: 6-month vaccination rates regression

Column1	(1) RoE inc. London	(2) RoE exc. London	(3) RoE inc. London	(4) RoE exc. London	(5) RoE inc. London	(6) RoE exc. London	(7) RoE inc. London	(8) RoE exc. London
The	28.90*	5.43	14.58*	14.38*	15.25*	13.75*	14.49*	13.37
	(1.41 to 56.39)	(-18.64 to 29.50)	(1.64 to 27.52)	(1.51 to 27.26)	(1.99 to 28.50)	(0.16 to 27.34)	(0.76 to 28.23)	(-0.44 to 27.19)
Age 18 to 19			-0.41	7.91	-0.34	6.39	-3.08	2.68
			(-23.30 to 22.48)	(-16.60 to 32.42)	(-23.41 to 22.73)	(-18.25 to 31.02)	(-26.57 to 20.41)	(-22.92 to 28.27)
Age 20 to 24			-1.12	-1.46	0.43	-4.34	3.27	-0.62
			(-12.14 to 9.91)	(-12.98 to 10.07)	(-11.00 to 11.86)	(-17.02 to 8.34)	(-8.42 to 14.96)	(-13.76 to 12.52)
Age 25 to 29			3.92	13.04	6.04	14.59*	3.08	9.17
			(-5.58 to 13.43)	(-0.35 to 26.43)	(-3.69 to 15.77)	(0.90 to 28.27)	(-6.92 to 13.08)	(-5.41 to 23.75)
Age 30 to 44			-4.13	2.12	-2.14	-0.65	0.57	1.94
			(-10.35 to 2.10)	(-6.20 to 10.44)	(-9.70 to 5.41)	(-9.67 to 8.37)	(-8.34 to 9.47)	(-8.98 to 12.85)
Age 45 to 59			11.74**	14.04**	14.41**	11.03*	17.30***	13.89*
			(3.50 to 19.98)	(5.18 to 22.91)	(5.37 to 23.45)	(0.74 to 21.32)	(7.49 to 27.12)	(2.71 to 25.07)
Age 60 to 64			-11.77	-2.67	-12.43	-4.01	-17.37	-8.54
			(-32.22 to 8.69)	(-23.97 to 18.62)	(-33.90 to 9.04)	(-25.67 to 17.66)	(-39.18 to 4.43)	(-30.73 to 13.65)
Age 65 to 74			32.94***	36.00***	36.44***	36.62***	38.33***	37.85***
			(18.57 to 47.32)	(20.98 to 51.01)	(21.68 to 51.19)	(21.50 to 51.74)	(23.56 to 53.09)	(22.63 to 53.07)
Age 75 to 84			-11.60	-5.05	-9.90	-6.97	-10.40	-7.77
			(-32.65 to 9.46)	(-26.83 to 16.73)	(-31.45 to 11.66)	(-29.29 to 15.35)	(-32.00 to 11.21)	(-30.23 to 14.70)
Age 85 to 89			63.38	66.00	54.21	64.82	52.32	64.60
			(-3.22 to 129.97)	(-2.60 to 134.60)	(-13.88 to 122.31)	(-4.82 to 134.46)	(-15.48 to 120.12)	(-4.89 to 134.10)
Age 90 and over			36.68	25.50	48.02	14.21	65.19	27.78
			(-35.40 to 108.75)	(-49.79 to 100.79)	(-25.94 to 121.99)	(-62.81 to 91.23)	(-10.78 to 141.16)	(-51.52 to 107.07)
Mixed/multiple ethnicity					4.37	11.88	4.06	13.35*
					(-5.93 to 14.66)	(-1.26 to 25.01)	(-6.22 to 14.34)	(0.05 to 26.65)
Asian or British Asian ethnicity					0.74	-0.31	0.88	-0.05
					(-0.28 to 1.75)	(-1.90 to 1.28)	(-0.18 to 1.94)	(-1.68 to 1.58)
Black ethnicity					-1.04	-8.09*	-1.18	-9.35**
					(-3.31 to 1.23)	(-14.28 to -1.91)	(-3.45 to 1.10)	(-15.76 to -2.93)
Other ethnicity					-5.35	3.63	-5.88	4.36
					(-12.38 to 1.67)	(-18.30 to 25.57)	(-13.00 to 1.24)	(-17.75 to 26.47)
IMD quintile 1 (least deprived; base category)							0.00	0.00
							(0.00 to 0.00)	(0.00 to 0.00)
IMD quintile 2							18.14*	13.84
							(2.06 to 34.22)	(-2.70 to 30.38)
IMD quintile 3							15.63	16.07
							(-1.65 to 32.91)	(-2.10 to 34.24)
IMD quintile 4							22.86*	22.64*
							(3.23 to 42.49)	(1.33 to 43.94)
IMD quintile 5 (most deprived)							17.03	14.97
							(-6.01 to 40.07)	(-9.68 to 39.62)
Constant	520.32***	543.79***	78.64	-286.31	-76.55	-141.44	-189.26	-235.10
	(507.18 to 533.46)	(531.56 to 556.02)	(-196.38 to 353.67)	(-678.25 to 105.64)	(-437.24 to 284.15)	(-615.35 to 332.47)	(-613.18 to 234.67)	(-784.27 to 314.07)
Observations	280	248	276	244	276	244	276	244

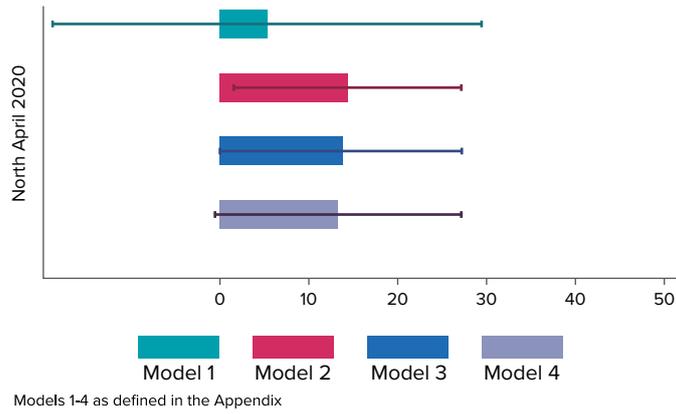Figure A5.1: **6-month vaccination rates regression excluding London**

Models 1-4 as defined in the Appendix

Figure A5.2: **COVID-19 vaccination rates by month**

December 2020

January 2021

February 2021

March 2021

April 2021

May 2021

Models 1-4 as defined in the Appendix

A year of COVID-19 in the North: Regional inequalities in health and economic outcomes

Figure A5.3: COVID-19 vaccination rates by month, excluding London

Models 1-4 as defined in the Appendix

Model 1   Model 2   Model 3   Model 4

Table A8.1: Claimant count rate between January 2020 and April 2021

Region	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	14 month
East Midlands	2.40	2.50	2.46	4.30	5.30	5.14	5.21	5.28	5.20	4.95	4.96	4.89	4.80	5.05	5.03	4.92	4.82
East of England	2.26	2.36	2.36	4.10	5.68	5.43	5.56	5.68	5.62	5.34	5.39	5.36	5.25	5.56	5.54	5.45	5.16
London	2.88	2.99	3.02	4.87	7.35	7.35	7.53	7.69	7.80	7.63	7.83	7.88	7.73	8.14	8.16	8.08	7.22
North East	4.67	4.84	4.86	7.21	7.84	7.74	7.83	7.88	7.81	7.64	7.52	7.40	7.37	7.60	7.58	7.44	7.41
North West	3.39	3.49	3.51	5.86	6.82	6.67	6.74	6.75	6.66	6.44	6.48	6.45	6.36	6.66	6.64	6.51	6.33
South East	2.02	2.12	2.13	3.90	5.33	5.08	5.22	5.37	5.34	5.10	5.15	5.12	5.03	5.32	5.29	5.18	4.90
South West	2.07	2.11	2.12	4.29	5.31	5.06	5.15	5.26	5.08	4.73	4.78	4.72	4.66	4.90	4.88	4.76	4.69
West Midlands	2.84	2.93	2.98	4.90	6.08	5.93	6.04	6.15	6.12	5.89	5.90	5.83	5.72	6.00	5.97	5.84	5.67
Yorks and The Humber	2.89	2.98	3.00	5.19	6.00	5.85	5.96	5.99	5.89	5.67	5.68	5.66	5.60	5.85	5.84	5.73	5.57

Table A8.2: Male claimant count rate between January 2020 and April 2021

Region	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	14 month
East Midlands	2.78	2.91	2.90	5.13	6.44	6.20	6.25	6.29	6.15	5.82	5.79	5.72	5.64	5.95	5.91	5.75	5.71
East of England	2.53	2.65	2.65	4.78	6.87	6.45	6.58	6.69	6.56	6.19	6.23	6.20	6.06	6.42	6.41	6.31	6.03
London	3.13	3.25	3.28	5.43	8.42	8.36	8.51	8.68	8.74	8.49	8.71	8.79	8.62	9.09	9.12	9.05	8.09
North East	5.85	6.08	6.06	9.19	10.08	9.90	9.94	9.98	9.87	9.56	9.39	9.24	9.21	9.52	9.46	9.25	9.33
North West	4.03	4.16	4.21	7.18	8.53	8.28	8.32	8.28	8.15	7.87	7.91	7.86	7.78	8.14	8.11	7.97	7.76
South East	2.30	2.42	2.43	4.61	6.47	6.09	6.21	6.35	6.30	5.95	5.98	5.97	5.87	6.20	6.18	6.03	5.76
South West	2.37	2.45	2.45	5.08	6.47	6.08	6.15	6.25	6.01	5.58	5.60	5.55	5.49	5.78	5.73	5.57	5.56
West Midlands	3.29	3.40	3.48	5.85	7.42	7.17	7.26	7.36	7.30	6.98	6.96	6.89	6.73	7.07	7.02	6.86	6.74
Yorks and The Humber	3.40	3.53	3.58	6.27	7.35	7.13	7.19	7.18	7.06	6.76	6.72	6.71	6.68	6.96	6.93	6.79	6.66

Table A8.3: Female claimant count rate between January 2020 and April 2021

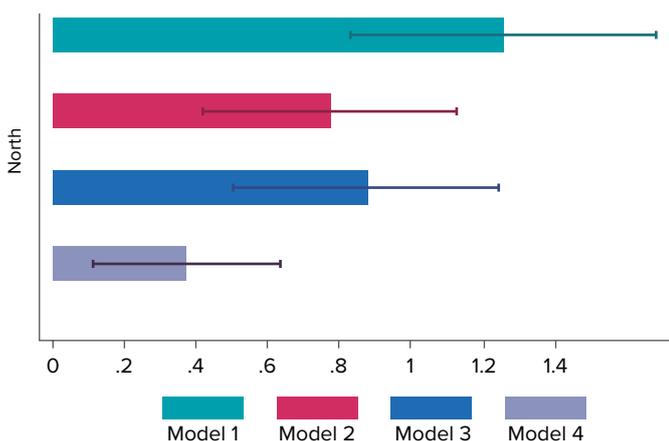| Region	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	14 month
East Midlands	2.03	2.10	2.05	3.48	4.15	4.08	4.21	4.30	4.27	4.10	4.13	4.06	3.98	4.17	4.17	4.11	3.95
East of England	2.00	2.08	2.08	3.43	4.52	4.42	4.55	4.68	4.68	4.50	4.56	4.52	4.43	4.68	4.67	4.61	4.31
London	2.63	2.75	2.74	4.32	6.25	6.35	6.52	6.67	6.85	6.76	6.94	6.96	6.85	7.17	7.20	7.11	6.33
North East	3.53	3.65	3.66	5.27	5.66	5.65	5.73	5.80	5.80	5.72	5.68	5.58	5.54	5.70	5.71	5.62	5.51
North West	2.74	2.81	2.81	4.55	5.14	5.09	5.18	5.25	5.20	5.03	5.09	5.03	4.97	5.19	5.18	5.08	4.92
South East	1.76	1.81	1.82	3.20	4.19	4.08	4.23	4.38	4.41	4.25	4.31	4.28	4.21	4.43	4.42	4.32	4.04
South West	1.77	1.78	1.77	3.52	4.19	4.05	4.15	4.26	4.16	3.90	3.95	3.90	3.86	4.05	4.05	3.97	3.84
West Midlands	2.40	2.45	2.49	3.96	4.73	4.67	4.79	4.94	4.92	4.82	4.85	4.78	4.69	4.92	4.91	4.80	4.59
Yorks and The Humber	2.37	2.44	2.44	4.12	4.65	4.59	4.73	4.79	4.74	4.60	4.65	4.61	4.56	4.75	4.78	4.69	4.48

Table A8.4: Claimant count regression

	RoE inc. London	RoEE exc. London	RoE inc. London	RoeE exc. London	RoE exc. London	RoE inc. London	RoeE exc. London
The North	0.95***	1.26***	0.86***	0.77***	0.88***	0.35**	0.38**
	(0.49 to 1.40)	(0.83 to 1.68)	(0.50 to 1.22)	(0.43 to 1.12)	(0.51 to 1.25)	(0.11 to 0.60)	(0.12 to 0.63)
Age 18 to 19			-1.02**	-1.11**	-1.03**	-0.56**	-0.49*
			(-1.66 to -0.37)	(-1.79 to -0.43)	(-1.71 to -0.34)	(-0.99 to -0.14)	(-0.97 to -0.01)
Age 20 to 24			-0.36*	-0.44**	-0.59**	-0.08	-0.17
			(-0.67 to -0.05)	(-0.76 to -0.12)	(-0.94 to -0.24)	(-0.29 to 0.12)	(-0.41 to 0.08)
Age 25 to 29			0.36**	0.53**	0.62**	-0.15	-0.13
			(0.10 to 0.62)	(0.15 to 0.90)	(0.24 to 1.00)	(-0.33 to 0.03)	(-0.41 to 0.14)
Age 30 to 44			-0.82***	-1.05***	-1.14***	-0.22**	-0.26**
			(-0.99 to -0.64)	(-1.27 to -0.83)	(-1.38 to -0.91)	(-0.38 to -0.07)	(-0.45 to -0.06)
Age 45 to 59			-0.63***	-0.69***	-0.73***	-0.11	-0.16
			(-0.85 to -0.42)	(-0.93 to -0.45)	(-1.00 to -0.45)	(-0.27 to 0.05)	(-0.36 to 0.04)
Age 60 to 64			-0.69*	-0.51	-0.45	-0.34	-0.35
			(-1.28 to -0.10)	(-1.11 to 0.09)	(-1.07 to 0.16)	(-0.74 to 0.06)	(-0.78 to 0.07)
Age 65 to 74			-0.33	-0.51*	-0.47*	-0.39**	-0.38**
			(-0.74 to 0.08)	(-0.92 to -0.09)	(-0.89 to -0.05)	(-0.66 to -0.12)	(-0.66 to -0.10)
Age 75 to 84			0.05	0.02	-0.10	0.23	0.16
			(-0.51 to 0.62)	(-0.55 to 0.58)	(-0.67 to 0.48)	(-0.13 to 0.59)	(-0.22 to 0.55)
Age 85 to 89			-0.28	0.00	-0.13	0.06	0.13
			(-1.88 to 1.31)	(-1.55 to 1.56)	(-1.70 to 1.44)	(-0.96 to 1.08)	(-0.93 to 1.20)
Age 90 and over			-1.60	-2.12*	-2.20*	-0.03	-0.17
			(-3.34 to 0.13)	(-3.83 to -0.41)	(-3.92 to -0.48)	(-1.16 to 1.09)	(-1.35 to 1.01)
Mixed/multiple ethnicity					0.42*	0.30**	0.34**
					(0.05 to 0.80)	(0.11 to 0.49)	(0.09 to 0.60)
Asian or British Asian ethnicity					-0.03	0.02	-0.01
					(-0.08 to 0.01)	(-0.00 to 0.04)	(-0.04 to 0.02)
Black ethnicity					-0.12	-0.01	-0.03
					(-0.29 to 0.05)	(-0.05 to 0.03)	(-0.15 to 0.08)
Other ethnicity					0.30	0.06	0.28
					(-0.30 to 0.91)	(-0.06 to 0.19)	(-0.14 to 0.69)
IMD quintile 1 (least deprived; base category)						0.00	0.00
						(0.00 to 0.00)	(0.00 to 0.00)
IMD quintile 2						0.91***	0.92***
						(0.62 to 1.19)	(0.61 to 1.22)
IMD quintile 3						1.64***	1.67***
						(1.34 to 1.95)	(1.34 to 2.01)
IMD quintile 4						2.59***	2.54***
						(2.25 to 2.92)	(2.16 to 2.92)
IMD quintile 5 (most deprived)						3.73***	3.80***
						(3.33 to 4.12)	(3.36 to 4.24)
Constant	5.34***	5.03***	45.83***	51.89***	54.37***	16.85***	19.17***
	(5.12 to 5.56)	(4.81 to 5.25)	(38.80 to 52.86)	(41.54 to 62.23)	(42.00 to 66.73)	(10.29 to 23.41)	(9.68 to 28.66)
Observations	306	273	301	268	268	301	268

Table A8.5: Furlough up-take rate between May 2020 and March 2021

Region	may_20	jun_20	jul_20	aug_20	sep_20	oct_20	nov_20	dec_20	jan_21	feb_21	mar_21	wave 1 avg	wave 2	11 month
East Midlands	25.37%	29.60%	15.10%	10.88%	8.00%	6.38%	11.35%	11.43%	14.02%	14.19%	12.86%	23.36%	11.14%	14.47%
East of England	24.74%	29.00%	15.84%	11.62%	8.73%	6.91%	12.11%	12.54%	15.25%	15.41%	14.21%	23.20%	12.10%	15.13%
London	24.63%	29.58%	19.13%	14.97%	11.97%	9.71%	14.74%	15.81%	17.80%	17.98%	16.33%	24.45%	14.91%	17.51%
North East	24.96%	29.25%	14.50%	10.00%	7.58%	6.17%	11.08%	11.24%	13.87%	14.05%	12.97%	22.90%	10.87%	14.15%
North West	25.81%	30.08%	15.92%	11.23%	8.41%	7.10%	12.44%	12.06%	15.24%	15.25%	14.07%	23.94%	11.97%	15.24%
South East	24.55%	28.83%	16.33%	11.95%	8.86%	7.00%	12.51%	13.02%	15.83%	15.93%	14.56%	23.24%	12.46%	15.40%
South West	26.41%	30.82%	16.36%	11.32%	8.14%	6.54%	12.75%	12.08%	16.00%	16.11%	13.87%	24.53%	12.10%	15.49%
West Midlands	27.22%	31.90%	16.73%	12.17%	8.93%	7.07%	11.83%	11.68%	14.76%	14.70%	13.38%	25.28%	11.82%	15.49%
Yorks and The Humber	25.63%	30.05%	15.14%	10.57%	7.90%	6.33%	12.00%	11.46%	14.72%	15.05%	13.76%	23.61%	11.47%	14.78%

Figure A8.1: **Claimant count regression excluding London**

Model 1   Model 2   Model 3   Model 4

Models 1-4 as defined in the Appendix

End notes

1   In this report "the North" comprises the following 77 local authorities in the North East, North West, and Yorkshire and Humber: Hartlepool, Middlesbrough, Redcar and Cleveland, Stockton-on-Tees, Darlington, Halton, Warrington, Blackburn with Darwen, Blackpool, Kingston upon Hull, East Riding of Yorkshire, North East Lincolnshire, North Lincolnshire, York, County Durham, Cheshire East, Cheshire West and Chester, Northumberland, Allerdale, Barrow-in-Furness, Carlisle, Copeland, Eden, South Lakeland, , Burnley, Chorley, Fylde, Hyndburn, Lancaster, Pendle, Preston, Ribble Valley, Rossendale, South Ribble, West Lancashire, Wyre, Craven, Hambleton, Harrogate, Richmondshire, Ryedale, Scarborough, Selby, , Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Stockport, Tameside, Trafford, Wigan, Knowsley, Liverpool, St. Helens, Sefton, Wirral, Barnsley, Doncaster, Rotherham, Sheffield, Newcastle upon Tyne, North Tyneside, South Tyneside, Sunderland, Bradford, Calderdale, Kirklees, Leeds, Wakefield, Gateshead.

2   Office for National Statistics (2015), Regional and sub-regional productivity in the UK, https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/articles/regionalandsubregionalproductivityintheuk/jan2017

3   Bambra, C., Munford, L., Brown, H., et al (2018) Health for Wealth: Building a Healthier Northern Powerhouse for UK Productivity, Northern Health Sciences Alliance, Newcastle. http://www.thenhsa.co.uk/app/uploads/2018/11/NHSA-REPORT-FINAL.pdf

4   Bambra, Munford et al (2020) COVID-19 and the Northern Powerhouse, Northern Health Science Alliance, Newcastle. https://www.thenhsa.co.uk/app/uploads/2020/11/NP-COVID-REPORT-101120-.pdf

5   https://www.thenhsa.co.uk/app/uploads/2020/11/NP-COVID-REPORT-101120-.pdf

6   We use the latest available data reflecting the 13-month period (March 2020 to March 2021). We stop at March 2021 as mortality rates attributable to COVID-19 become small from April 2021.

7   Defined in the previous section; the North East, the North West, and Yorkshire and the Humber.

8   Our main comparison in the whole of the rest of England. However, in the appendices we also report comparisons for the North against the rest of England excluding London, given London was atypically affected during various stages of the pandemic.

9   The ONS use ICD10 codes "U07.1" and "U07.2" to define deaths where COVID-19 was the underlying cause. These deaths due to COVID-19 only include deaths where COVID-19 was the underlying (main) cause. Deaths "due to other causes" includes any deaths where the underlying cause was not COVID-19; this category may include some deaths where the underlying cause was not COVID-19 but COVID-19 was mentioned on the death certificate as a contributory cause of death.

10 https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/datasets/deathsduetocovid19bylocalareaanddeprivation

11 High is defined as above the mean and low is defined as below the mean.

12 Areas with higher rates of people shielding will, by definition, have higher levels of ill-health than areas with lower rates of people shielding. We have used other measures of population health and the results are qualitatively very similar.

13 100*(29.4-15.2)/15.2 = 48.299%

14 This model includes the full set of covariates discussed above.

15 We could not include August and September 2020 as they had low death counts and hence mortality rates were not defined in many local authorities, particularly in the rest of England.

16 100*(145.8-30.7)/145.8 = 78.989%

17 https://www.sciencedirect.com/science/article/pii/S2666776221001216

18 The expected level of mortality is usually obtained by using previous years.

19 https://www.medrxiv.org/content/10.1101/2021.07.05.21259786v1.full.pdf+html

20 See Figure 5.2, page 27, of: Bambra C, Munford L, Brown H, Wilding A, Robinson T, Holland P, et al. Health for Wealth: Building a Healthier Northern Powerhouse for UK Productivity. Northern Health Sciences Alliance; 2018.

21 https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/causesofdeath/datasets/deathregistrationsandoccurrencesbylocalauthorityandhealthboard

22 https://www.england.nhs.uk/statistics/statistical-work-areas/covid-19-hospital-activity/

23 https://ifs.org.uk/publications/15432

24 Data on testing was only made available from May 2020, hence we cannot include March or April 2020.

25 https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/datasets/coronaviruscovid19infectionsurveydata/2021

26 https://www.england.nhs.uk/statistics/statistical-work-areas/covid-19-vaccinations/

27 https://www.understandingsociety.ac.uk/topic/covid-19

28 For more information see: https://www.gl-assessment.co.uk/assessments/products/general-health-questionnaire/

29 NHS Business Services Authority- English Prescribing Data (EPD). https://www.nhsbsa.nhs.uk/prescription-data/prescribing-data/english-prescribing-data-epd

30 https://www.ons.gov.uk/employmentandlabourmarket/peoplenotinwork/unemployment/datasets/claimantcountbyunitaryandlocalauthorityexperimental/current

31 https://www.gov.uk/government/statistics/coronavirus-job-retention-scheme-statistics-3-june-2021

32 https://www.nomisweb.co.uk/. Original data are from the Annual Study of Hours and Earnings (ASHE).

33 Areas with higher rates of people shielding will, by definition, have higher levels of ill-health than areas with lower rates of people shielding. We have used other measures of population health and the results are qualitatively very similar.