DIRECTOR OF PUBLIC HEALTH REPORT 2023

Sheffield and the COVID-19 Pandemic. What did we learn?

Greg Fell
Greg.fell@sheffield.gov.uk

2	COVID Community Buses
10	Pharmacies providing logistical support
15	PCNs providing logistical support
105	FPNs issued
1,020	Outbreaks managed
1,500	PH Queries, FOIs and general enquiries
1952	Deaths
3,500	Vaccinations from COVID Busses
4,000	Complaints responded to
5,723	Hours of comms
13,000	Env. Health visits
13,500	Admissions to hospital
23,000	Contacts traced by local team
38,000	LFD kits distributed
55,000	Calls to community support helpline
210,600	Cases confirmed by testing
1,000,000	Tests at home & testing sites (fixed or mobile)
£ 2,000,000.00	Hardship payments
£ 2,100,000.00	Isolation Payments
£ 2,500,000.00	COVID community grants

Contents

Section 1 – A health Profile for Sheffield

Section 2. The run up to the pandemic. Will it be "the big one".

Planning for a pandemic

Sheffield has longstanding inequalities in health and wealth. We went into the pandemic in bad shape health wise, and in bad shape public sector funding and service delivery wise.

The run up

The early days of the COVID-19 pandemic in Sheffield

Establishing the picture in Sheffield

Good public health intelligence was essential for our response

Section 3 – a near term historical and epidemiological overview of the whole of the pandemic.

The initial phase – the Wuhan strain

The Alpha variant, a home grown variant initially detected in Kent

Delta – imported variants. Reminded us of the global nature of the pandemic.

Omicron – each new variant needs to be more transmissible to compete. This one was on another level

Inequality in the vaccine roll out

Section 4 – The local Response in Focus:

1. Surveillance and data challenges and learning

2. Keeping Schools Going, Managing Outbreaks and Illness.

3. Local Authority Health Protection, Outbreak Control Response

4. Voluntary and Community Sector.

5. keeping transport going.

6. Healthcare

7. The road to recovery will be long.

Section 5: Conclusions and Recommendations – Greg Fell, Director of Public Health.

1. Data saves lives

2. We can locally organise around complex multi dimension problems and deliver. A complex problem requires a whole of society response.

3. An infectious disease control playbook is necessary but nowhere near sufficient for managing an infectious disease pandemic. The baseline health status of a population is hugely important in the eventual outcomes of infection.

The Legacy. What has covid taught us

Foreword

This year's Sheffield DPH report is focused on the health inequalities that were present before the pandemic in Sheffield, the impact of COVID-19 on those inequalities across health and socio-economic themes. I try to give an overview of the detail of the whole city response from the Local Government, the NHS, the Voluntary and Community Sector (who were the trusted, credible boots on the ground in our communities). The report concludes with recommendations on what we need to do as a city to address this to better prepare for the next pandemic. Considerable focus in this report is given to the epidemiological surveillance data and reporting which was set up by Louise Brewins This was a fundamental building block of the Public Health response, from which a lot of the wider response in the city was built. Louise sadly passed away unexpectedly in November 2021.

This report is divided into four sections. The first presents a broad overview of the state of health in Sheffield with reference to data from the OHID Fingertips profiles and the Global Burden of Disease data on morbidity, mortality and risk factors. The second deals with the run up to the pandemic in early 2020. The third section uses the epidemiological intelligence generated during the response to illustrate the flow of the pandemic and the response effort. This section also contains reflections from some of those on the front line of the response effort. The fourth section focusses on the lessons learned. This report attempts to detail the immensity of the whole city response from the Local Government, NHS, VCS teams (who were the trusted, credible boots on the ground in our communities) and conclude with recommendations on what we need to do as a city to address this to better prepare for the next pandemic. Even within this lengthy report, it is impossible to spotlight all the people, stakeholders and sectors that contributed to the response. There are many who made significant contributions I have not be able to reflect.

Tribute

It is relatively unusual for a Director of Public Health to pay tribute to people in an annual report, but I will break with that tradition. Firstly I would like to pay tribute to those looked after those who were made ill with covid, to those that provided essential support to especially the most vulnerable and to all those from across the whole of the city that kept Sheffield running in some of the most testing years of our lives. We all owe you a debt of gratitude.

Secondly I would like to pay my tribute to all those who lost their lives to this illness, and to the loved ones they leave behind.

Thirdly I would like to pay personal tribute to my colleague Louse Brewins. She was the steward of many DPH reports over many years and was the lead officer for public health intelligence for such a long time period. She died suddenly and unexpectedly in November 2021. She was held in such high regard by all who knew her, and in part this report is a testament to her and the difference she made.

Contributions

Thanks to all those that contributed to the preparation of the report. Specifically, Chris Gibbons, Bethan Plant, Ruth Granger, Keith Leyland, Helen Steers, Tim Taylor, Rachel Foster, Kev Smith and many others.

Section 1 – A health Profile for Sheffield

This section of the report gives a broad overview of health in Sheffield. More detail can be found in the Sheffield Joint Strategic Needs Assessment, the Local Authority Health Profile produced by the Office of Health Improvement and Disparities at https://fingertips.phe.org.uk/ and on the Global Burden of Disease GBD Compare website at https://vizhub.healthdata.org/gbd-compare/.

The health of residents of Sheffield matters enormously. It is important in its own right (obviously people value their health and well being), poor health is increasingly recognised as a determinant of economic productivity, it obviously is important in NHS and social care demand. The gap in health between most and least affluent and between other groups in society is a critical social justice issue.

The overall story on health for Sheffield is one of stalling life expectancy and health life expectancy over the last decade or so. Like almost everywhere we went into the pandemic in poor shape health wise, and this had a significant bearing on outcomes IN the pandemic.


Better 95% Similar Worse 95% Not applicable Quintiles: Best Worst Not applicable

Recent trends: – Could not be calculated → No significant change ↑ Increasing & getting worse ↑ Increasing & getting better ↓ Decreasing & getting worse ↓ Decreasing & getting better ↑ Increasing ↓ Decreasing

Benchmark Value: Worst | 25th Percentile | 75th Percentile | Best

Indicator	Period	Sheffield			Region	England	England		
		Recent Trend	Count	Value	Value	Value	Worst	Range	Best
Life expectancy and causes of death									
Life expectancy at birth (Male, 3 year range)	2018 - 20	–	-	78.6	78.4	79.4	74.1		
Life expectancy at birth (Male, 1 year range)	2021	–	-	78.9	78.0	78.7	72.3		82.9
Life expectancy at birth (Female, 3 year range)	2018 - 20	–	-	82.4	82.2	83.1	79.0		
Life expectancy at birth (Female, 1 year range)	2021	–	-	82.0	82.0	82.8	78.6		86.0
Under 75 mortality rate from all causes	2021	–	1,705	380.5	394.9	363.4	625.1		205.7
Under 75 mortality rate from all cardiovascular diseases	2021	–	368	83.2	86.8	76.0	133.9		49.6
Under 75 mortality rate from cancer	2021	–	561	126.6	131.0	121.5	189.8		75.8
Suicide rate	2019 - 21	–	168	11.0	12.5	10.4	19.8		4.8
Killed and seriously injured (KSI) casualties on England's roads	2021	→	235	148.6*	110.8*	95.6*	469.8		31.2
Emergency Hospital Admissions for Intentional Self-Harm	2021/22	–	825	143.3	146.7	163.9	425.7		47.9
Hip fractures in people aged 65 and over	2021/22	–	540	546	546	551	741		
Injuries and ill health									
Percentage of cancers diagnosed at stages 1 and 2	2020	→	806	53.6%	50.6%	52.3%	43.7%		%
Estimated diabetes diagnosis rate	2018	–	-	77.3%	81.9%	78.0%	54.3%		5%
Estimated dementia diagnosis rate (aged 65 and over)	2022	→	4,507	70.3%	63.1%	62.0%	50.3%		
Admission episodes for alcohol-specific conditions - Under 18s	2018/19 - 20/21	–	60	17.0	27.2	29.3	83.8		7.7
Admission episodes for alcohol-related conditions (Narrow)	2021/22	–	2,842	562	533	494	840		251
Smoking Prevalence in adults (18+) - current smokers (APS)	2021	–	-	13.3%	14.1%	13.0%	22.0%		6.6%
Behavioural risk factors									
Percentage of physically active adults	2020/21	–	-	68.1%	65.2%	65.9%	48.8%		76.5%
Percentage of adults (aged 18 plus) classified as overweight or obese	2020/21	–	-	63.9%	66.5%	63.5%	76.3%		
Under 18s conception rate / 1,000	2020	→	133	14.8	16.5	13.0	30.4		2.7
Smoking status at time of delivery	2021/22	↓	-	9.4%	12.0%	9.1%	21.1%		3.1%
Baby's first feed breastmilk (previous method)	2018/19	–	-	71.7%	56.4%	67.4%	43.6%		
Child health									
Infant mortality rate	2019 - 21	–	61	3.5	4.4	3.9	7.5		1.2
Year 6: Prevalence of obesity (including severe obesity)	2021/22	↑	1,570	25.3%	24.9%	23.4%	34.0%		
Deprivation score (IMD 2019)	2019	–	-	27.1	26.0	21.7	45.0		5.8
Smoking prevalence in adults in routine and manual occupations (18-64) - current smokers (APS)	2020	–	-	19.9%	25.5%	24.5%	42.1%		
Inequality in life expectancy at birth (Male)	2018 - 20	–	-	10.9	10.7	9.7	17.0		
Inequalities									
Inequality in life expectancy at birth (Female)	2018 - 20	–	-	8.7	8.8	7.9	13.9		
Children in relative low income families (under 16s)	2020/21	↑	28,029	26.4%	25.2%	18.5%	42.4%		6.2%
Children in absolute low income families (under 16s)	2020/21	↑	24,060	22.7%	21.5%	15.1%	39.2%		5.2%
Average Attainment 8 score	2021/22	–	265,585	46.1	46.9	48.7	39.2		
Wider determinants of health									
Percentage of people in employment	2021/22	→	290,200	75.8%	74.3%	75.4%	62.9%		.1%
Homelessness: households owed a duty under the Homelessness Reduction Act	2021/22	–	3,403	13.8	12.0	11.7	29.9		4.4
Violent crime - hospital admissions for violence (including sexual violence)	2018/19 - 20/21	–	890	45.7	47.3	41.9	116.8		12.0
Excess winter deaths index	Aug 2019 - Jul 2020	–	250	15.7%	16.6%	17.4%	50.2%		0.7%
New STI diagnoses (excluding chlamydia aged under 25) per 100,000	2021	↓	-	193	285	394	2,634		103
TB incidence (three year average) New data	2018 - 20	–	130	7.4	5.9	8.0	43.1		0.6

The major causes of death and disability are detailed in the Global Burden of Disease data for Sheffield, the most recent data available are from 2019. It is important to note, a very large proportion of these deaths and causes of illness and disability are preventable or delayable.

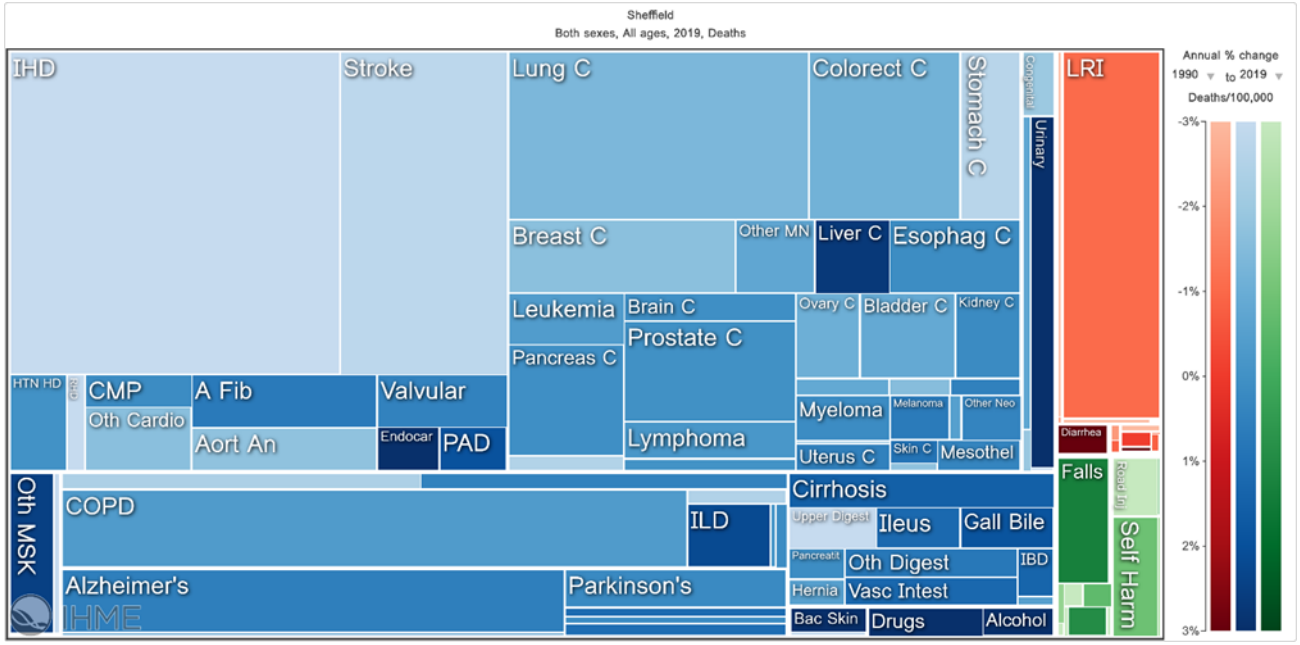


Figure 1 GBD treemap of causes of death, both sexes, all age, rate per 100,000 2019, Sheffield

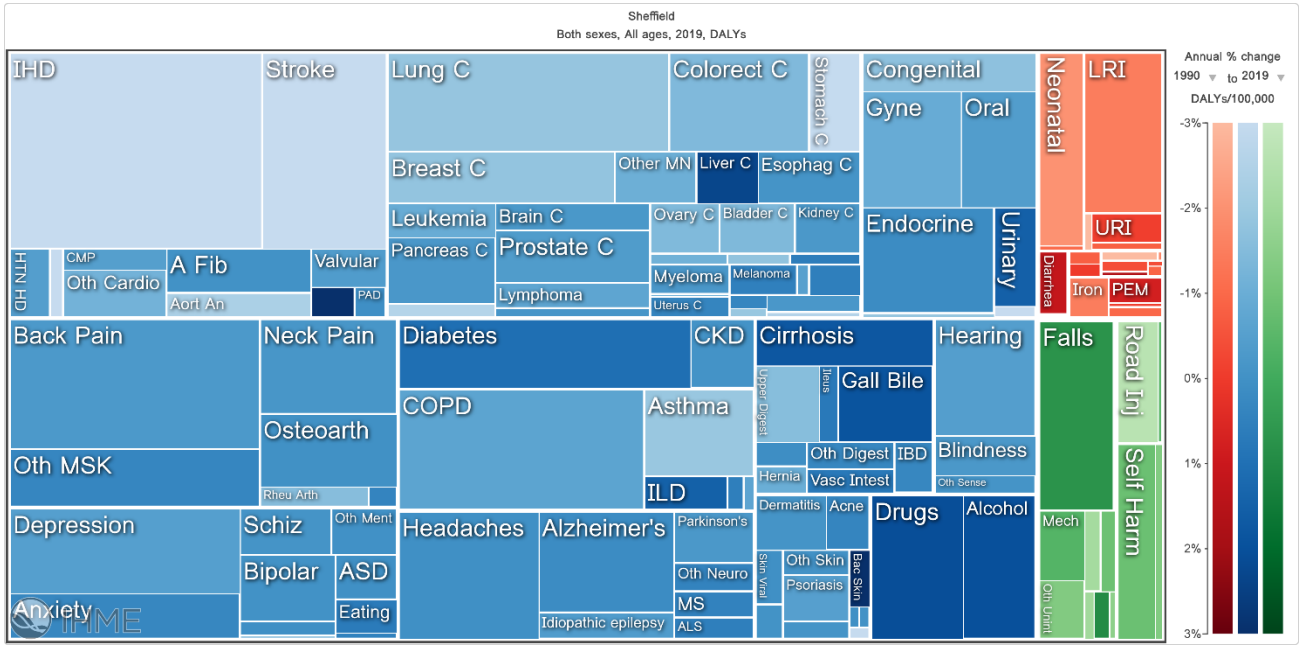


Figure 2 Disability Adjusted Life Years (DALYS) for major causes of morbidity, all ages, both sexes, Sheffield 2019

The tree maps shown in Figs 1&2 detail the major causes of death and morbidity which have remained broadly constant since 1990, with significant progress made on smoking, diet and lipid modification as well as some advances in diagnosis meaning that CVD and some cancers have seen a drop in rates for both mortality and morbidity. Worsening trends for Sheffield are shown in darker shades, and are consistent with the findings of the Lancet Commission which explored the changing health needs of the UK population. Figure 3 sets out how some of those key burdens of illness have changed for men and women over a 20 year time period for the UK, despite risk factors remaining relatively constant (Fig 4).

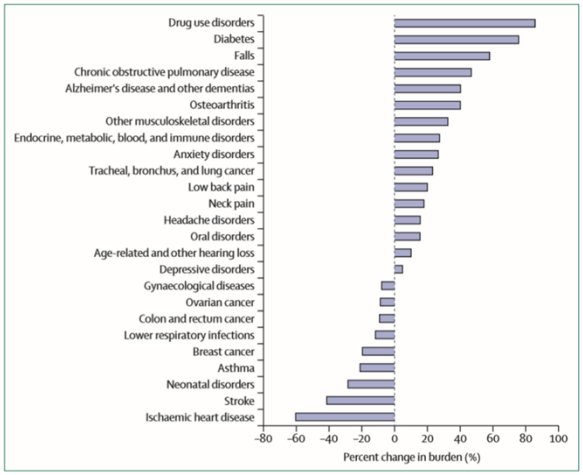


Figure 5: **Percentage change in burden due to the top 25 causes of DALYs in women in the UK, 1990–2019**
Source: Global Burden of Disease. DALY=disability-adjusted life year.

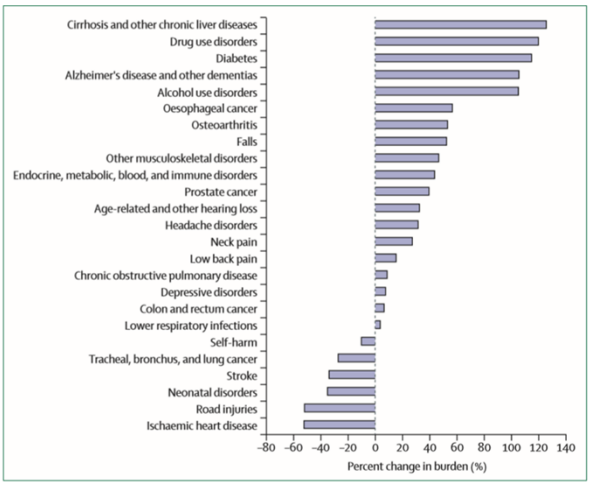
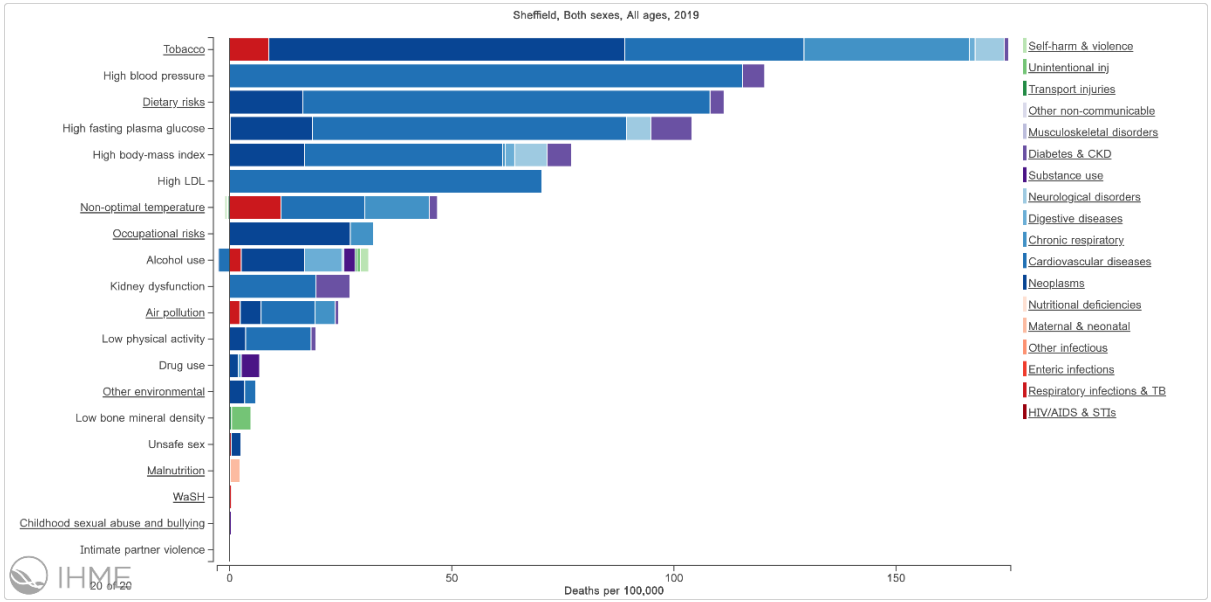


Figure 6: **Percentage change in burden due to the top 25 causes of DALYs in men in the UK, 1990–2019**
Source: Global Burden of Disease. DALY=disability-adjusted life year.

Figure 3 McKee et al. 2021 Lancet Comission

It should be noted that a large change in a something that is relatively common will not make as big an impact on overall health as a relatively small change in something that is very common. Another important hidden issue in the data is that there is a growing burden on working age people, with the percentage change evident in chronic liver diseases in men for example being indicative of this phenomena. There is also interaction between risk factors and health outcomes are often a result of the cumulative effect of multiple and overlapping risk factors. Tobacco consumption is a risk factor for cancer and cardiovascular diseases, and high blood-pressure a risk for heart disease and stroke, but tobacco consumption also causes and worsens high blood pressure, for example.



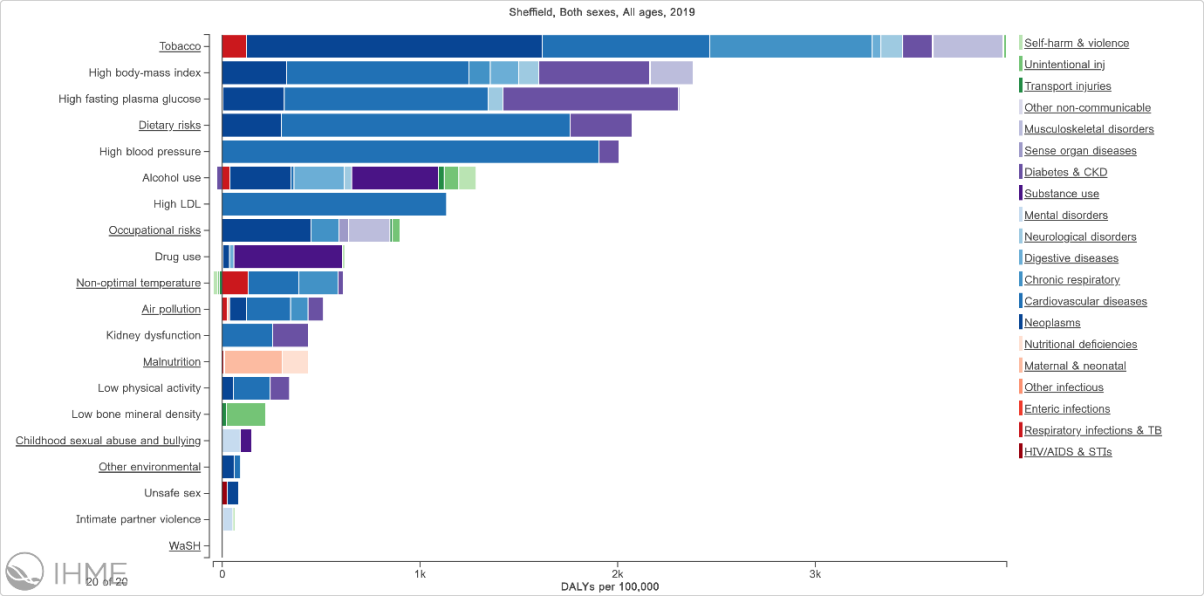
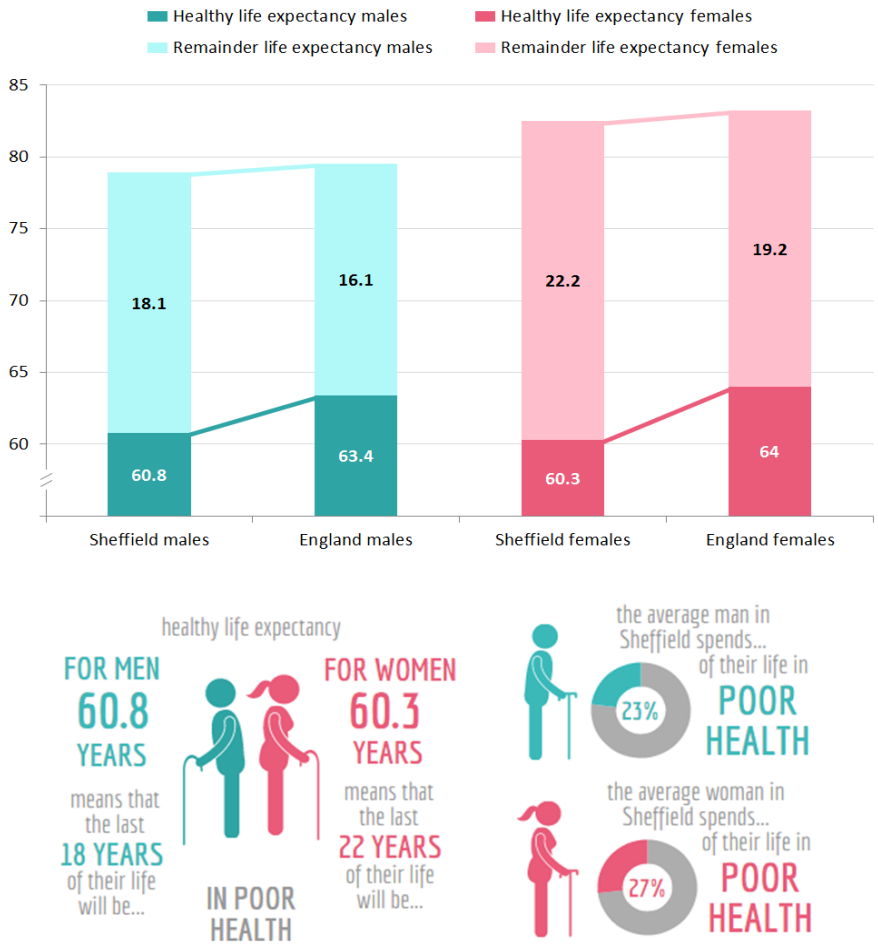


Figure 4 Risk factors for death (top) and morbidity (bottom), all ages, both sexes, Sheffield 2019

Since 2011, increases in life expectancy slowed after decades of steady improvement. In 2020, the Covid-19 pandemic itself caused a sharp fall in life expectancy larger than at any time since the Second World War. However the bigger story is the longer term trend on stalling life expectancy Health policies and interventions such as childhood immunisations, the introduction of universal health care, medical advances in treating adult diseases such as heart disease and cancer, and lifestyle changes including a decline in smoking had increased life expectancy over many years. Healthy life expectancy has also increased over time but to a lesser degree than life expectancy, so for many people more years are spent in poor health. Recent data for both life expectancy (LE) and healthy life expectancy (HLE) suggest that for much of the population historic gains are slowing down, and for those living in the most deprived areas the trend is worsening. Around 30% of the life expectancy differences between the richest and poorest areas are due to differences in the prevalence of cardiovascular and respiratory diseases, which are preventable conditions.



In Sheffield, life expectancy and healthy life expectancy direction of travel are a similar shape to the national data but the numbers are worse relative to England. What is particularly concerning is that the overall data masks considerable inequality at a local level, with people living in the most deprived areas of this city experiencing both shorter lives and a greater proportion of their lifetime in poor health relative to people in the least deprived neighbourhoods (Fig 5). A baby born in Firth Park can expect to live a third of their shorter life with poor health, with a large proportion of that in working age. A baby born in Carterknowle and Millhouses will live a seventh of a longer life with poor health.

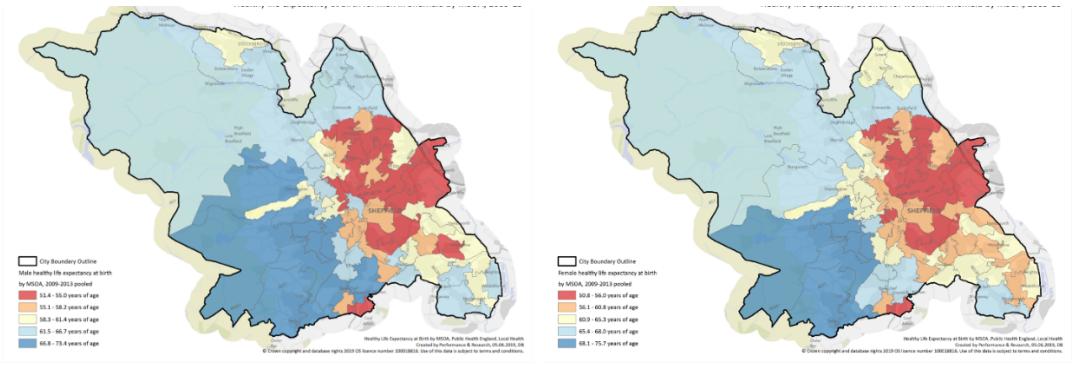
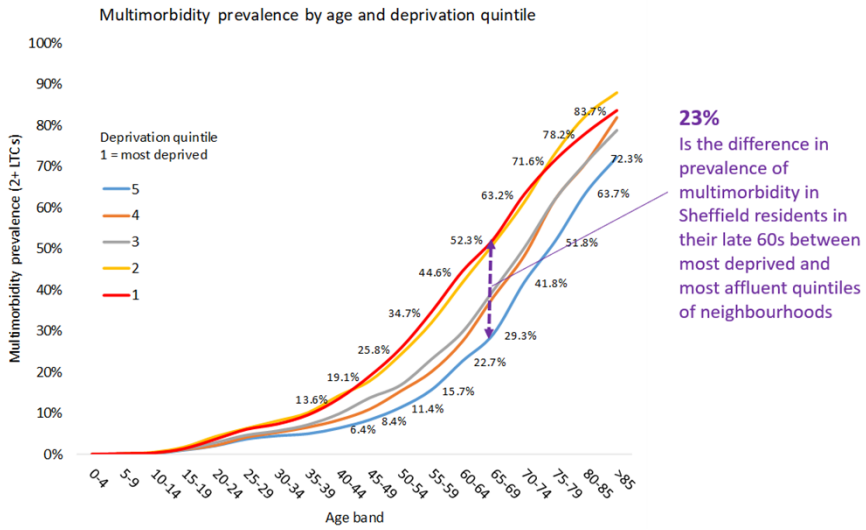


Figure 5 HLE for men and women, Sheffield

The gap in healthy life expectancy matters to both the NHS & social care, with rising demand largely from preventable non-communicable diseases (NCDs) and long term conditions (LTCs) with earlier onset in some populations. It also matters to the economy because of lost productivity on account of poor health at earlier ages. It is also, fundamentally, an issue of social justice.

Underpinning this variation is the growing problem of multimorbidity (MM), defined as two or more illnesses. In sheer numbers terms multi morbidity is more common than having only one illness, and it is more common in those of working age compared to those who are older. This was first well documented in Scotland (Barnett on multi morbidity in Scotland. Lancet 2012) but similar work has been done in many places in England over recent years (Somerset, Sheffield, Bradford) and the story is broadly the same. The key metric is that multi morbidity developed 10 -15 years sooner in people living in the most deprived areas that those in the most affluent, or at any given age an approximate 15% percentage point difference in prevalence between the same groups. Put another way, by the age of 65, 1 in every 2 people in the most deprived 20% in Sheffield will have 2 or more long term conditions - this compares to only 1 in every 4 people in the most affluent.



The principal impact of socioeconomic deprivation on the development of long term conditions (LTCs) is to bring forward the age at which they develop and accumulate. There is an approximate doubling of the prevalence of multimorbidity in most deprived relative to most affluent neighbourhoods. And this is true at all ages following the onset of LTCs. This is where NHS and social care demand comes from and represents the biggest single shift in epidemiology of non-communicable diseases in the last 3 decades. Ever more efficient systems to address health care demand will not address this problem. Multi morbidity or frailty is not "inevitable". Its constituent parts are largely preventable. From the LSE/ Lancet Commission paper on the changing health needs of the UK population: **"Meeting the challenges of the future will require an increased focus on health promotion & disease prevention, involving a more concerted effort to tackle the multiple social, environmental, and economic factors that lie at the heart of health inequalities"** – and are driving the increase in MM and declining HLE.

Despite the growing recognition of multimorbidity's importance in driving demand for healthcare services, there is evidence that resource allocation in the healthcare system has not caught up with an increasingly complex, multimorbid population. Data from the LSE/ Lancet Commission shows that funding for single specialty consultants rose considerably compared with that allocated to GPs in the ten years from 2008-2018 with the latter actually falling over the same period. See figure 3 in this paper - Securing a sustainable and fit-for-purpose UK health and care workforce - The Lancet

Framing of "health"

Again and again, conversations on health come back to being about or framed in the NHS or framed in NHS at the centre and then worked out from that focal point. It is the wrong starting point. The starting point should be the whole of government, and the structural determinants and environment not individual behaviour and personal responsibility. This point probably can't be underscored enough. The cycle of ever increasing spend on health care (mostly the high tech variety where the incremental marginal benefit is low relative to cost) comes with the opportunity cost of less health (as investments with a much higher value in health terms get crowded out). **The opportunity cost of more medicine is less health.** Illich wrote about this at least 5 decades ago.

The data shown in the charts in figure 4 further emphasises that ill health and its main drivers are amenable to prevention and intervention. There is a temptation to view this data and reduce the risk factors and the burden of ill health to a simplistic and false narrative about poor individual choice and a lack of 'personal responsibility' for health. Commercial actors and media outlets sympathetic to this narrative encourage policy to be shaped around the individual and education to make 'informed decisions' about commodities that are addictive, harmful, and heavily promoted. This detracts from investment in upstream interventions which have much greater benefit to population health (see Defining and conceptualising the commercial determinants of health - The Lancet 2023 for more detail).

Why does this matter in the context of a pandemic?

The overall story on health is of a stalled improvement based on historical trends. The underlying health of a population matters enormously to individuals and to society. However, it also mattered to the spread of covid and the impact of COVID-19 on Sheffield particularly with reference to the inequitable nature of that impact.

The illness profile is largely made up of what is known as non communicable disease (or NCD). Preventable illness. Not really a function of "lifestyle choices" but a function of social, commercial and other determinants of our health.

Sheffield in 2020 had broadly well understood and stable causes of ill health in the population. There were concerning trends in LE and HLE which were indicative of worsening inequalities in some areas and were underpinned by the growing problem of multi-morbidity. When COVID-19 arrived in Sheffield, its impacts were overlaid on top of those existing inequalities.

Multimorbidity is a defining feature and single biggest shift in epidemiology in the last three decades. It is caused by multiple, often preventable or delayable illness and is not simply a function of an ageing population. Multimorbidity and frailty are not inevitable, and the inequality in the prevalence of multimorbidity and frailty was a major contributor to the unequal impacts of the pandemic.

The underlying health status of a population, particularly the unequal nature of it, when combined with underpinning inequality in differences in social and economic factors (overcrowded housing, the financial inability to be able to afford isolation, the type and nature of some roles meaning they cant be undertaken remotely) explain a large proportion of inequality in exposure to the virus, overall infection force and outcomes from the virus.

The pandemic was marked by a series of phases characterised by the dominant strain of COVID-19 circulating at the time, the non-pharmaceutical interventions deployed by the government to mitigate against it, and the numbers of cases, hospitalisations and deaths.

Section 2. The run up to the pandemic. Will it be "the big one".

Planning for a pandemic

An influenza pandemic has been at the top of the National Risk Register for decades and in the years running up to the coronavirus pandemic I had been involved in two national pandemic planning exercises, in addition to the 2009 swine flu pandemic. While they were for influenza, not coronavirus, many of the big issues identified in these exercises turned out to also be of significance in the COVID-19 pandemic, such as social care, supplies of personal protective equipment and when to close schools. The point of planning exercises is to be prepared but, unfortunately, society did not take heed of the important lessons from these exercises.

We did have a pandemic influenza plan for Sheffield, and it stood us in good stead, many of the mechanisms set up across the city were built on the pandemic flu plan. The properties of the virus played out differently to influenza – COVID-19 was more transmissible and showed symptoms later, there was debate in early 2020 about the degree to which airborne transmission was significant and it became clearer over time that it was - but the structures that were set out in the pandemic influenza plan were largely the ones we used during the pandemic. You can never plan for all eventualities, things adapt and evolve, but the basic principles and structures were there.

Sheffield has longstanding inequalities in health and wealth. We went into the pandemic in bad shape health wise, and in bad shape public sector funding and service delivery wise.

In February 2020, as the pandemic unfolded, Sir Michael Marmot published *Health Equity in England: The Marmot Review 10 Years On*. In it, he described stalling improvements in life expectancy, people spending more of their lives in ill health and a growing gap in health between the richest and poorest in society. For the most deprived 10% of people in Yorkshire and Humber, life expectancy has actually fallen.

We see these structural inequalities impacting health locally. There is a big difference in health in Sheffield between the East and the West of the city; between the most deprived and the least deprived. Less measurable, but no less present, are differences by ethnicity, disability and in those with severe mental illnesses. These health gaps are unjust.

As we later saw, underlying social and economic inequalities badly impacted outcomes from the pandemic. Factors such as overcrowded housing and not being able to afford to isolate really mattered for transmission. This did not become apparent until too late. One of my critical bits of learning was that we went into a pandemic with an infectious disease control playbook, but it soon became apparent this was not sufficient and we couldn't control spread with only the traditional tools of health protection which for a respiratory virus were based heavily on a pandemic influenza scenario. A whole of society response, taking into account underlying structural inequalities was necessary. The importance of a trusted message and trusted messenger became particularly apparent early on.

The run up

Like most people, my first knowledge of COVID-19 was from stories on the news about an outbreak of a viral pneumonia in China towards the end of 2019. In late December I received an email from a colleague at Public Health England. He had forwarded on an alert from the World Health Organization about the virus commenting, "You might want to watch out for this one". At the time it is almost impossible to pick out the signal from the noise. WHO send literally hundreds of "novel disease" alerts in any given year. Very few take off.

By January 2020 it was obvious that if this was not going to the "The Big One", then it was certainly going to be something of significant international concern. The virus was already spreading in Southeast Asia, and it was apparent that it was going to reach Europe and eventually the UK.

The early days of the COVID-19 pandemic in Sheffield

The public health team were on high alert from January 2020. In the early days we knew very little. We did not know how transmissible or severe it would be. The UK had its first confirmed cases by the end of January and Sheffield's first cases came towards the end of February when two passengers from the Diamond Princess cruise ship were transferred to our specialist infectious diseases unit. More cases came as people travelled home from in particular February half term holidays in Europe where the virus was spreading rapidly, and it took off from there. During this period teams in Public Health England were leading contact tracing activities, this undoubtably slowed and blunted transmission and this is under recognised. Our local efforts were hampered by lack of testing capacity, however in Sheffield in particular we were quick off the mark in this space thanks to the efforts of STH lab team and Primary Care Sheffield. The contact tracing efforts of PHE were also hampered by lack of capacity, PHE put out a number of asks for mutual aid.

In the run up to the lockdown, I was talking to a lot of our community and faith institutions and people were calling for society wide action, including what eventually became known as "lockdown". legally and mandate wise there was nothing that could be done until the Prime Minister made his statement on March 23rd, locking the country down. At that time society was scared and compliance with the lockdown was really very high, as was evidenced in human movement data taken from phones and other sources.

Establishing the picture in Sheffield

Very little data was available to our public health team in the first few months. The first information we had came from early testing at Sheffield Teaching Hospitals, but we knew this was a gross underestimation of what was really happening. Public Health England surveillance reports were excellent but could not give us the granular information we needed to support the people of Sheffield. It was a long and uphill battle to get access to the data we needed to provide an accurate picture of what was happening in Sheffield and to enable a focused operational response. As more data became available, the Public Health Intelligence Team skilfully brought together information from multiple sources to give us the truest picture they could of the situation in Sheffield. We made the best decisions we could with the information available to us.

It was four months into the pandemic before we had access to all of the testing data we needed to enable accurate epidemiological reports. By the summer of 2020, a weekly surveillance report was produced, knitting together data from various sources, and this was perfected and crafted over time.

Good public health intelligence was essential for our response

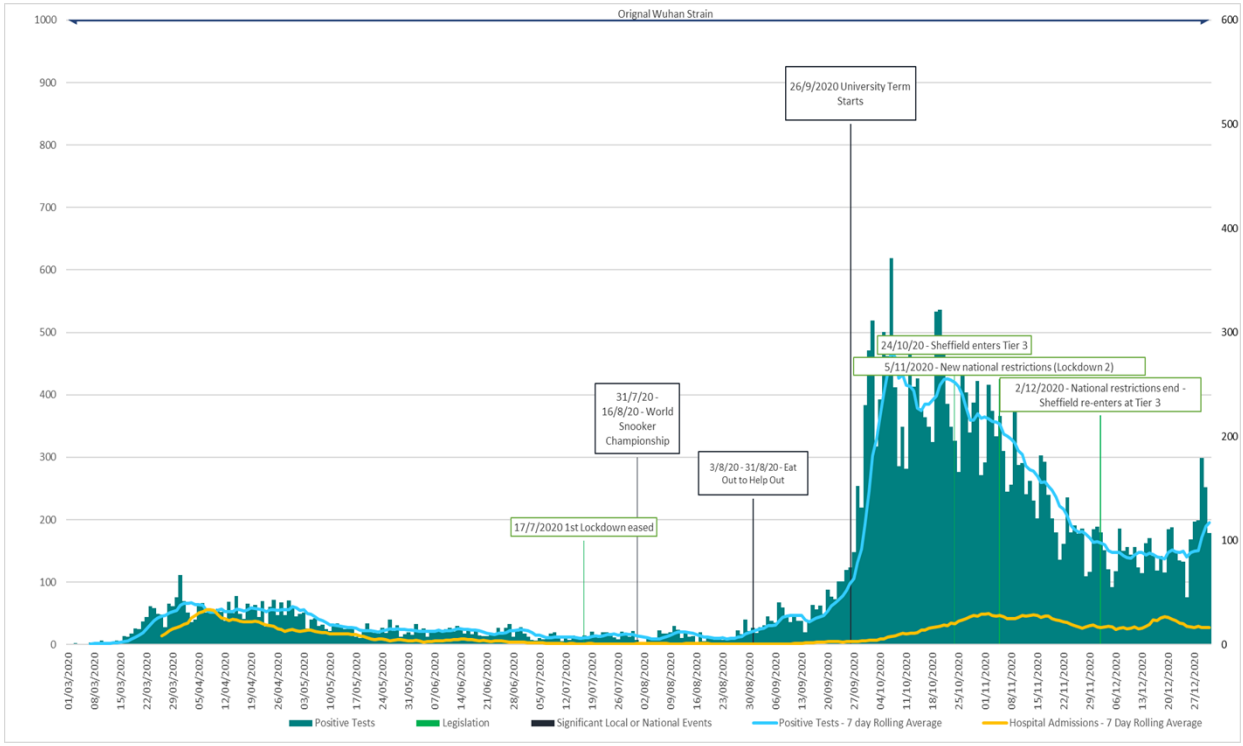
Having a clear picture of what was happening in Sheffield was invaluable because it allowed us to target our interventions. Knowing that cases were high in a particular geographical area or specific setting allowed us to step up our engagement and education activities in those areas. It also told us where to focus our energy in terms of contact tracing.

Good public health intelligence also informed the narrative for Sheffield City Council's communications with the city. My weekly videos were heavily informed by the weekly surveillance reports.

Section 3 – a near term historical and epidemiological overview of the whole of the pandemic. The power of data to tell the story and to direct interventions.

The following section describes each of those phases from the original Wuhan strain through to the most recent – Omicron.

The initial phase – the Wuhan strain



Looking at the whole pandemic timeline, the original wave of Covid looks relatively small but this is certainly an underestimation. It is unknown (or more accurately it is known with less certainly) what case levels for the original Wuhan strain of Covid-19 were in the early days of the pandemic before mass public testing came available.

As most testing at this stage was being carried out in hospitals, thus most of the "cases" are those that were poorly enough to be admitted. Obviously we know this is a significant under estimate as there will have been significant community based transmission in this time. Community testing, what became known as Pillar 2 (community testing) was rolled out in May 2020. From then members of the public able with symptoms were able to access PCR tests via test centres - initially just a single 'drive-thru' centre at Meadowhall, later expanded to several semi-permanent community test centres and a mobile unit deployed to hot spots.

By the time we were finally getting full data on who had covid locally, lockdown had had a significant effect and case numbers and hospitalisations had fallen. Summer 2020 was a quiet period in terms of case numbers – despite lockdown (the full 'stay at home' restrictions) ending, many non pharmaceutical interventions remained such as table service only at licensed premises, travel restrictions, encouraging (and enforcing) social distancing, limits on numbers attending events (the delayed world championship snooker, for example) and mask wearing. Many indoor premises (e.g. theatres, children's soft play) remained closed until mid-August. Local lockdowns were in force in Leicester at this time and the enforcement of local restrictions was a real possibility; case numbers in Sheffield were watched carefully for signs of a summer wave that did not materialise.

In September cases in Sheffield started to climb again – this coincided with the university term beginning, which led to some speculation that students travelling from many parts of the country and enjoying an active social life were driving Sheffield cases to unprecedented levels. Whilst student cases played their part in the autumn wave, taking the long view, it can be seen that cases were in fact rising before the start of the university term. The general appetite to 'get back to normal' started an inevitable rise in cases correlated with increased levels of social-mixing. Further analysis of the age breakdown of the autumn 2020 wave shows a stacking effect – whilst cases in the 18-24 age group were initially high (this is also reflected in the low ratio of cases to hospitalisations in the early part of this wave – young people were much less likely to be hospitalised)), cases eventually spread upwards through the age bands to all age groups. Thus this was a community-wide wave.

A significant government intervention followed this wave –the 'tier system', with differing levels of restrictions depending on case numbers. Sheffield was immediately placed in Tier 3 – hospitality venues closed (although shops and hairdressers remained open), social mixing indoors was banned and outdoor mixing was restricted to groups of six.

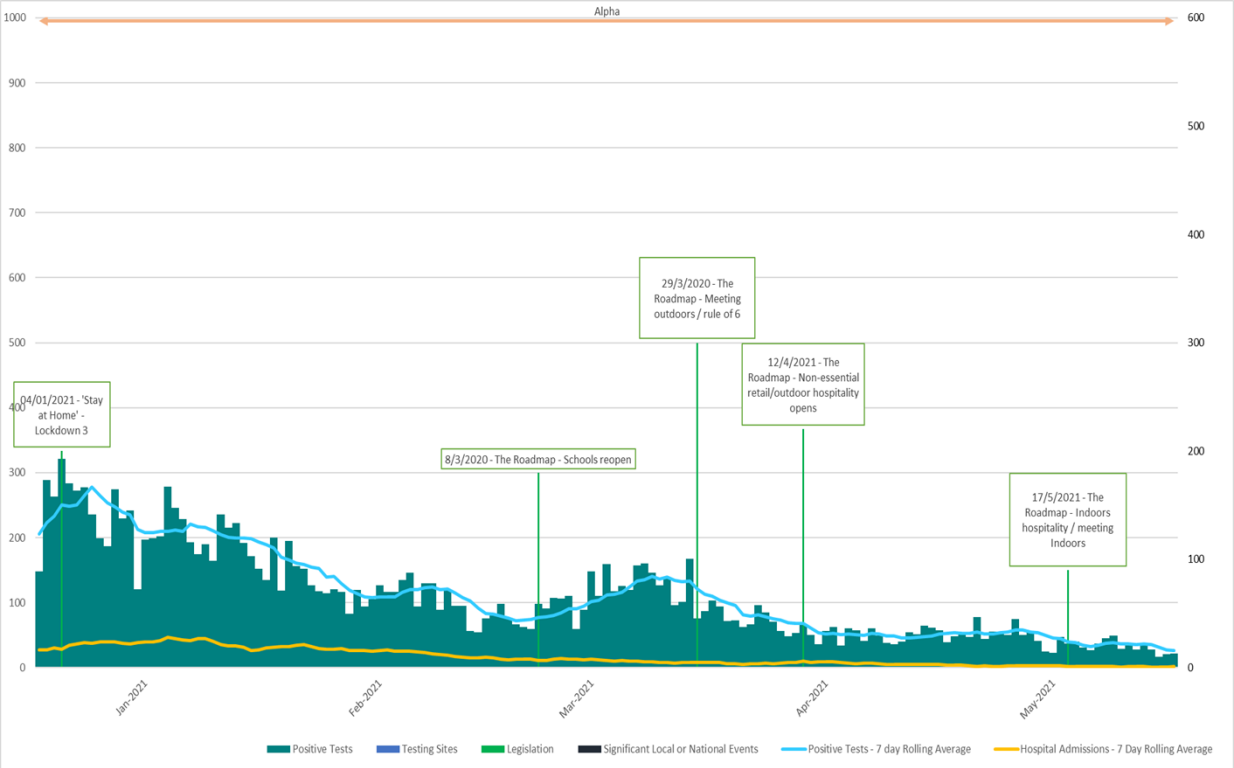
Cases in Sheffield initially fell back from their peak but then peaked again toward the end of October – with hospitalisations rising throughout October, showing this general community spread was now reaching those more vulnerable to hospitalisation. With cases rising precipitously nationally, on the 4th November a new lockdown was declared. At that time, Sheffield had been in Tier 3 for the best part of a month. Cases began to fall and on the 2nd of December the national lockdown was declared over, and Sheffield was once again placed in Tier 3. Cases began to plateau in Sheffield at a level, which at the time, seemed alarmingly high, with hospital admissions remaining high.

The Alpha variant, a home grown variant initially detected in Kent

Coming into Christmas 2020 the government implemented a policy of 3 households being able to mix over the Christmas period (from 23rd to 27th December). However on the 19th December (alongside placing London and South East in Tier 4 due to the emergence and rapid spread of the Alpha variant and steepening daily case counts) it was announced that 3 households would only be able to meet on Christmas Day itself.

The vaccine roll out began in December 2020 (with the first dose in the UK administered on 8th December 2020) the subsequent case figures, hospitalisation rate and indeed the response to covid has to be seen with this in mind and in the context of a vaccine being available. Whilst we didn't know precisely the real world impact of the vaccine at the time, we now know the vaccine had a limited effect on transmission, but a very significant effect on preventing serious illness and death. From December 2020 onwards, the epidemiology also needed to take into account strain type and characteristics, NPI implementation at both individual (face mask) and policy level (restrictions on movement and mixing), vaccine coverage, speed of roll out and the impact of vaccine on infection rates and illness & death rates.

Responding to increased social mixing over Christmas, coupled with a new more transmissible variant, cases began to rise in Sheffield with a sharp elbow in the data immediately after the Christmas period. At this point in January 2021 the Alpha variant became the dominant strain being picked up in Sheffield testing – somewhat delayed from its rise and spread in the South East of the country.



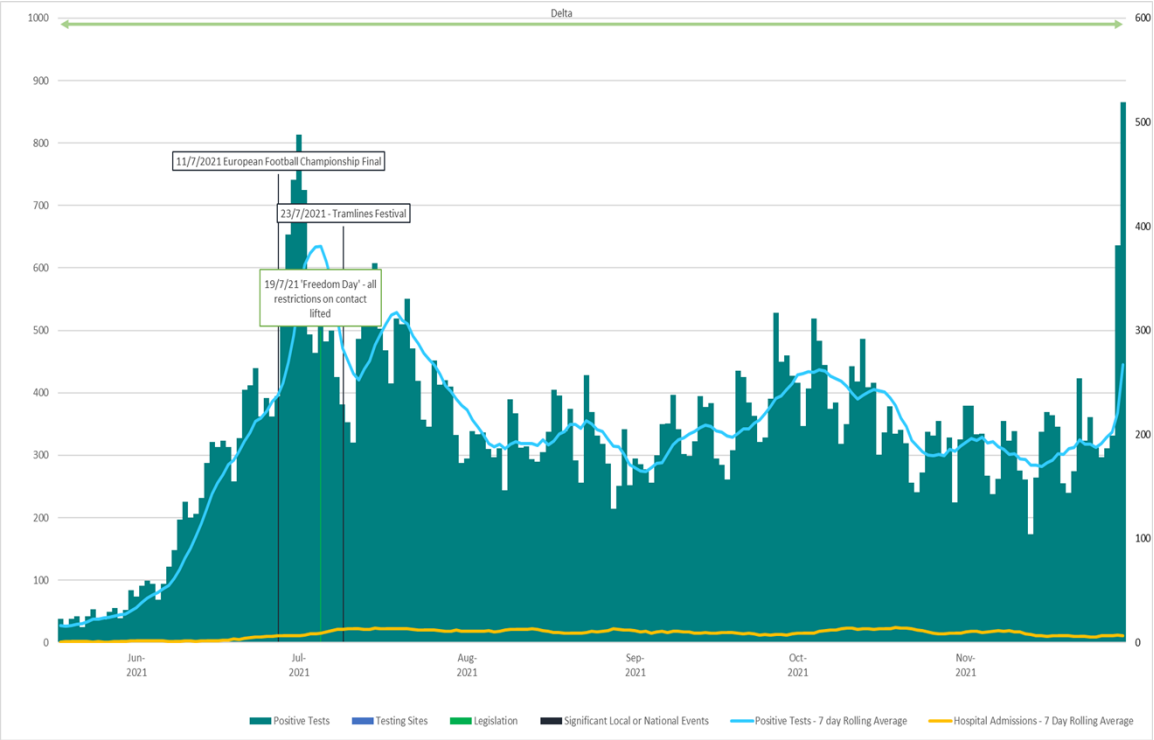
The spread of alpha prompted a third lockdown on 4th January 2021, which unlike the short lived second lockdown in November 2020, resembled the more complete 'stay at home' instruction first issued in March 2020. Schools were once again closed, people were asked to work from home where possible and all socialising (indoor and outdoor) was restricted to one household (or household bubble). In Sheffield, however, potentially due to having been in something resembling lockdown (Tier 3) since October 2020, cases continued to fall from their peak. However, hospitalisations remained high and vulnerable settings were on high alert for outbreaks.

In February the government announced the 'roadmap' a number of steps out of lockdown conditional on cases continuing to fall and the continued success of the vaccine rollout. These steps would be taken on a national rather than local basis.

From April 2021 lateral flow device (LFD) tests were made available to the general public and began to contribute to the positive test figures.

Having reached a low at the start of March 2021, Sheffield figures began to rise as schools reopened as the first step out of lockdown. The rise was gentle and short-lived and cases continued to fall, to a plateau of around 50 cases a day in Spring 2021. Other roadmap steps such as allowing meeting outdoors (in groups of six), non-essential retail opening and finally indoor meeting and hospitality did not seem to upset this equilibrium. The assessment at the time was that case numbers seemed high compared with the original Wuhan strain but the success of the vaccine programme was preventing serious illness and hospitalisation. A certain level of community spread was expected, given the extra transmissibility of the Alpha variant. It is worth noting that some vestiges of lockdown behaviour and caution also remained – for example mask wearing on transport and in indoor spaces was still advised. The relative success in opening up after lockdown led to the government setting 21st June 2021 as the date when all restrictions would be removed and lockdown would be declared over. However, a new variant, Delta, first identified in India, was causing concern – not only was it more transmissible (repeating the advantage Alpha had over the Wuhan strain) it also appeared to cause more severe complications and hospitalisation. 'Freedom Day' was postponed for four weeks to the 19th July 2021.

Delta – imported variants. Reminded us of the global nature of the pandemic.



Delta became the dominant variant detected in Sheffield in June 2021. The easing of restrictions, coupled with this new variant (although the contribution of factors remains a subject for research) led to accelerating growth.

However, the success of the vaccine programme kept hospitalisations and deaths low.

Cases of delta continued to climb as the easing of all restrictions – 'freedom day' – approached. The England men's football team also made progress through the delayed European Championships – a factor correlated with more mass mixing in pubs and other venues. Cases continued to rise after the final match peaking at 813 recorded positives on 15th July. The easing of restrictions two days later on the 17th actually coincided with a drop in cases before another 'mass event' – the Tramlines festival prompted another peak (smaller than the previous). After a month of decline going into Autumn, the Delta variant appeared to settle in an oscillating pattern of around 300 cases a day and 10 hospital admissions per day. Despite these low numbers, this rolling plateau of Covid-19 cases placed a significant burden on healthcare. Peaks in this oscillation appeared to be associated with the return of schools and universities – but crucially, due to vaccine coverage, LFD testing and some remnants of NPIs (encouragement to self-isolate, hand washing, mask wearing) there was no runaway growth and precipitous increase in hospitalisations.

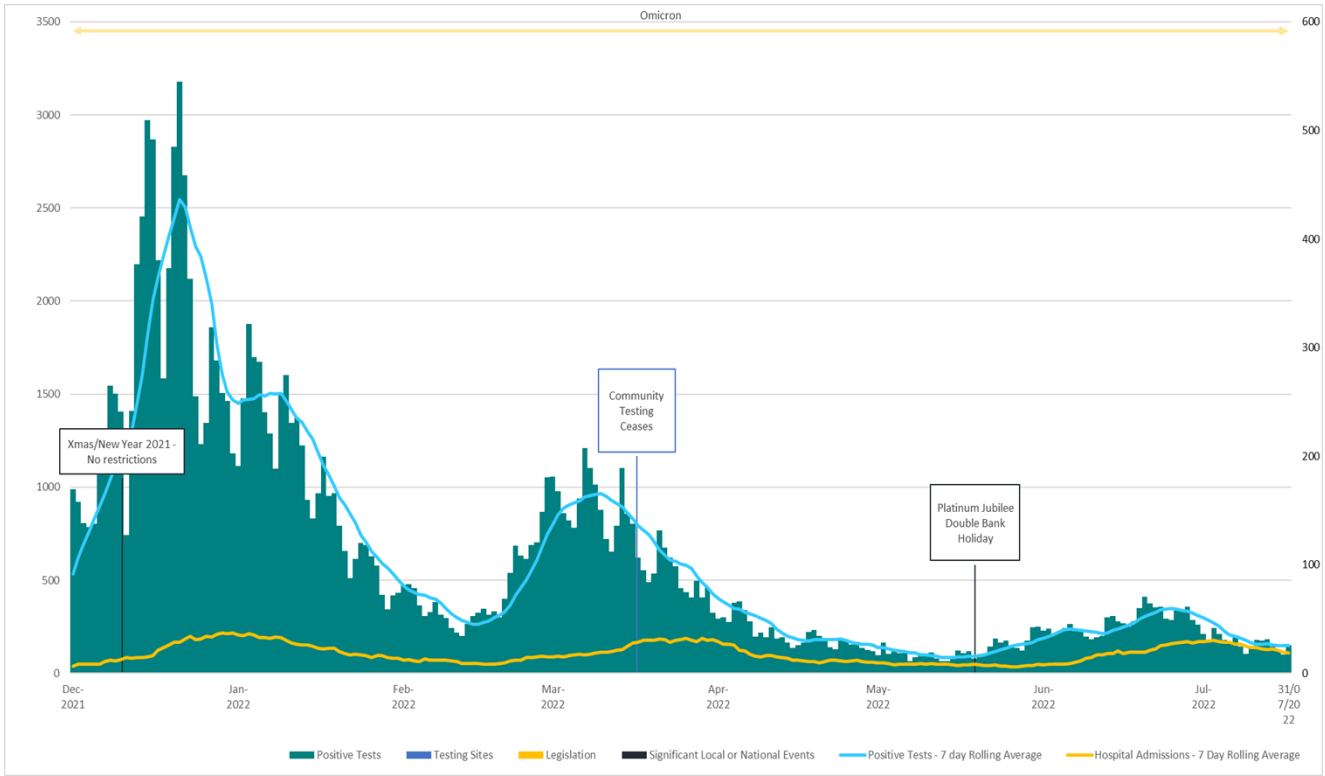
The Omicron variant, first identified in South Africa was first identified in UK samples at the end of November 2021. Omicron had – like Alpha and Delta before it – the advantage of being more transmissible. It also had significant immune escape – this means previous infection (with Wuhan or subsequent variants) and the vaccines already delivered provided little protection from re-infection. However, initial reports from South Africa suggested Omicron infection was less likely to result in serious illness and hospitalisation compared with Delta.

Omicron – each new variant needs to be more transmissible to compete. This one was on another level

The two features of Omicron – greater transmissibility and reduced severity of illness following infection – set the scene for the next change in the case count data. Despite much debate over short 'circuit breaker' lockdowns or reintroduction of some restrictions there was no change to the government stance on restrictions. Coupled with the fact that it was now winter, where respiratory diseases get an advantage as much socialising and activity occurs indoors, there was nothing short of an explosion in cases dwarfing all previous waves (apart from perhaps the original Wuhan wave, which was not monitored by mass testing). In the run up to the Christmas/New Year period cases began to climb steeply, eventually peaking at a 7 day average of 2547 on 4th January which was higher than the previous peak in July.

A number of sub-lineages of Omicron (not sufficiently different to be designated new Greek letters) began to circulate. This added complexity to the picture as reinfection rates (included in the figures from the end of January 2022) differed depending on previous infections with different sub-lineages seeming to provide varying levels of protection against others.

Cases fell almost as steeply as they had risen to a low of around 280 cases per day in mid-February. Cases then rebounded to a 7 day average of almost 1000 before falling back. On 1st April 2022, testing was no longer available to the public (and the fall coinciding with this could perhaps in part be attributed to the signal this sent as to the utility of getting tested). At this point the case rate data loses its reliability. However, LFD tests continued to be reported, as did tests carried out in hospitals and other health care settings. What is noticeable from the Omicron chart – despite this unreliability over the true number of community cases – is the flatness of the hospital admissions line (averaging 15 admissions a day in summer 2022). Despite vastly reduced harm as seen in the deaths figures but also in detailed hospital figures around the interventions required and time spent in hospital, Covid remained ongoing issue that hospitals and other settings had to deal with, effectively putting the NHS on a winter pressures footing throughout the summer of 2022.



There were significant inequalities in the impacts of the different waves. For each wave we noticed a pattern that the strain was first detected in the west of the city (likely more testing) then spread equally across the city but concentrated in the East of the city (largely on account of underlying structural factors – type and nature of work, zero hours contracts, low pay, ability to isolate at home in crowded housing. For each wave we noticed that the concentration of cases was highest in decile three (probably work patterns). For each wave we are clearly able to observe that the hospitalisation and death rate tracks underlying case rate, age, vaccination coverage, and baseline health status. Thus we know within Sheffield the pattern of the epidemiology and the impact reflects socio economic profile and economy structure.

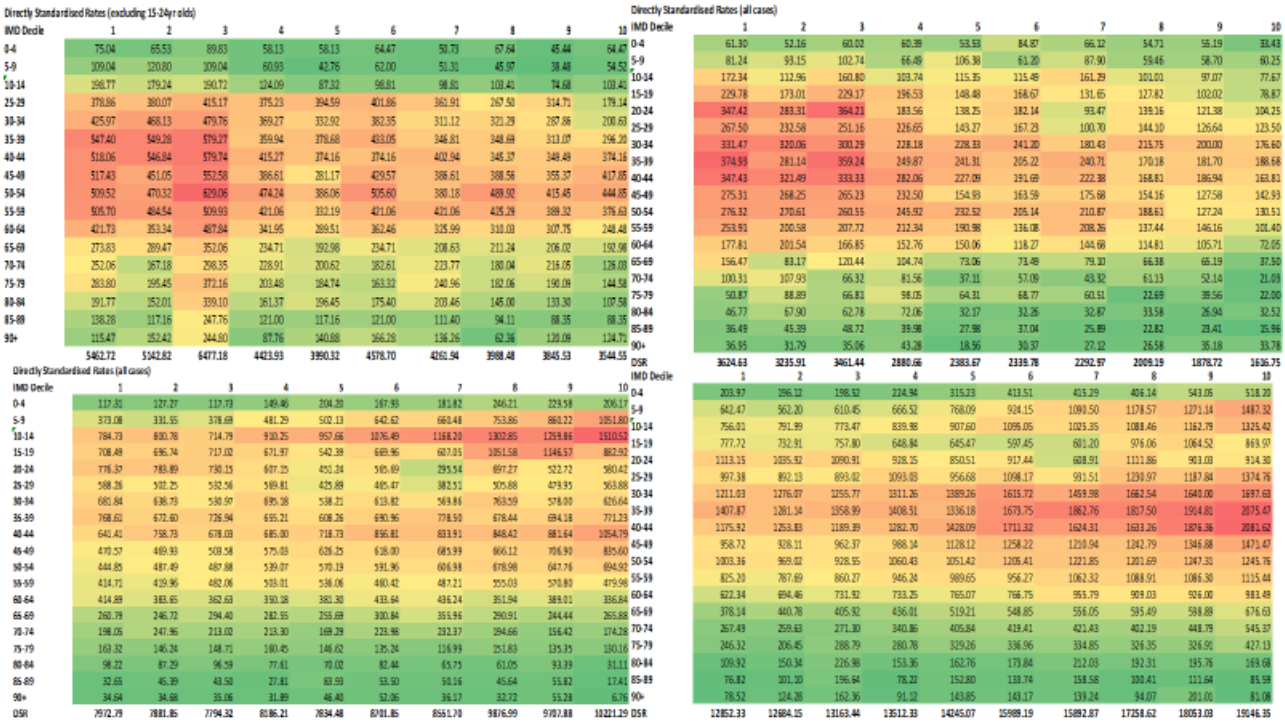
However, there were considerable blind-spots in the data we were able to collect at the time on these inequalities. Cases information was by far the most detailed and near-real time data available, along with hospital admissions activity. The latter did not give detailed information on age and ethnicity in a way that could be linked with other data to improve surveillance and, particularly during the vaccine rollout, was a missing piece of intelligence which could have contributed to that effort.

Figure 6 DSR COVID Cases per 100,000 for each wave, with IMD Decile on the x-axis (decile 1 is most deprived, decile 10 most affluent). Note for Wuhan the cases are plotted with and without the HE-age population since many halls of residence are located in less deprived neighbourhoods.

It is notable that in the Wuhan and particularly the Alpha waves, there is a clear bias in positive cases towards more deprived areas and to people of working age. This is because these people weren't able to work from home, or couldn't afford not to be at work because of low pay/insecure employment. The most dangerous time period of the pandemic was before vaccination. Although vaccination started in December 2020 it was April 2021 before people age 50 were getting their first vaccination. So the most dangerous period was from onset in March 2020 through to about April / May 2021. Affluence really protected people during this time period (Wuhan and Alpha) because more affluent people were in jobs that could be done from home, or could afford not to go into an office. Poorer people were in jobs that couldn't be done from home, so were more exposed to the virus (and therefore illness and death) on a daily basis. By the time Delta came around, most eligible

people had had at least 1 if not 2 vaccines and because of the success of the vaccine on preventing serious illness and death, this meant more affluent people could afford to be exposed to the virus (through social mixing and other means) hence the changing nature of the charts in Figure 6.

Notice also that in the first two waves, cases were more numerous in older people in the lowest quintiles of deprivation. This is partly because in Sheffield there is a higher number of care homes in the lowest (most deprived) quintiles, and also reflects that older adults in less deprived areas were better able to shield for longer. During Delta (bottom left Fig 7) the data became shaped more by mandatory testing requirements in certain workplaces and in schools. Positive test results at this time still required mandatory isolation which for many meant potential financial hardship, missed education and other opportunities to meet family and loved ones. Whilst some central government support was available the degree to which this was sufficient to enable isolation and encourage the uptake of testing requires further research. During Omicron, cases were more concentrated among working age adults and particularly those in less deprived areas, some of whom had avoided infection (being more likely to work from home etc) and others who were becoming reinfected as attitudes to risk and mixing changed following widespread vaccination and the easing of restrictions.



Directly Standardised Rates (excluding 15-24yr olds)

IMD Decile	1	2	3	4	5	6	7	8	9	10
0-4	75.04	65.53	89.83	58.13	58.13	64.47	50.73	67.64	45.44	64.47
5-9	109.04	120.80	109.04	60.93	42.76	62.00	51.31	45.97	38.48	54.51
10-14	198.77	179.24	190.72	124.09	87.32	98.81	98.81	103.41	74.68	103.41
15-19	378.86	380.07	415.17	375.23	394.59	401.86	362.91	267.50	314.71	179.14
20-24	425.97	468.13	479.76	369.27	332.92	382.35	311.12	321.29	267.86	200.63
25-29	547.40	549.28	579.27	359.94	378.68	433.05	346.81	348.69	313.07	296.20
30-34	518.06	546.84	579.74	415.27	374.16	374.16	402.94	345.37	348.48	374.18
35-39	517.43	451.05	552.58	386.61	281.17	429.57	388.61	388.56	355.37	417.85
40-44	509.52	470.32	629.06	474.24	386.06	505.60	380.18	489.92	415.45	444.85
45-49	505.70	494.54	509.93	421.06	332.19	421.06	421.06	425.29	389.32	376.63
50-54	421.73	353.34	487.84	341.95	269.51	362.46	325.99	310.03	307.75	248.48
55-59	273.83	289.47	352.06	234.71	192.98	234.71	208.63	211.24	206.02	192.98
60-64	252.06	267.18	298.35	228.91	200.62	282.61	223.77	180.04	216.05	126.03
65-69	283.80	295.45	372.16	203.48	284.74	263.32	240.96	182.06	190.09	144.59
70-74	191.77	252.01	339.10	261.37	196.45	175.40	203.46	145.00	133.30	107.59
75-79	138.28	117.16	247.76	121.00	117.16	121.00	111.40	94.11	88.35	88.35
80-84	115.47	152.42	244.80	87.76	140.88	166.28	136.26	62.36	120.09	134.75
85-89										
90+										
DSR	5462.72	5142.82	6477.18	4423.93	3990.32	4578.70	4261.94	3988.48	3845.53	3544.55

Directly Standardised Rates (all cases)

IMD Decile	1	2	3	4	5	6	7	8	9	10
0-4	61.30	52.16	60.02	60.39	53.53	84.87	66.12	54.71	55.19	33.43
5-9	81.24	93.15	102.74	66.49	106.38	61.20	87.90	59.46	58.70	60.25
10-14	172.34	112.96	160.80	103.74	115.35	115.48	161.29	101.01	97.07	77.67
15-19	229.78	173.01	229.17	196.53	148.48	168.67	131.65	127.82	102.02	78.87
20-24	347.42	283.31	364.21	183.56	138.25	182.14	93.47	139.16	121.38	104.25
25-29	267.50	232.58	251.16	226.65	143.27	167.29	100.70	144.10	126.64	123.50
30-34	331.47	320.06	300.29	228.18	228.33	241.20	180.43	215.75	200.00	176.60
35-39	374.93	281.14	359.24	249.87	241.31	265.22	240.71	170.18	181.70	188.68
40-44	347.43	321.49	333.33	282.06	227.09	191.69	222.38	168.81	186.94	163.81
45-49	275.31	268.25	265.23	232.50	154.93	163.59	175.68	154.16	127.58	142.93
50-54	276.32	270.61	260.55	245.92	232.52	205.14	210.87	188.61	177.24	130.51
55-59	253.91	200.58	207.72	212.34	190.98	136.08	208.26	137.44	146.16	101.40
60-64	177.81	201.54	166.85	152.76	150.06	118.27	144.68	114.81	105.71	72.05
65-69	156.47	83.17	120.44	104.74	73.06	73.48	79.10	66.38	66.19	37.50
70-74	100.31	107.93	66.32	81.56	37.11	57.09	43.32	61.13	52.14	21.09
75-79	50.87	88.89	66.81	58.05	64.31	68.77	60.51	22.69	39.56	22.00
80-84	46.77	67.90	62.78	72.06	32.17	32.26	32.87	33.58	26.94	32.52
85-89	36.48	45.39	48.72	39.98	27.98	37.04	25.89	22.82	23.41	15.96
90+	36.95	31.79	35.06	43.28	18.56	30.37	27.12	26.58	35.18	33.78
DSR	3624.63	3235.91	3461.44	2880.66	2383.67	2339.78	2292.97	2009.19	1878.72	1636.75

Directly Standardised Rates (all cases)

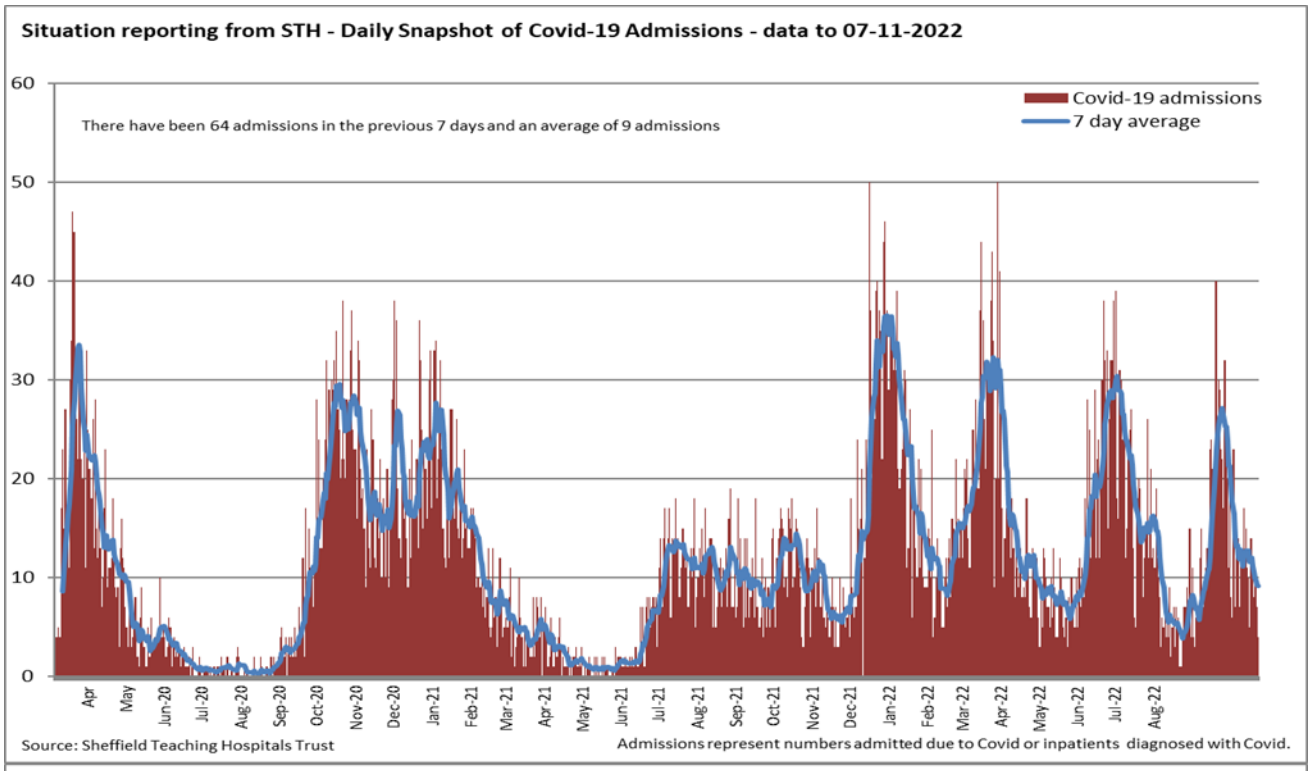
IMD Decile	1	2	3	4	5	6	7	8	9	10
0-4	117.31	127.27	117.73	149.46	204.29	167.95	181.82	246.21	229.58	206.17
5-9	373.08	331.55	378.68	481.29	502.13	642.62	660.48	753.86	860.22	1051.80
10-14	784.73	830.78	714.79	930.25	957.66	1076.49	1168.20	1302.85	1259.86	1510.59
15-19	708.49	696.74	717.02	671.97	542.39	689.96	607.05	1051.58	1146.57	862.94
20-24	776.37	783.89	730.15	607.25	451.24	565.69	295.54	697.27	522.72	580.42
25-29	588.26	502.25	532.56	569.81	425.89	485.47	382.51	505.88	479.95	563.88
30-34	680.84	636.73	530.97	695.38	538.21	613.82	569.86	768.59	578.00	626.64
35-39	768.61	672.60	726.94	635.21	608.26	680.96	778.50	678.44	694.18	771.23
40-44	641.41	758.73	678.03	685.00	718.73	856.81	833.91	848.42	881.64	1054.78
45-49	470.57	469.93	508.58	575.03	626.25	628.00	685.99	666.12	706.90	835.60
50-54	444.85	487.49	487.88	539.07	570.19	591.96	606.98	678.98	647.76	694.91
55-59	414.71	459.96	482.06	503.01	536.06	480.42	487.21	555.03	570.80	479.98
60-64	414.89	383.65	362.63	350.38	381.30	438.64	436.24	351.94	389.01	386.84
65-69	260.79	246.72	294.40	282.35	256.69	300.84	355.96	290.91	244.44	265.88
70-74	198.05	247.96	213.02	213.30	169.29	223.98	232.37	194.66	156.42	174.26
75-79	163.32	146.24	148.71	160.45	146.62	135.24	116.99	151.83	135.35	130.16
80-84	98.22	87.29	96.59	77.61	70.02	82.44	65.75	61.05	93.39	91.11
85-89	32.65	45.39	43.50	27.81	83.59	53.50	50.16	45.64	55.82	17.41
90+	34.64	34.68	35.06	31.89	46.40	52.06	36.17	32.72	55.28	6.76
DSR	7972.79	7881.85	7794.32	8186.21	7834.48	8701.85	8551.70	9876.99	9707.88	10221.29

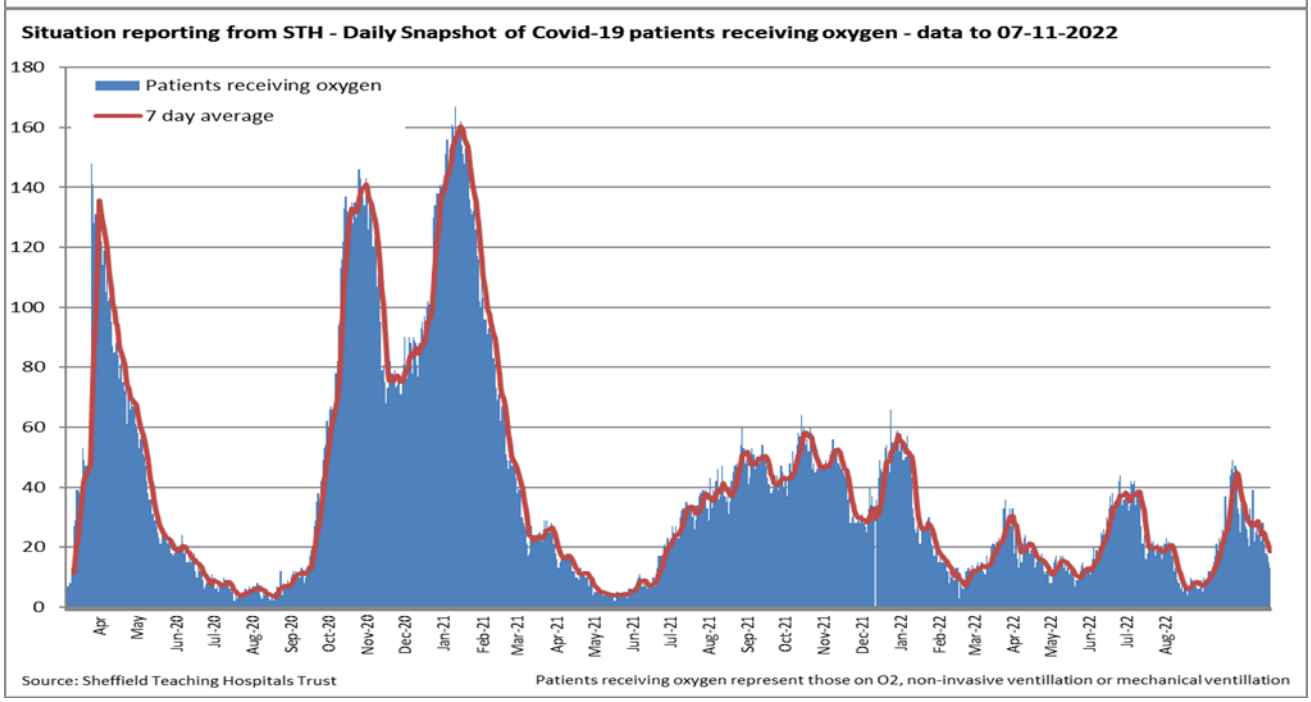
Directly Standardised Rates (all cases)

IMD Decile	1	2	3	4	5	6	7	8	9	10
0-4	203.97	196.12	198.52	224.94	315.23	413.51	415.29	406.14	543.05	518.20
5-9	642.47	562.20	610.45	666.52	768.09	924.15	1090.50	1178.57	1271.14	1487.32
10-14	756.01	791.99	773.47	839.98	907.60	1096.05	1025.35	1088.46	1162.79	1325.42
15-19	777.72	732.91	757.80	648.84	645.47	597.45	681.20	976.06	1064.52	869.97
20-24	1113.15	1035.92	1090.91	928.15	850.51	917.44	608.91	1111.86	903.03	934.30
25-29	997.38	892.13	893.02	1093.03	956.68	1098.17	931.51	1293.97	1187.84	1374.76
30-34	1211.03	1276.07	1255.77	1311.26	1389.26	1615.72	1459.98	1662.54	1640.00	1897.63
35-39	1407.87	1281.14	1358.99	1408.51	1336.18	1673.75	1862.76	1817.50	1914.81	2075.47
40-44	1175.92	1253.83	1189.39	1282.70	1428.09	1712.32	1624.31	1633.26	1876.36	2081.62
45-49	958.72	928.11	962.37	988.14	1128.12	1258.22	1210.94	1242.79	1346.88	1471.47
50-54	1003.36	969.02	928.55	1060.43	1051.42	1205.41	1221.85	1201.69	1247.31	1245.76
55-59	825.20	787.89	860.27	946.24	989.65	956.27	1062.32	1088.91	1086.30	1115.44
60-64	622.34	694.46	731.92	733.25	765.07	766.75	955.79	909.03	926.00	983.49
65-69	378.14	440.78	405.92	436.01	519.21	548.85	556.05	595.49	584.89	676.63
70-74	267.49	259.63	271.30	340.86	405.84	419.41	421.43	402.19	448.79	545.37
75-79	246.32	206.45	288.79	280.78	329.26	336.96	334.85	326.35	326.91	427.13
80-84	109.92	150.34	226.98	153.36	162.76	173.84	212.03	192.31	195.76	169.68
85-89	76.82	101.10	196.64	78.22	152.80	138.74	158.58	100.41	111.64	85.59
90+	78.52	124.28	162.36	91.12	143.85	143.17	139.24	94.07	201.01	81.08
DSR	12852.33	12884.15	13163.44	13512.33	14245.07	15989.19	15892.87	17258.62	18053.03	19446.35

Figure 7 Directly Aged Standardised Case Rates per 100,000 persons by Age and IMD for each major wave.

Hospital admissions data also show some important differences between the waves. Had testing been widely available it is important to note that the Wuhan wave would appear larger on the charts presented here. The hospital admissions data shows the pressures on the hospital system, is a measure of the morbidity (and in the early stages indicative of the mortality) impact and indicative of when some other healthcare became the opportunity cost of COVID pressures, particularly elective care.





The other trend event in the admissions data is the evident decline in number of admissions with requirement for oxygen after the vaccination rollout, despite the number of admissions during later waves being higher than at any other point for which data is reliable. This decoupling effect was also evident in data on deaths in hospital, which fell sharply as the 1st dose of vaccine was taken up. However, the data also paints a picture of relentless pressure on hospitals, which with the exception of the summer of 2020 and late spring of 2021, experienced levels of demand for respiratory care and beds for a length of time that was unprecedented.

In 2020, COVID-19 resulted in 1682 years of life lost in the community (not including deaths in care homes). COVID shortened life expectancy in people who could have been expected to live for many more years - it was not only the very old and frail who died. Data suggest that in the pre-vaccination era higher losses of years of life were experienced in more deprived areas where life expectancy pre-pandemic was already significantly lower than less deprived areas. In addition, a greater number of

deaths (expressed as the standardised mortality rate or SMR) occurred in the most deprived areas relative to the least deprived over the same period – which is a function of the inequality in case rates that was observed and caused by people's continued exposure because of inability to work from home, and their inability to shield and to isolate because of financial precarity compared to those in less deprived areas of the city.

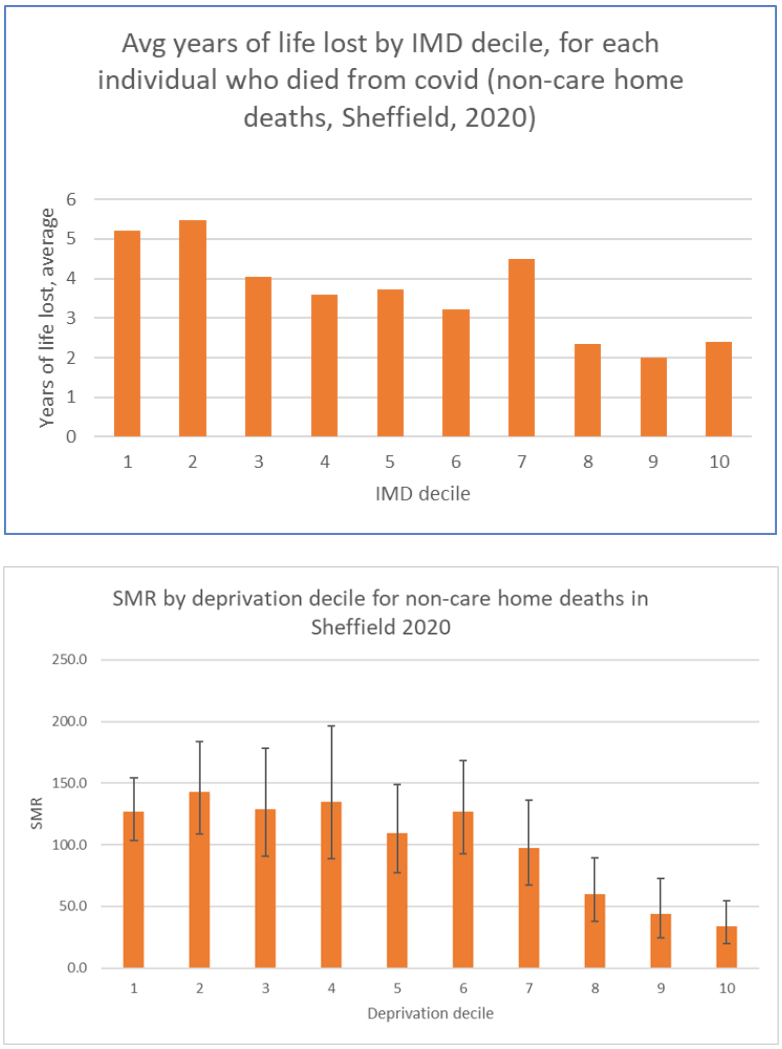


Figure 8 Years of Life Lost and SMR by deprivation decile, 2020.

Death rates from COVID-19 were higher for Black and Asian ethnic groups when compared to White ethnic groups. The pandemic exposed and exacerbated longstanding inequalities affecting BAME groups in the UK. The increased risk was not a direct function of particular ethnicity, skin colour or genetic trait per se, but almost certainly a consequence of higher rates of poverty, poor health (particularly type 2 diabetes and obesity), occupational exposure, a higher likelihood of living in multiple occupancy households, and higher prevalence of greater allostatic load (the cumulative burdens of health and socio-economic environment).

Figure 9 summarises the cases, hospitalisations, deaths and vaccine doses up to February 2022 and includes notable events and policies. Notice the decoupling effect of the vaccine on hospitalisations and deaths.

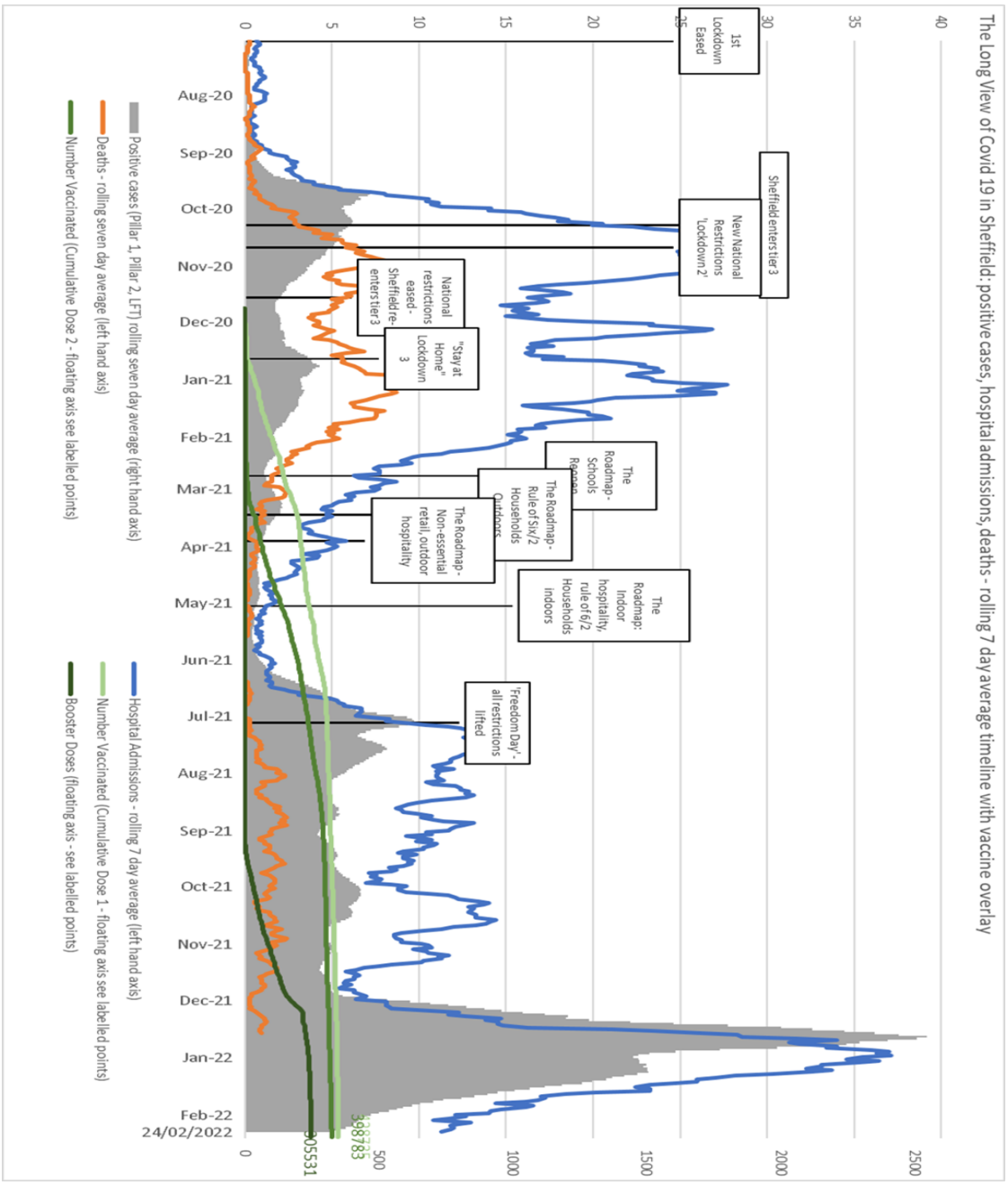


Figure 9 Cases, hospitalisations, deaths, and vaccination doses on a single chart

Inequality in the vaccine roll out

Inequality also featured in the vaccine rollout. Risk of severe illness and death from COVID was known to increase with a number of risk factors including age, ethnicity and certain underlying health conditions. Of these, age was considered by a distance to be the overriding risk factor. This was why the JCVI recommendations were unerringly based on age priority; in addition age stratification was logistically the most practical in terms of prioritising populations (most people's ages are documented on health records whereas other data such as ethnicity is typically not well recorded). This prioritisation by age groups meant that, because of the inequalities in life expectancy across deciles of deprivation, a structured inequality in vaccine provision was evident from the outset. People in the South West of the city are more likely to live until their 80s compared to people in the East of the city, despite many communities in the East having higher prevalence of other risk factors such as diabetes, COPD, and kidney disease. These areas also have a higher proportion of non-white ethnic groups. Vaccine hesitancy is also more common in communities where risk factors are more prevalent for reasons including historical injustices, preferred sources of information and

media and associated misconceptions about the vaccine, and also inequalities and barriers in terms of access to healthcare.

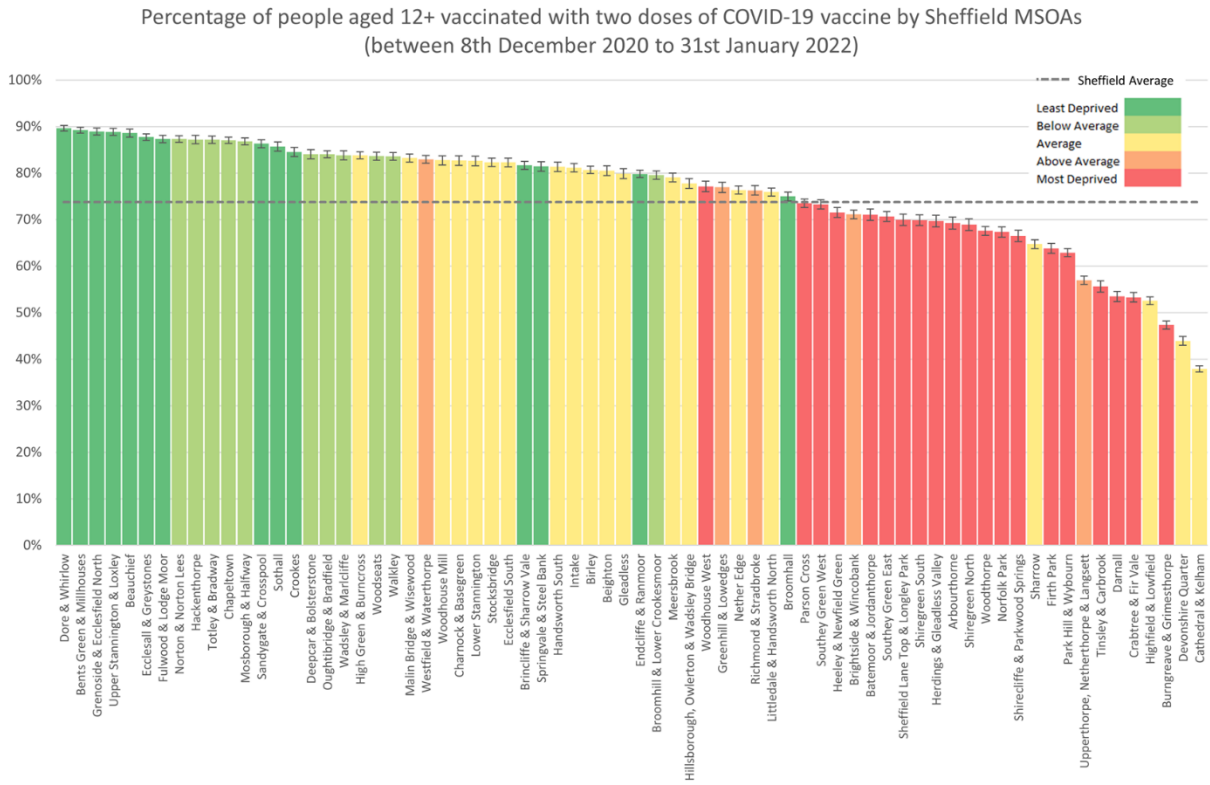


Figure 10 Vaccine uptake by MSOA and deprivation quintile, Sheffield.

Despite these inequalities, and largely due to the significant and coordinated efforts of primary care, the Longley centre, the COVID response hub, community and voluntary sector, the public health team, COVID vaccine uptake for Sheffield was consistently highest of the England's Core Cities. Average uptake across the city was above 75% and whilst it did scale with deprivation the levels of uptake were in excess of what would be expected for other vaccination schemes. Above all other interventions it is the vaccine which saved the most lives and allowed the city to begin to move towards recovery.

Data and intelligence enabled GPs and others with deep knowledge of their communities to target particular areas at higher risk and where uptake was lower. Whilst it was possible to take a broad scale MSOA level view of uptake (Figure 11) it was also possible through the data available on the COVID portal provided by PHE (later OHID) to undertake a hyperlocal analysis to enable targeted provision (Figure 12).

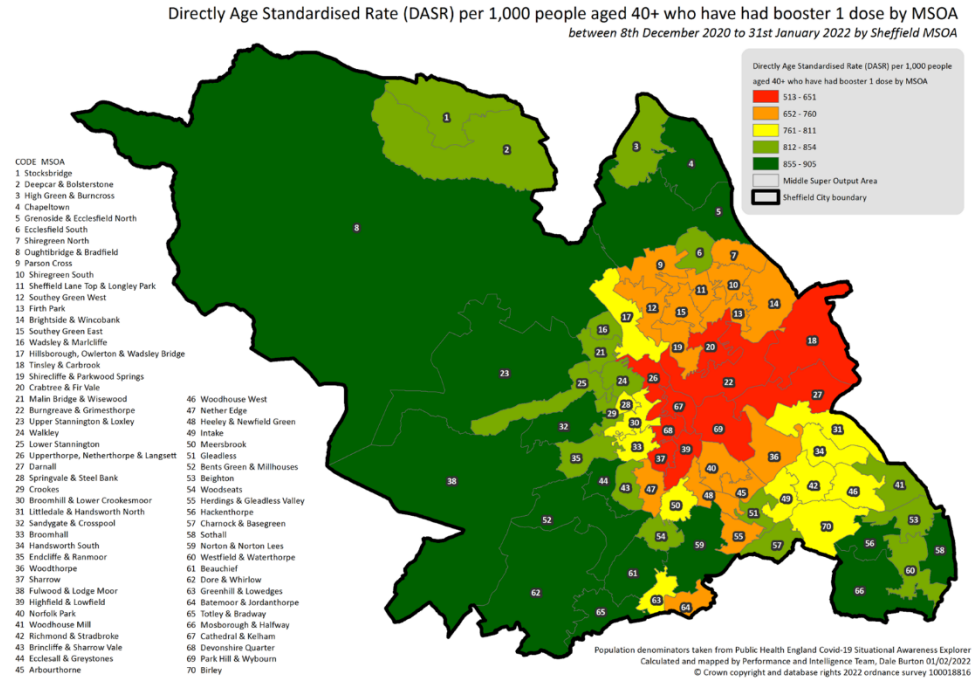


Figure 11 Vaccine uptake by MSOA, December 2020 to Jan 2022

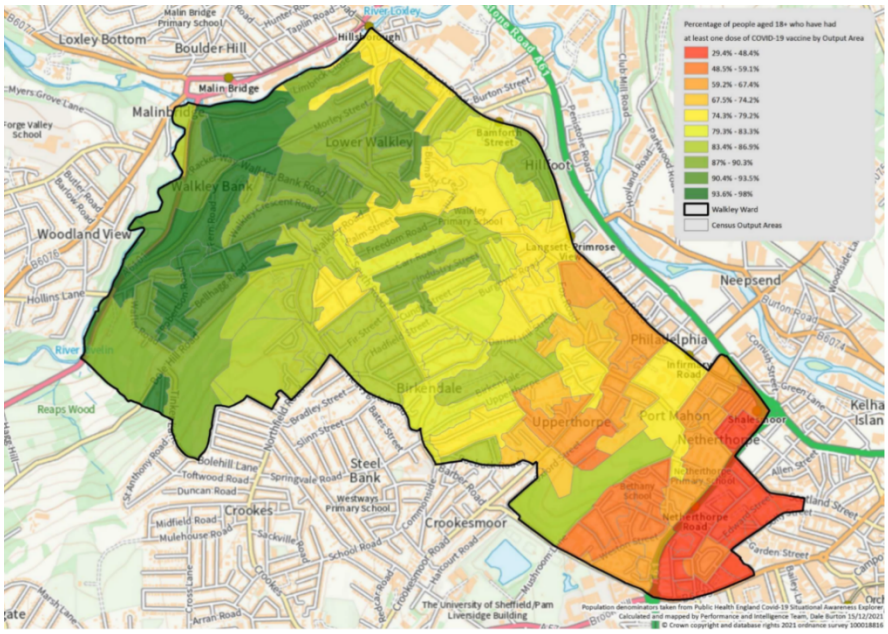


Figure 12 Local scale analysis of vaccine uptake

Section 4 – The local Response in Focus:

1. Surveillance and data challenges and learning

Sheffield established a surveillance effort early in the pandemic. The early key questions were around planning for number of cases, hospitalisations, deaths, cremations, mortuary capacity and emergency body storage, and likely staffing impacts (for example absence and bereavement). Would it be one wave? Multiple waves? What was the immunity and reinfection likelihood and effectiveness of interventions that could be deployed? The early weeks following the first cases were a highly uncertain data environment polarised between it will be fine to it will be catastrophic. The pandemic moved faster than research could keep up and the default was to refer to pandemic influenza modelling for emergency planning.

In the early phase of the pandemic there was very little central government information available, yet high pressure from all stakeholders to have some planning assumptions. There were very high levels of pressure on the Sheffield Public Health Intelligence team. Modelling was developed by the team with help of regional PH colleagues. Adaptive to new data, this model was shared with other local authorities nationally.

There was some tension between the need for planners to incorporate scenarios versus our inability to properly quantify the level of uncertainty we had at the time. This led to a "Fog of War" from an epidemiological point of view, not helped by relatively sparse planning assumption information and data from central government.

The key learning from this time period was the need to be utterly transparent with how we were arriving at estimates, what we knew, what we needed to know, and what was unknown/unknowable. We had to emphasise in conversations the possibility for compounding of error – incorrect numbers leading to decision error leading to harm.

We relied often on inferences drawn from multiple data sources rather than having the means of linking them. This meant that it was not possible to create a single digital thread connecting COVID positive test result, vaccination status, and risk data such as ethnicity, pregnancy, employer and other risk factors. These things were all examined quantitatively and qualitatively via communities of practice such as the South Yorkshire Data Cell, but linking a lot of critical data was not possible. All these data exist in varying completeness. Culture, technology and information governance challenges must be addressed in the future to address this.

One of our critical early lessons was to maximise the skills and expertise at local level in terms of epidemiology but also in terms of knowledge of local place.

We assembled a large body of evidence about restrictions and interventions that must be incorporated into future pandemic modelling including knowledge at community level.

Our local surveillance program showed that inequalities in vaccination uptake were particularly pronounced in some communities , despite a huge effort across many different organisations. *Because* of that work the inequalities in coverage were much less than they might have been work across the system. COVID morbidity including Long Covid will continue to be disproportionately concentrated on those communities with low vaccination uptake and other risk factors. Vaccination is the means of mitigating COVID's ability to cement inequality.

The local NHS and partners require integrated data systems and system-wide access to health, primary care, hospital, economic, vulnerability and sociodemographic data that is joined up with

ease. As it stands, COVID has highlighted this gap in capability which hinders our ability to plan for other emergencies, be they epidemiological, financial, or climate.

The surveillance program shone a light on what we knew and what we didn't at all stages of response: "Anticipate the questions and try and provide the answers - but don't guess" was the mantra.

The surveillance program was also able to provide reassurance and comms to multiple groups and forums which meant consistency of message delivered to strategic, operational and community groups across the city's anchor institutions. It served as a city surveillance function not a Sheffield City Council one. It was a reactive, responsive and rapid system with content tailored to changing needs through the different waves. At no other time have the public been more aware of epidemiological language and data. We capitalised on this increased data literacy, and provided a counterpoint (without directly engaging with) the significant quantity of misinformation in circulation.

2. Keeping Schools Going, Managing Outbreaks and Illness.

The pandemic tested nursery and education settings in ways not thought possible. Overnight child care workers, teachers, class room assistants and education leaders all had to become skilled in infectious disease control: managing outbreaks, symptoms and continuing to provide education and childcare to children, pupils and students as well as protecting their staff.

In Sheffield the response was established at pace and all settings became familiar with new structures set up to support and help. These included:

- Weekly and sometimes daily Education and Skills COVID bulletins informing settings of constantly changing guidance.
- Virtual briefings from Greg Fell, Director of Public Health
- A Sheffield City Council outbreak management and advice help line – operating 7 days a week, staffed mainly by 2 members of the Public Health team - dedicated to Education and childcare settings
- UKHSA Standard Operating procedures detailing how to respond to cases and outbreaks including participating in Outbreak Management meetings and making extraordinary changes to the way in which education could be continued to delivered.
- Regular letters and communication to education settings and parents/carers, being open and honest about the difficulties.
- Making bold decisions to delay the opening of schools after one of the lockdowns.

The reality of what life in a pandemic meant for nursery, education and childcare settings.
Childcare and Education leaders felt a huge responsibility in trying to do the right thing for staff and pupils' health and wellbeing. They were often making critical decisions on how to minimise COVID transmission and enable children and young people to access childcare and education and enable critical workers during lockdown to continue to get to work. This balance at times was impossible and often the council's Public Health staff spoke to education leaders who were understandably emotional and anxious about the brave decisions they had to take.

Childcare and education settings learned how to:

- Contract trace: they became experts in understanding transmission, establishing classroom 'bubbles', cohorting staff.
- Calculate risk of transmission and guide families with what action they should take as a consequence.

- Become experts in wearing and guiding people on the use of face coverings.
- Implemented testing for pupils and staff:establishing testing on sites and acting on positive results
- Continuing to safeguard and educate children; and delivering remote learning and continuing to ensure vulnerable children and young people were supported and safe.
- Secondary settings set up vaccination opportunities in schools.

Phenomenal efforts were needed, and the collective efforts of education and childcare leaders, the public health team and partners in the city saved lives and reduced the amount of illness

The duration of the pandemic, the changes in how guidance was implemented and the reality of staff and pupils getting COVID meant the childcare and education system was stretched beyond imagining. Staff went above and beyond to continue to deliver childcare and education.

There were many things that settings consistently did throughout the pandemic that made the difference. Some specific examples include:

- The efforts by public health staff, working with PHE colleagues, to trace 'missing' PCR results to make sure that Santa could still pay a visit to a school when his results were known to be negative. Christmas wasn't cancelled!
- The new starter events held outdoors on school playing fields. All the innovative ways in which settings took education and care 'outside' despite the notorious British weather.
- Efforts put in to place to ensure that pupils did get tested regularly.
- The planning that went in to enabling pupils to continue to access school trips and the sadness when trips had to be cancelled on the day of departure due to positive cases.
- The teaching and learning that continued throughout.

3. Local Authority Health Protection, Outbreak Control Response

For many years in public health we have been writing and exercising plans to respond to pandemic flu. This was top of the national risk register and we have seen a number of situations which did not turn out to be as serious or impactful as we had been concerned they might be. Swine Flu in 2009 was fortunately not very pathogenic but was still relatively disruptive.

We knew from exercises that there would be challenges with a pandemic which would compound each other for example that we would be responding to new challenges while also having staff off sick which would disrupt services.

The nature of a pandemic is that it is a newly emerging disease which individuals, groups and society don't have immunity to so we were aware that we would be dealing with a large number of uncertainties and areas where we didn't (and couldn't) have the answers. We were apprehensive about how any new infection could affect different age groups and people with different vulnerabilities with the knowledge that no amount of planning can cover all eventualities and combination of issues.

March to May 2020
The government launched a scheme for 1.5 million vulnerable individuals, providing food and supplies to their homes. SCC planned to identify individuals in need and facilitate a community-based response alongside this and to make sure the most vulnerable people were supported. We created the Community Support Programme and used the customer contact centre to connect offers

of help with requests, and referred individuals known to Social Care for specific support. We also formed plans to scale up arrangements as demand increased, and establish a Local Community Response Team to coordinate support at the ward level. There was a real senses of coming together to do what ever it was that needed to be done at a time of national need and emphasis on a local response.

gBy the time the Lockdown ended in May the Council had co-ordinated:

- 1,081 emergency food parcels;
- 10,631 Covid-19 related calls from the public;
- Shopped for food and other essential supplies 1,426 times;
- Delivered medication 864 times;
- Visited 3,209 homes to check people are safe and well;
- Telephoned 16,078 people to check their wellbeing;
- Posted 5,500 letters and 250,000 postcards advertising the support available.
- Covid-19 contact centre established, every call was recorded and tracked in CRM;
- Developed businesses process, call centre scripts, information flows and training guides;
- Established a food distribution centre that provides emergency food parcels, helps food banks and homeless charities/groups;
- Established 7 community response teams able to visit people and help with their shopping, medication and well-being;
- Created a web site and self-service online forms;
- Enabled businesses to submit offers of support to the Council, NHS and others;
- Produced communication materials, promoted the services city wide;
- Established an outbound contact centre capable of telephoning 30,000 shielded people;
- Managed highly complex datasets and information flows from multiple sources;
- Enabled the public to volunteer and employees to be redeployed;

Critical Success factors:

- Prioritisation
- Allocation of Resources
- Leadership & Trust
- Exceptional Team, Skilled
- Can Do Attitude, Public Service Ethos
- Agile Approach
- One Team, Joined Up, Togetherness

These critical success factors would remain throughout the rest of the COVID Response.
Some of the difficulties during this initial phase were connecting to national support, this theme would repeat throughout the COVID response rapidly evolving policy at a national level led authorities such as SCC to have concerns that people would be missed as groups were categorised as vulnerable. Managed data received from MHCLG of “Shielded” individuals – had just over 40k households what this didn’t take into account was people that became vulnerable as a result of of COVID for example, socially isolated or suffering from poverty. SCC took the approach to manage its own database of vulnerable households and to make sure everyone was contacted in addition to taking a city-wide approach to communication such as postcards to all households in collaboration with partners.

Post May 2020
At the end of May 2020, every upper tier local authority was asked by central government to develop an Outbreak Control Board and an Outbreak Control Plan to support and augment with the National Programme of Test and Trace . This was arguably the most challenging phase of the response supporting and augmenting the National Programme of Test and Trace which over time increasingly moved towards Local Authorities replacing parts of the National System.

The SCC local response to Covid-19 went on to work across four distinct waves and in between waves in a robust and intense way. Within SCC the COVID Response Hub was established as operational arm of Public Health working together to co-ordinate a response with a workforce many of whom rapidly adapted to new roles and ways of working and who repeatedly went over and above the call of duty to contribute to the pandemic effort. Throughout, the teams flexed and adapted the response to take account of changing circumstances, both epidemiological and political: every wave was different, had different national responses, and therefore required different local responses. This led to some innovative service design that has delivered at a time of need for our communities.

By December 2021 the SCC Covid Response delivered:

- £2.5m community covid grants across 3 phases
- £2m hardship payments
- £2.1m Isolation payments
- 55k calls answered from the covid community support helpline
- 1020 Outbreaks controlled
- 23k CT calls handled by our local team.
- 38k LFD kits handed out
- 13k EH visits, 105 FPN (£27k), 4k Complaints (H&S, TTI, business closures, Hygiene, Social Distancing)
- 85 FOI on covid (1 a week), >400 individual PH queries responded to >1000 more general
- 5273 hours (3 years worth) of comms
- 2 x Community COVID Buses
- Over 3500 – vaccinations carried out from the Covid Bus
- 15x PCNs provided logistic support
- 10 x pharmacies provided logistic support

While it was stressful and constantly changing it was also great to see how we worked together as 'team Sheffield' to bring our collective skills, expertise and relationships to do all we could for our city.

A great example of this was our collaborative work on providing Covid vaccination. Our NHS colleagues were brilliant at vaccinating those who were eligible and a whole range of partners supported this being as effective and reaching as many people as wanted to be vaccinated. Our work included the logistics of providing suitable venues, communicating with local groups and supporting them to communicate with communities, looking at the data to see where we most needed to target vaccinations and even the nitty gritty of making sure there were grit on the road and pavements round GP practices for those icy days when the vaccination programme began with those aged over 80. The work continued for over 18 months and we are really proud that as Team Sheffield we achieved the highest levels of covid vaccination take up of all the Core Cities (which are large cities with similar characteristics to us).

Its difficult to thank everyone individually for the work they did contributing to the effort, so many worked hard, gave their skills and knowledge, supported each other and showed Sheffield Steel. Thank you to everyone we couldn't have got through it without working together.

We learnt so much though the pandemic. While the whole of society was affected by Covid 19 there were groups in the population who were disproportionately affected. This included the most vulnerable because of their existing health conditions, those who lived in poverty or poor health before the pandemic began and those who's living and working conditions exposed them to Covid. This included those working in low paid jobs where they couldn't work from home and those who were lonely and isolated.

We saw how social care staff residents and clients were particularly vulnerable to Covid and the social care sector worked very hard under great pressure to try to protect their clients. A lesson we learnt (again) is that care is broader than just the NHS and a wide number of organisations in Sheffield had a part to play in support people, often under great pressure.
It was heartening to see how we could work together across teams and organisations in Sheffield to do our best for the city and to bring the local dimension. We saw time and again how beneficial our local knowledge and relationship were. Thank you to everyone who played their part and supported others in their work and home live to get through a really challenging time that we are still feeling the impact and recovering from.

The pandemic has shown us how quickly we can respond when we need to. Getting the right people round the table and delivering things together. We have been able to retain some of this way of working to support resilience and deal with post pandemic challenges. Initially established to provide an operational service for Covid-19 testing, vaccination and outbreak management; delivering on the SCC's One Year Plan objectives to support residents to stay well through the pandemic. We have adapted to the changing environment, built on learning and relationships gained during the pandemic and now deliver the organisation's new Delivery Plan objectives, supporting communities through the cost-of-living crisis.

4. Voluntary and Community Sector.

The Voluntary and Community Sector in Sheffield "*responded swiftly and effectively to the pandemic through a three-tiered effort based on informal neighbourhood activity, formal community level support hubs, and city level co-ordination.*" (Dayson, C, Woodward, A. 2021)

Reflections and evaluation of the role of Voluntary Action Sheffield (VAS) and the wider Voluntary and Community Sector (VCS) after the fact have illustrated the different types of capacity that were brought to support city partnership work, to manage infection control and vaccination uptake, and also to hit the ground running with responses that kept people well and connected to help.

This capacity has been defined by academics "as absorbing the shock of lockdown in vulnerable communities", allowing support to be adapted, creating new ways of connecting support to people as need moved with the roll-out of different phases of lockdown, and the cumulative impact started to stack up and take a toll on people.

"Areas of need where VCSEs were most active included physical activity, social isolation, domestic violence, mental health, and food insecurity. " (Dayson, C, Woodward, A. 2021)

The positioning of the sector allowed fast movement to connect to people who were vulnerable for a number of reasons and not visible or connected to statutory support. The agency and trust the VCS has with people was instrumental in making quick connections that added huge value to the wider responses in the health and care system.

The inclusion of the VCSE in the tactical and operational planning and decision making was effective in connecting and coordinating help that had the speed and reach that wouldn't have been enabled without a collective partnership approach.

In my VAS role I was working with a cross-VCS team that operated through a Hub that enabled the street level insights to be escalated to planning and decision-making functions, the City responses to be connected to communities and communities of interest and for resources and responses to be deployed as effectively as possible at a City level. This centred around the Public Health insights that

guided us as City leaders, to concentrate on the things that mattered as changes and impacts were felt. This had a stabilising effect at points where it felt the challenge was spiralling out of reach.

The Public Health insights connected with the community insights were transformational in guiding the way resources and activities were deployed and have left a mark on how we work in the City, particularly to understand the interplay of different types of deprivation and disadvantage with health inequalities.

*Capacity through crisis The Role and Contribution of the VCSE Sector in Sheffield During the COVID-19 Pandemic Author(s): Chris Dayson Abi Woodward Sheffield Hallam University February 2021

5. keeping transport going.

SYMCA first considered its response from a transport perspective in January 2020, with the risk being added to the corporate risk register during this month. Initial plans for customer awareness activities (advertisements in our interchanges) and provision of hand sanitiser in February 2020 were put in place. The Local Resilience Forum (LRF) SYMCA were part of the South Yorkshire LRF, a regional coordinating group that is part of a statutory response to emergencies through the Civil Contingencies Act.

Specifically on transport, the first national lockdown was announced on 26 March 2020. At that point there was no emergency funding for either bus or light rail services, but there was an expectation that a level of service would continue to support key workers who still have to leave home and attend their place of work. This was particularly important in South Yorkshire given the makeup of our economy (higher reliance on manufacturing and care services alongside a low propensity of professional services and car ownership).

Regular engagement with officials from Department for Transport then commenced through the Urban Transport Group (UTG) of which the SYMCA is a member. The UK Government took a modal approach to funding, with national rail service funding being confirmed within a matter of days of the lockdown coming in to effect.

The first agreed bus support funding (Coronavirus Bus Services Support Grant) was confirmed on 9 April 2020. This funding did not cover light rail and as such SYMCA participated in with discussions with the UK Government that resulted in a funding agreement for light rail (relevant for South Yorkshire), which was agreed on 23 May 2020.

These funding arrangements for each mode continued for some time (and indeed on bus are still in place to some extent) to ensure that service levels could be maintained.

Passenger numbers across modes understandably fluctuated significantly during periods of lockdown and restrictions, falling to below 10% of pre-pandemic numbers at times. In particular, and not surprisingly, passenger numbers for elderly passengers saw a pronounced reduction given concerns as to the consequence of infection. Even now, elderly bus passenger numbers have only recovered to around 65% of pre-pandemic numbers.

In terms of service delivery, detailed guidance was issued to passengers in respect of the need to wear a face covering, apply social distancing measures whilst on board and in interchanges.

On board capacity management did not typically present an issue throughout the periods of lockdown or restrictions as demand levels were such that it was uncommon for buses or trams to be anywhere near capacity. However, in relation to school bus services, particularly for the return of pupils in September 2020, careful consideration had to be given to mixing of year groups and pupils and how

services could still comply with social distancing guidelines. SYMCA procured (with funding from government) additional bus and coach capacity at the time to ensure there were sufficient services in place and that capacity and demand were appropriately matched across Sheffield and South Yorkshire.

Following the ending of the last range of national restrictions being lifted, SYMCA have continue to work to protect bus and tram services and safely encourage passengers back on to public transport.

6. Healthcare.

My involvement in the COVID19 Pandemic was as an Infectious Diseases Consultant, providing direct care to patients with COVID19 admitted to Sheffield Teaching Hospitals, starting with the very first patients who came off the cruise ship, at which time we had vain hopes of containing the spread of this disease and we were wearing Category 3 PPE (as for Ebola) such that we couldn't even properly examine that patients, and were only allowed to swab patients from particular geographic areas, such was the limited access to testing. Things evolved rapidly, wards becoming rapidly full of patients suffering from pneumonitis, with high death rates. We also geared up research; participating in the RECOVERY and other studies as we investigated potential treatments, participating in the CHADOX vaccine study, and I participated as a recruit in the SIREN study as we all scrabbled to learn about the effects of this virus and how our immunity to it might evolve. I was involved in teaching infection prevention control techniques and disseminating information about evolving PPE policy to the wider hospital, and producing teaching materials for non-specialists on management of COVID19 etc. I also worked up a system for those isolating at home to support limited staff left in the hospital to identify and treat sick patients – which was, thankfully, never needed. The first few months were exhausting and anxiety-provoking as we tried to respond to the emerging situation while putting ourselves in the face of an infection we might catch and or pass on to our families. Death rates were high and this was upsetting, particularly to witness people dying without their family around them, worse still for the nurses and junior doctors. It also felt good to be able to participate in the effort in some useful way, but odd to be so frenetically busy while others were locked down.

I was invited to liaise with the City Council and Public Health team with regards to contact tracing. Initially this was probably as there has been a history of contact tracing for other infectious diseases such as TB and measles. It became apparent that many inpatients were missing out on contact tracing as they were too unwell to answer their phone or had other barriers to phone communication, which impaired our ability to prevent onwards spread of infection in the community. This led to a pilot of face to face contact tracing of inpatients by myself, then with the help of medical students, and eventually the development of an inpatient contact tracing team using money, via the City Council from NHS Test and Trace, to employ a team to undertake inpatient contact tracing. The sharing of this information with the council also facilitated the identification of transmission hot-spots in the community, which helped with temporary closure and cleaning of premises of high transmission. It also provided much-needed emotional and informational support to inpatients.

As part of this work I participated in LOCOG meetings with members of the public health team and City council, where I heard about their response to provision of testing, vaccination, education of the community, enforcement of isolation rules, support of evolving PPE recommendations in different settings, and outbreak control in nursing homes, schools and other institutions. My main contribution was to update the team as to the situation and numbers and demographics of patients being admitted to hospital. I appreciated the support expressed by that wider team. It was through

this group that I was able to communicate with members of Public Health team who were undertaking contact tracing in the community once responsibility for an aspect of this was devolved to the City Council.

There were limitations of the City Council's participation in contact tracing. Firstly it took many months for the testing information to be shared with GPs or with Public Health teams in such a way that there could be a local response to contact tracing. Once the information was eventually made available the success rate of contacting patients and speed of doing so from onset of symptoms was much higher than the National NHSTT rates – local knowledge and use of systems enabled more comprehensive tracing of patients and also the provision of advice about financial and other support to those in need. In a future pandemic I would like to see sharing of testing results with primary care and public health teams from the outset to enable their engagement in treatment and prevention strategies as local knowledge can facilitate a response to outbreaks in that community.

secondly, it was not possible to contract and expand the numbers of personnel required to undertake the task of contact tracing quickly enough to keep pace with the exponential growth in case numbers during new 'waves' caused by different variants. There are volunteers in the community who could be put on standby to help in such circumstances in a future pandemic. They could receive top up training intermittently so they would be ready to respond in the future to public health emergencies. Use of Medical students (who were missing out on a valuable opportunity and much of their usual learning experiences) could be made to help provide such a response. Plans should be put in place IN ADVANCE so that the necessary agreements with STH, Public Health, The Council and the Medical School do not act as a impediment in future response efforts. The pilot work we did demonstrated that medical students are willing and able to rapidly learn contact tracing skills in such an event.

Thirdly, although there was a contact tracing team employed by the Council, it was decided not to share that team, or expand it, to enable contact tracing to be done within the hospital (although there were team members willing and able to do so). Instead there was a decision to provide money to Sheffield Teaching Hospitals so that our organisation could employ the necessary personnel to undertake this task. This required information governance and honorary contracts to be arranged and lengthy recruitment processes to be gone through, taking many months before we were able to employ people to undertake this role. This was frustrating and was a wasted opportunity. By the time the employees were in place, due to the successive waves of infection by different variants, the reducing severity of disease in the face of vaccination and the eventual acceptance that attempts at contact tracing were no longer fruitful, we had missed the moment during which most benefit could have been gained from that considerable effort. This could be avoided in the future by creating pre-existing data-sharing agreements, and having 'ready-to-go' contracts (held either by public health, the Council, or STH), to enable us to 'stand up' contact tracing much more swiftly in collaboration.

Finally, there could have been better use made of voluntary groups: Sheffield Community Contact Tracers (SCCT) are/were a group of enthusiastic volunteers (retired doctors, nurses and Public Health physicians amongst others) who called for symptom-based contact tracing before testing facilities became widely available. As testing became available, due to the failure to share testing data, GPs and volunteers were unable to assist with contact tracing, so this was the only option. There was a decision made not to involve this voluntary group in the official efforts to undertake contact tracing although they had developed considerable knowledge and expertise by that point. I presume this was because of their original desire to contact trace on the basis of symptoms, and to avoid a conflict of process/style, but this would have changed as testing became available, and appeared to be a wasted opportunity. I was grateful for the support of SCCT and help in training medical students

and providing pastoral and practical support as we designed processes for contact tracing in the hospital. They also helped contact trace those patients with COVID19 who had false-negative swab results, of whom there were significant numbers early in the pandemic, but far fewer by the time we had our processes organised.

7. The road to recovery will be long.

the Marmot recommendations on

- communities and places (providing more resources for more deprived areas and communities by redistributing existing assets and seeking greater investment from business and central government), housing,
- transport and the environment ('healthy living' standards for housing, environment and employment. Addressing overcrowded housing, and damp, cold and mouldy homes which are a risk for respiratory health. Providing guaranteed training and support for young people)
- early years, children and young people (prioritising future generations – with no young person without employment, education or training after they leave school. Providing additional support for mental health in schools and workplaces and more mental health service provision for young people)
- Income, poverty and debt (advocating nationally for a minimum income level to be the benchmark for wages and welfare payments).
- Work and unemployment (a stronger role for business in achieving social goals, including reducing health and social inequalities, by being good employers, having 'equitable' supply chains, investing in / contributing to communities, investments to be sustainable and healthy, and providing beneficial products and services)

Are all highly pertinent to pandemic recovery.

In terms of the role of the healthcare system in recovery, there are other specific actions that it can take.

- COVID has seen unprecedented growth of elective care waiting lists. The prioritisation of reducing these should be biased towards unmet need in underserved, more deprived communities. As part of this effort, there is a need to re-emphasise the "Make every contact count" effort on smoking, alcohol, exercise, debt management and others at every opportunity.
- The healthcare system needs to take concrete steps towards addressing multimorbidity and resourcing primary care and generalists with that goal in mind. Improving technical efficiency in single disease specialties will not address this fundamental demand pressure. Given the resource constraints, and the problems of allocative inefficiency which are making inequalities worse in some areas, the healthcare system needs to work with and if necessary, fund partners/allied sectors. Given the challenges of multimorbidity and increasing complexity, primary care needs to be able to fulfil the generalist role best suited to meeting these challenges – with funding commensurate to that task. This may require a rethink of current funding models.
- Population Health Management is still very much a concept rather than actual practice and there is a risk that if the focus of it is, as a result of where data is most complete and comprehensive, disease and clinical risk stratification it will lead many to conclude that resources should be moved towards precisely the wrong things. Diagnostic screening, increasing medicalisation of social ills, and a medical system that will design services and patient care based on data that is about the conditions people have and does not give equal importance to the conditions people live in. This will miss an opportunity to use this data to resource, empower and develop communities recovering in the wake of one of the most significant societal emergencies of our lifetimes.

Section 5: Conclusions and Recommendations

There will be another global pandemic. It is impossible to predict when. Climate change, biodiversity breakdown and the consequences of both may increase the risk of future pandemics.

Covid was not unprecedented, it may be unkind, but we were unprepared for the full force of what we lived through. It is thus important to learn from the covid pandemic. It was, to date, the preeminent emergency of our lifetimes. The learning and reflection exercise has been conducted in various ways both within individual service areas, across organisations in the city as a whole and across South Yorkshire. The Covid Inquiry will bring together the learning for the nation.

In summarising I have tried to set out what I see as the main lessons

1. Data saves lives

If ever we needed an articulation of the importance of good quality and granular data It was here. It took too long and too much effort to enable the city to have the right level of data on the spread of covid to be able to track it never mind to be able to direct intervention.

Many do rightly worry about information governance risks associated with data confidentiality. Not sharing data can cost lives. We need agreement that person level data will be shared as it is available, with a clear understanding it will be handled lawfully. A lesson from the pandemic was that real world insights from lots of sectors were as important as epidemiological data. Together these provide rich intelligence and the ability to direct interventions at a very granular level.

In advance of another pandemic, we need to have immediate data access permissions that we managed to establish over the course of COVID to avoid any delay in getting the vital data we need.

Timely, granular surveillance enables a good picture of what is happening, what emerging trends are there. This allows some confidence, it also enables focused and targeted response. Data sharing always has risks – associated both with sharing the information and not sharing critical information. It can be a tricky balancing act, but fundamentally teams need to be able to plan and respond on the basis of the best data available and that requires an information governance structure and culture that facilitates and enables. In over two years of access to individual patient information on COVID testing, there were no local data breaches.

Secondly, at a local level, we need a skilled team of public health analysts to make sense of any data we do have. Our team have the capability but not the numbers – if another pandemic were to hit, all our resources would again have to be directed to that at the expense of other important public health work.

Sadly, many things that will be important in the next pandemic are less easily addressed. Going into the next pandemic we cannot underestimate the impact of structural inequalities. We know that people's ability to isolate was affected by factors such as sick pay and overcrowded housing. These factors require a 'whole of government' response- local and national - to address.

Recommendation 1 – data saves lives. Timely access to person level data is needed.

In advance of another pandemic, we need to have immediate data access permissions that we managed to establish over the course of COVID to avoid any delay in getting the vital data to be able to give information to decision makers what is happening and to direct both policy and operational response.

2. We can locally organise around complex multi dimension problems and deliver. A complex problem requires a whole of society response.

We cannot manage such multi dimensional emergencies through simple command and control, at any level. It is impossible to understate the importance of disseminated and distributed leadership, with a clear simple strategy around which all stakeholders align. There are roles for local government in this, roles for the Voluntary Sector, roles for the NHS and roles for actors across the city including within every community in the city.

The city's basic strategy (will it keep people safe, will it protect the vulnerable, will it enable Sheffield to run) and core principles of operating served us well from the start to the end of the emergency.

Good relationships and trusted leaders are critical. Leadership in this context isn't a one person job. There is no place for hero leadership in these types of circumstances.

Early on we didn't know the nature of the problem nor what fronts we would need to fight on.

One core lesson is the importance of the need for a national / local partnerships with clear understanding of each other's roles and contributions. The city has since deployed similar models of working around the cost of living crisis.

Obviously the difference between covid and cost of living was the level of government resource available, but as a city we need to wilfully lock in the model of multi disciplinary and multi agency operational level response to deal with a multi dimensional problem.

for a long time there was a very centralised strategy and many of the core tools outside local control (testing, contact tracing, national comms strategy). We consistently demonstrated that with local intelligence, ownership and control we could deliver better outcomes than nationally controlled delivery.

Whilst much focus was, rightly, on the NHS and social care – both in terms of the impact of covid on this sector and its contribution to the response – every sector in Sheffield had an important role to play and was impacted by the pandemic.

The most obvious learning is that health isn't just about healthcare. It's about entitlement to sick pay, support for those isolating, access to testing that is acceptable to the hardest hit communities. But its also about a living wage, access to training and education and affordable housing. Lockdown measures, whilst effective, had less effect when people had to leave their homes to survive to buy food or to work. We know similar patterns are present when we look at uptake of screening programmes, attendance for out-patient appointments and use of primary care. Covid has just shown up the cracks.

Recommendation 2 - the scope of planning for pandemics and exercising.

When planning for, exercising for and responding in future pandemics, we need to think about how the whole of the city is impacted, particularly with reference to those with poorest health and every sector has a role in the planning and response. Pandemic planning should include planning for communication infrastructure, maintaining education systems, job retention, economic resilience, community engagement, ensuring robust sick pay policies, systems for distribution of food and medicines. These activities are as important as modelling, stockpiling of PPE and ventilators and NHS resilience.

3. An infectious disease control playbook is necessary but nowhere near sufficient for managing an infectious disease pandemic. The baseline health status of a population is hugely important in the eventual outcomes of infection.

A critical lesson is that for covid, structural issues in society massively outgun individual behaviour in outcomes terms. The structural determinants of infection were much more important to transmission chains of infection than individual behaviour. For too long this wasn't recognised in policy

There was more covid infection in some communities than others (in account of social structure, occupation type, housing type, the ability to be able to afford to isolate). On account of underlying morbidity there was more serious consequences outcomes wise in some communities than others. On account of more infection there will be a greater burden of long covid – that may also have long lasting consequences. Lastly there were more deaths (often at a younger age) in some communities than others. This will all cast a long shadow over the health of our population for some time to come.

Health inequalities in Sheffield are not new. The pandemic brought them into sharp relief and has made some gaps wider. It will take many years of focussed action to mitigate the damage done and recovery will not happen overnight, particularly now the cost of living crisis is proving to be a second major societal disturbance event.

Those with the poorest health were disproportionately affected by infectious diseases and pandemics and have less resources to be able to recover in terms of health, finances, work and the wider issues that affect wellbeing.

The pandemic showed how an infectious disease can affect all parts of our individual, family lives and wider society therefore the role of a wide range of organisations supporting housing, transport, employment, financial support, community support and well being are crucial in effectively reducing the impact and helping people recover from the pandemic.

Recommendation 3 – the response cannot ignore the structural determinants of how infection spreads and poor outcomes

Planning, preparation, policy and operational response must not ignore the structural determinants of health that amplify and sustain chains of transmission, and thus outcomes.

The Legacy. What has covid taught us

Covid has taught us many things.

Covid taught us The importance of early intervention and prevention. We now all understand the importance of exponential growth. In the now infamous words of the WHO emergency planning lead, Mike Ryan – "You need to go earlier than you want. You need to go harder than is comfortable. And a level of much greater uncertainty. If you need to be right before you move, you will never win"

Covid taught us about the false trade off between "health" and "the economy". We are seeing this further now as the impact of ill health in working age people becomes more and more important to economic productivity. This was known before the pandemic, reinforced in it. it has come sharply into relief in recent months as the impact of population health is showing up in labour market statistics and economic productivity.

Covid taught us that we have a world class NHS and Care system which has responded to a pandemic unprecedented in its history.

Covid taught us that we have an astounding ability to mobilise across whole of local govt, VCS and civil society

However, covid taught us more that cracks in our society matter enormously. Our poorest communities have multiple risks that left them unprotected when the virus spread into those neighbourhoods.

The Cholera monument a]bove the railway station stands as testament to the cholera epidemic of 1832. There were 339 victims of cholera are buried in the area near the monument. John Blake, the Master Cutler of the time is named on the pinnacle but the names of the other victims are not included. The cracks exposed by cholera led to the Public Health Acts of the Victoria era: clean water, slum clearances and waste management.

The Sheffield covid monument is in Barker's Pool. It stands as a monument to the legacy of the more than a thousand who lost their lives to covid in Sheffield. The city is still undertaking a listening and reflection exercise. Our collective job is to learn the lessons about what pandemics can teach us, how to keep people safe through them and how to minimise the impact.

This page is intentionally left blank