

Direct and Indirect Impacts of COVID-19 on Excess Deaths and Morbidity: Executive Summary

Department of Health and Social Care, Office for National Statistics, Government Actuary's
Department and Home Office

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Background

The COVID-19 pandemic will impact the health of many people in England and unfortunately many people will lose their lives. This paper provides a summary of research and analysis, discussing and estimating the health impacts (both excess deaths¹ and morbidity) from the pandemic.

Impacts of the pandemic may be direct from COVID-19 or may be indirect from changes to the healthcare system or lockdown measures. We conceptualise harm to health using the following four categories:

- A. Health impacts from **contracting COVID-19 (A)**
- B. Health outcomes for COVID-19 worsened because of **lack of NHS critical care capacity (B)**
- C. Health impacts from **changes to health and social care** made in order to respond to COVID-19, such as changes to emergency care ([C1](#)), changes to adult social care ([C2](#)), changes to elective care ([C3](#)) and changes to primary and community care ([C4](#)).
- D. Health impacts from factors affecting the wider population, both from **social distancing measures (D1)** and the **economic impacts** increasing deprivation ([D2](#)).

The results are briefly discussed in the [section](#) below; summary tables of the [mortality](#) and [morbidity](#) impacts can also be found below.

Methodology and scope

It is important to note that the estimates presented are based on scenarios; they do not represent forecasts. This paper was written in the middle of the pandemic; the estimates represent a point in time, using evidence from the initial months of the pandemic to model scenarios going forwards. Estimates for the different categories of harm use different scenarios and assumptions; these are outlined below:

- **Category A:** Estimates for direct COVID-19 deaths are based on a scenario that shows incidence of COVID-19, and hence number of deaths, is constant over time from 20th June to March 2021, at a level of 900 deaths per week. This scenario is one of five signed off by SAGE in May 2020 for planning purposes and is the closest of these scenarios to the latest available weekly data at the time of writing². It should be noted this scenario is not a forecast or an official Government planning scenario. In this document it is referred to as the COVID-19 Static Scenario (or "CSS"). This scenario is compared to the other four SAGE scenarios in [Annex H](#).
- **Category C:** Harm from changes to emergency care (C1) and adult social care (C2) are also linked to the CSS. Estimates of harm from changes in elective care (C3) assume that 6-

¹ Defined as *any death due to the COVID-19 pandemic which would not have occurred otherwise within one year*.

² In the week ending 19th June 2020 there were 744 deaths registered with a mention of COVID-19 on the death certificate.

months of non-urgent elective activity is delayed for up to 5 years; estimates from primary and community care (C4) are based on a 6-month reduction in activity.

- **Category D:** For impacts from social distancing measures (D1), we assume a 2-month lockdown based on illustrative scenarios, which does not take into account the CSS or try to reflect the staged relaxation of restrictions that have occurred to date. We use percentage changes in disease specific mortality due to an OBR forecast increase in unemployment to model the short (1 year), medium (2-5 years) and long-term (5-45 years) impacts of a lockdown-induced recession (D2). For the long-term impacts we also take an alternative approach using the Index of Multiple Deprivation.

Further discussion and the methodology underpinning the estimates cited here can be found in the full paper. The range of health impacts presented are not exhaustive; there are likely to be more impacts that are not discussed because of their complexity and indirect links to the pandemic.

Summary of direct and indirect health impacts

The impact on mortality and morbidity for each category of harm are discussed in more detail below. Figure 1 presents the total impact in terms of excess deaths. Figure 2 and Figure 3 present the total Quality Adjusted Life Years (QALYs) for mortality and morbidity; in Figure 2 these are split across three different time periods, for Figure 3 these are split by mortality and morbidity.

These comparisons show several interesting points:

- The direct COVID-19 deaths account for the majority of all excess deaths
- However, when morbidity is taken into account, the estimates for the health impacts from a lockdown and lockdown induced recession are greater in terms of QALYs than the direct COVID-19 deaths.
- Much of the health impact, particularly in terms of morbidity, will be felt long after the pandemic is assumed to last (1 year for this exercise, though this is a scenario not a forecast).

It should be noted that the health impacts modelled here represent a scenario with mitigations in place. Without mitigations, a far larger number of people would have died from COVID-19 such that the QALY impact from COVID-19 deaths would be more than **three times** the total QALY impact of all the categories (mortality and morbidity impacts) for the CSS mitigated scenario presented here. A comparison with an unmitigated scenario³ is provided in [Annex G](#) and shows that mitigation have prevented up to 1.5m direct COVID-19 deaths.

³ This is the “Unmitigated RWC” (31st March) scenario which is an illustrative scenario if social distancing measures were not introduced to prevent or delay the spread of disease.

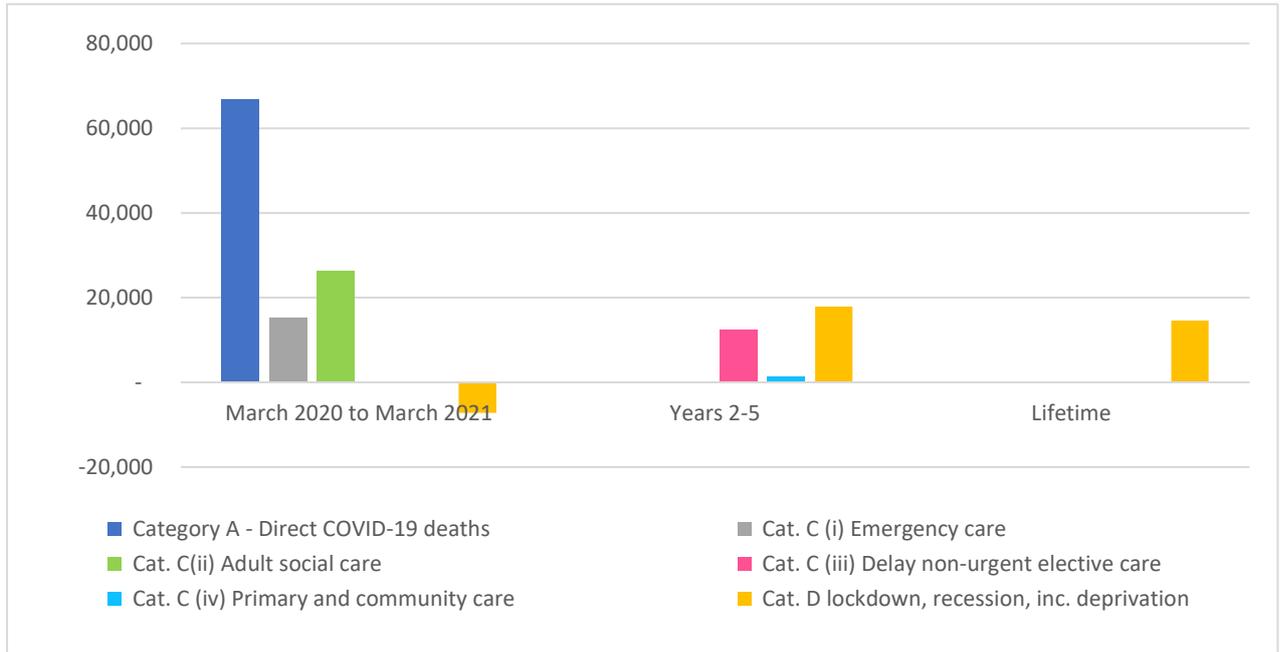


Figure 2 Estimated excess deaths from Categories A, C and D

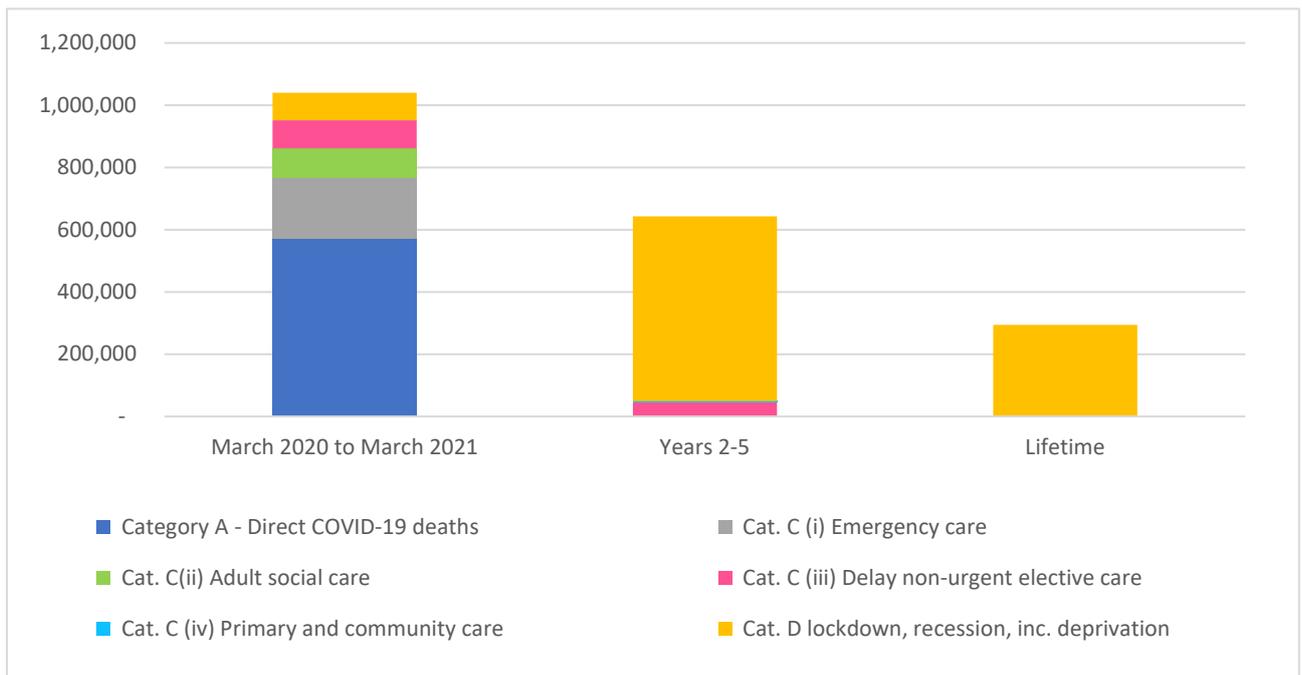


Figure 1 Estimated total QALYs (morbidity and mortality) from Categories A, C and D

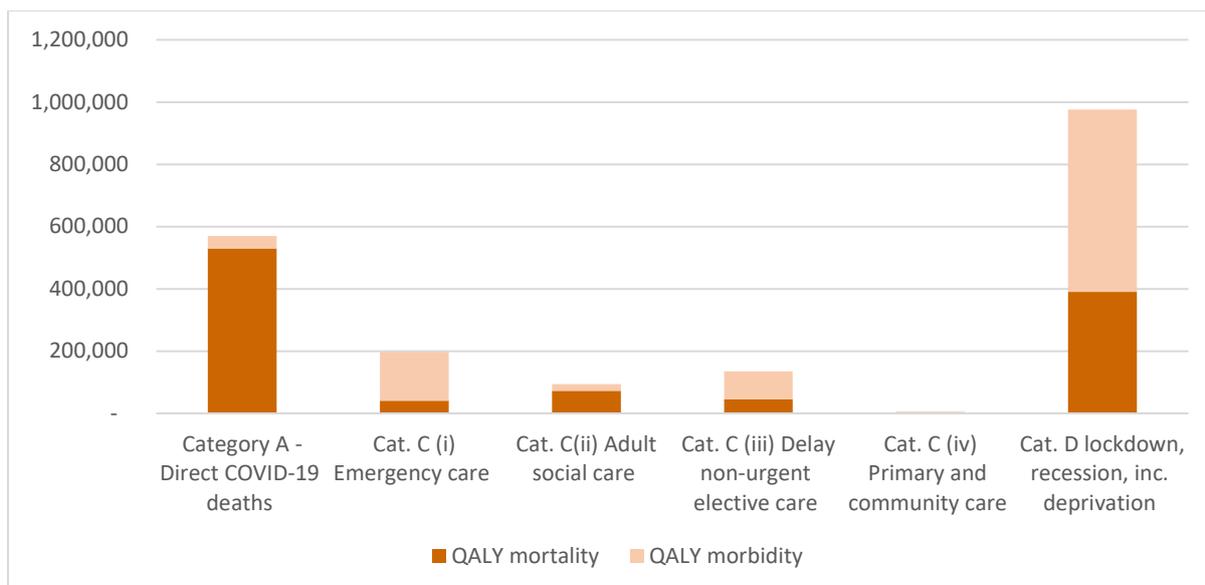


Figure 3 Estimated total lifetime QALYs for Categories A, C and D

Description of health impacts

Category A: Health impacts from contracting COVID-19

We estimate that from the 32,000 COVID-19 deaths registered between 21st March and 1st May, 25,000 were “excess deaths” in that they would not have occurred otherwise within 1-year⁴. Under the COVID-19 Static Scenario (CSS), it is estimated there would be an additional 53,000 COVID-19 deaths to March 2021, 42,000 of which would be “excess deaths”. In total this equates to 530,000 lost Quality Adjusted Life Years (QALYs) and 700,000 Years of Life Lost (YLL) over the 12 month period (21st March 2020 to 19th March 2021).

For people who contract COVID-19 and survive, there are likely to be morbidity impacts particularly amongst those hospitalised and needing critical care, including cognitive, physical and mental health impairments. We estimate these equate to 40,000 lost QALYs within 1-year. The long-term health impacts are unknown.

Category B: Health outcomes for COVID-19 worsened because of lack of NHS critical care capacity

Following the experience of other countries ahead of England in the COVID-19 pandemic, there were concerns that the UK’s critical care capacity and ventilation provision would not be sufficient. Efforts were made to increase capacity through the creation of new Nightingale hospitals and extending existing provision. It is judged that there have been no cases of NHS critical care capacity being breached to date, and none are anticipated within the CSS. Analysis of an unmitigated scenario suggests there could have been up to 1 million additional COVID-19 deaths in patients unable to access the hospital care they require. This is on top of an estimated 400,000 COVID-19 deaths that would have occurred if mitigations to reduce infections were not put in place even with fatality rates that assume sufficient NHS critical care capacity.

⁴ Note, this is a different definition for “Excess deaths” to that used in other contexts, such as in the ONS weekly deaths statistics, which computes “Excess deaths” by comparing the weekly total to the previous 5-years average for the equivalent week.

Category C: Health impacts from changes to health and social care made in order to respond to COVID-19

C1: Changes to emergency care

Emergency attendance and admissions have decreased since the start of the pandemic; people may have been reluctant to attend accident and emergency departments because of fears or perceptions that they should remain at home, and some causes may have decreased due to lockdown measures.

We estimate changes to emergency care may account for 6,000 existing excess deaths in March and April 2020. If emergency care in hospitals continues to be low for a full 12-months, this could result in an additional 10,000 excess deaths. This equates to 41,000 lost QALYs over the year (to March 2021).

We estimate the impact of reduced emergency care in hospitals in March and April to be around 31,000 QALYs. If emergency care in hospitals continues to be low for a full 12 months, the morbidity impact is estimated to 140,000 QALYs. There are also likely to be specific mental health impacts on healthcare staff during and following the pandemic, which could equate to 17,000 lost QALYs.

C2: Changes to adult social care

Excess deaths may have occurred for a range of reasons related to changes in adult social care provision, such as a potential impact on access to primary and preventative care in care homes, or not being able to or willing to attend hospital in the case of non-COVID-19 medical emergencies.

We estimate there were approximately 10,000 non-COVID-19 excess deaths of care home residents in March and April 2020. We estimate there could be an additional 16,000 non-COVID-19 excess deaths over 12-months in care home residents if the outbreak follows the CSS scenario. This equates to 73,000 lost QALYs over the year (to March 2021). There may also be morbidity impacts on adult social care service users, but it has not been possible to quantify these.

As a result of increased pressure on the adult social sector, there may also be mental health impacts for adult social care staff, estimated to equate to 21,000 lost QALYs.

C3: Changes to elective care

Many non-urgent elective treatments have been postponed or cancelled by the NHS in preparing for COVID-19. Delaying access to care could equate to 12,500 excess deaths, equivalent to 45,000 lost QALYs over approximately 5-years; morbidity impacts are estimated to equate to 90,000 lost QALYs by April 2021.

C4: Changes to primary and community care

Some primary and community services have been stopped during lockdown and others have been reduced to only provide urgent care. Focused analysis of cancer diagnosis, including GP referrals and emergency presentations, suggests that disruption to these pathways could result in 1,400 excess deaths equivalent to 3,500 lost QALYs.

There are likely to be health impacts as a result of some routine services stopping, and the potential backlog of appointments meaning that some health problems may not be identified early and may become more severe; it has not been possible to quantify these impacts.

Category D: Health impacts of lockdown

D1: Impacts of social distancing

The main mortality impacts of the lockdown are expected to come from an estimated reduction in the number of fatalities due to better air quality, with further, smaller, reductions expected due to

lower alcohol misuse, lower road injuries and lower childhood infectious diseases. These impacts are somewhat counterbalanced by an estimated increase in the number of fatalities due to lower physical activity, increased home accidents, increased self-harm, and increased musculoskeletal conditions. Overall, we estimate mortality impacts to equate to 3,000 fewer deaths, equivalent to 30,000 gained QALYs.

The main morbidity impacts of the lockdown are expected to come from an estimated increase in musculoskeletal conditions, increased domestic abuse, and increased mental health problems. Overall, we estimate morbidity impacts to equate to 134,000 morbidity QALYs.

D2: Impacts of a lockdown-induced recession

Short-term impacts

The short-term mortality impacts of the lockdown-induced recession are estimated to be 4,500 fewer excess deaths (equivalent to 30,000 gained QALYs) occurring within a year of the lockdown; these are expected to come from an estimated reduction in the number of fatalities due to a reduction in cardiovascular diseases, dementias and respiratory diseases. We assume here that mortality is procyclical – i.e. that a deteriorating economic situation is associated with short-term reductions in mortality rates⁵. Studies have found higher mortality rates during economic booms and lower mortality rates during recessions, with the relationship holding true for previous economic downturns.

The short-term morbidity impacts of the lockdown-induced recession are estimated to equate to 17,000 gained QALYs; they are expected to come from an estimated increase in mental health problems, counterbalanced by a reduction in unintentional injuries (mostly occupational injuries), reduction in chronic respiratory diseases, and reduction in transport injuries.

Medium and long-term impacts

We estimate an increase of 18,000 excess deaths as a result of the medium-term mortality impacts of the lockdown-induced recession, occurring 2-5 years following the lockdown, equivalent to 157,000 lost QALYs; the main impacts are expected to come from an estimated increase in the number of fatalities due to increased cardiovascular diseases. We estimate the medium-term morbidity impacts of the lockdown-induced recession to equate to 438,000 lost QALYs; the main impacts are expected to come from an estimated increase in musculoskeletal disorders and mental health problems.

We estimate the long-term mortality impact of the lockdown-induced recession (more than 5 years in the future) using two different approaches. In the first approach, we use the Office for National Statistics' (ONS) life tables to estimate the impacts on those who were aged 15-24 during the lockdown-induced recession. We assume a -0.3 GDP-to-mortality elasticity. This estimates 15,000 excess deaths, equivalent to 294,000 lost QALYs; this is from a slightly elevated all-cause mortality impact for younger people who would enter the labour market a few years before, during, and a within a few years after the recession.

It is important to note that the robustness of the medium and long-term impacts of a lockdown induced recession is low as estimates are based on academic literature on previous recessions. The

⁵ Notable exceptions are studies of developing countries that tend to find mortality being countercyclical e.g. Jacinto Pde A, Tejada CA, Sousa TR (2010) Effects of macroeconomic conditions on health in Brazil. *Revista de Saude Publica*, 44 (2): 310–7; Cutler DM, Knaul F, Lozano R, Mendez O, Zurita B (2002) Financial crisis, health outcomes and ageing: Mexico in the 1980s and 1990s. *Journal of Public Economics*, 84: 279–303.

profile of past recessions will be different to a lockdown induced recession, and should be considered when reviewing the estimates.

For the other approach, we use the Index of Multiple Deprivation for England (IMD) and assume a -1.0 GDP-to-IMD score elasticity per year giving an estimate of 17,000 additional deaths per year for every year that GDP remains at a low level. The timing of when these excess deaths would occur is not specified but they are likely to be long-term.

Table 1 Summary of mortality impacts

Category of harm	Brief description	Short-term (March 2020 to March 2021)				Long-term (up to 50 years)			
		Excess deaths to 1 st May '20	Excess deaths (May-March '20)	QALYs ⁶	YLL	Excess deaths	QALYs	YLL	
A	Directly from COVID-19	Mortality as a result of contracting COVID-19.	25,000	42,000	530,000	700,000	Not quantified	Not quantified	Not quantified
B	From COVID-19 as a result of lack of NHS critical care capacity	It is judged that there have been no cases of NHS critical care capacity being breached to date, and none are anticipated within the CSS.							
C1	From changes to emergency care, to respond to COVID-19	There has been a significant reduction in A&E attendances and emergency admissions. Some of this is unmet need, possibly due to patients' reluctance to seek medical attention or other changes to protocols.	6,000	10,000	41,000	54,000	Not quantified	Not quantified	Not quantified
C2	From changes to adult social care, to respond to COVID-19	Patients may be dying due to early discharge from hospital, from non-COVID-19 medical emergencies and not being able to attend hospital, impacts on quality of primary and preventative care in care homes, patient safety impacts or residents not wanting to transfer to hospitals.	10,000	16,000	73,000	108,000	Not quantified	Not quantified	Not quantified
C3	From changes to elective care, to respond to COVID-19	Patients waiting longer for non-urgent elective care will have to live with symptoms for longer and a significant impact on quality of life. We assume none of the non-COVID-19 excess deaths to date are due to postponement of non-urgent care; owing to these being expected to be longer-term impacts.	0	0	0	0	12,500	45,000	Not quantified
C4	From changes to primary and community care, to respond to COVID-19	Changes to community services may lead to increased mortality. We model the impact of delayed cancer diagnosis from reduced GP referrals or emergency presentations on excess deaths.	0	Not quantified	Not quantified	Not quantified	1,400 (Cancer only)	3,500 (Cancer only)	4,900 (Cancer only)
D1	Social distancing measures	We expect a net reduction in some non-COVID-19 causes of death in the short-term because of the lockdown (better air quality, alcohol misuse, road accidents and childhood infectious diseases, but increases due to lower physical activity, increased home accidents, self-harm, and musculoskeletal conditions).	-2,000	-1,000	-30,000	-45,000	Not quantified	Not quantified	Not quantified
D2	Economic impacts-lockdown induced recession	We expect a net reduction in some non-COVID-19 deaths from a lockdown induced recession due to healthier lifestyles in the short-term (reduction in the number of fatalities from cardiovascular diseases, dementias and respiratory diseases).	-500	-4,000	-30,000	-43,000	0	0	0
		We expect a net increase in some non-COVID-19 deaths from a lockdown induced recession due to increased cardiovascular diseases in the medium-term.	0	0	0	0	18,000	157,000	230,000
	Economic impacts increasing deprivation	There may long-term increases in excess deaths as a result of a lockdown induced recession due to a slightly elevated all-cause mortality impact for younger people who would enter the labour market a few years before, during, and within a few years after the recession. For illustration, an increase in deprivation due to entrenched recession is presented, but this is a worse scenario than general economist consensus present.	0	0	0	0	15,000 total (17,000 per year in more challenging economic scenario)	294,000	465,000
Total			38,500	63,000	584,000	774,000	47,000	500,000	700,000

⁶ QALYs have been discounted at 1.5% according to Green book guidelines

Table 2. Summary of morbidity impacts

Category of harm		Brief description	Time period	QALYs
A	Directly from COVID-19	COVID-19 survivors may experience a range of health impacts following critical care and/or hospital admission, including cognitive, physical and mental health impairments. There may be additional long-term health impacts that are currently unknown.	Mar 20 – Mar 21	40,000
B	From COVID-19 as a result of lack of NHS critical care capacity	It is judged that there have been no cases of NHS critical care capacity being breached to date, and none are anticipated within the CSS.		
C1	From changes to emergency care, to respond to COVID-19	There has been a significant reduction in accident and emergency attendances and emergency admissions. Some of this is unmet need, possibly due to patients' reluctance to seek medical attention or other changes to protocols.	Mar 20 – Mar 21	140,000
		Healthcare staff are likely to be impacted as a result of the additional pressures on the sector, in terms of burn-out and mental health problems.	Mar 20 – Mar 21	17,000
C2	From changes to adult social care, to respond to COVID-19	Adult social care users and people receiving informal care may be coping with reduced levels of support during the pandemic, which may have health impacts such as mental health, ability to maintaining hygiene and potential for falls. It has not been possible to quantify these impacts. Carers may be providing more care and may be experiencing increased stress and impacts on their mental health. The impact on this group has not been quantified.	Not quantified	
		Adult social care staff are likely to be impacted as a result of the additional pressures on the sector, in terms of mental health problems.	Mar 20 – Mar 21	21,000
C3	From changes to elective care, to respond to COVID-19	Patients waiting longer for non-urgent elective care will have to live with symptoms for longer and a significant impact on quality of life. There may be impacts on morbidity as a result of cancellation or postponement of elective care.	By April 2021	90,000
C4	From changes to primary and community care, to respond to COVID-19	It has only been possible to quantify the impacts of delayed cancer diagnosis from reduced GP referrals or emergency presentations and other morbidity impacts following changes primary and community care has not been quantified. However, changes to some services (e.g. GP services, dental services) may lead to worsening health outcomes; changes to other services such as optometry and audiology may have relatively limited health impacts depending on how long services are paused for and provided that appointments are caught up once services return.	5 years	300
D1	Social distancing measures	The lockdown is expected result in an increase in musculoskeletal conditions, increased domestic abuse, and increased mental health problems.	Based on a 2-month lockdown ⁷	134,000
D2	Economic impacts-lockdown induced recession	The lockdown-induced recession is expected to result in an increase in mental health problems, but a reduction in unintentional injuries (mostly occupational injuries), chronic respiratory diseases, and transport injuries.	April 2020 to March 2021	17,000
		In the medium-term, due to lockdown-induced recession, there is expected to be an increase in musculoskeletal disorders and mental health problems and have been quantified.	2-5 years	438,000
	Economic impacts increasing deprivation	In the long-term there would be some morbidity impacts for the same cohort of younger people entering the labour market around the time of the recession.	5-45 years	Not quantified
Total				900,000

⁷ The evidence does not indicate whether some of the behaviour changes would continue after the lockdown or not and therefore impacts could occur after a 2month lockdown.

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Department of Health and Social Care, Office for National Statistics, Government Actuary's
Department and Home Office

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1. Introduction

The COVID-19 pandemic will affect the health of many people in the UK, directly or indirectly, and unfortunately, as we already know, many people will lose their lives. This extends beyond people dying from COVID-19 directly: there will also be indirect health impacts on the population due to an array of wider impacts; from changes in healthcare activity required to tackle COVID-19, to the wider impacts that result from social distancing measures.

Evidence about the wider impacts on health as a result of the pandemic is constantly evolving; globally, we are in uncharted territory and the full extent of the health impacts are complex and may never be fully understood. It is likely that many individuals' health has been or will be impacted as a result of the pandemic. This might be due to contracting the virus itself, and indeed we do not know the longer-term impacts of the virus on health. Alternatively, health could be impacted as a result of measures put in place to prepare the healthcare system; every avenue of healthcare provision is likely to have been impacted in different ways, such as postponing elective care or reduced use of emergency care. Individual's health may also be impacted by social distancing measures, put in place to contain the spread of the virus.

This paper first examines what we already know about excess mortality since the start of the pandemic in the UK (see [Section 2](#)).

It then considers what excess mortality and morbidity we could expect to see in the pandemic as a whole, both short-term and longer term, within the following four categories (see summary in [Table 2](#)):

- A. **Health impacts from contracting COVID-19** (see [Annex A](#))
- B. **Health outcomes for COVID-19 worsened because of lack of NHS critical care capacity** (see [Annex B](#))
- C. **Health impacts from changes to health and social care made in order to respond to COVID-19** (see [Annex C](#)):
 - (i) Changes to emergency care
 - (ii) Changes to adult social care
 - (iii) Changes to elective care
 - (iv) Changes to primary and community care
- D. **Health impacts from factors affecting the wider population** (see [Annex D](#)):
 - (i) Social distancing measures
 - (ii) Economic impacts increasing deprivation.

We have investigated the potential impacts of the four categories of health impacts in terms of:

- 'Excess deaths' (defined as *any death due to the COVID-19 pandemic which would not have occurred otherwise within **one year***).
- Morbidity impacts, including short and long-term worsening of mental and/or physical health.

Where possible, we have quantified the impact on health, by estimating the years of life lost (YLL) and Quality Adjusted Life Years (QALYs) lost. Summaries are provided in tables throughout. Further discussion is provided in the Annexes, for each category of health impact. Note that this is an update

to a paper written for SAGE on 6th April 2020 which covered an estimate of the mortality impacts according to the four categories of excess deaths, and is published on their website^{viii}.

2. What we know about excess deaths from the pandemic so far

There are multiple official sources of data on deaths during the pandemic. The most prominent and reliable are the Department of Health and Social Care's (DHSC) daily death count, and the Office for National Statistics' (ONS) weekly death registration statistics. DHSC's figures are more timely but only include deaths in hospitals where the patient has tested positive for COVID-19. ONS's figures include deaths in all locations and include "assumed COVID-19"; but only count a death once it is registered. Sixty percent of deaths are registered within five days of occurrence, but there can be a much longer delay between date of death and date of registration if cause of death is more difficult to confirm. As many of the categories of interest in this paper include people who do not contract COVID-19 themselves – or do not die because of it if they do – ONS's weekly death registrations will be used to consider the excess deaths observed so far.

ONS have published an article investigating the non-COVID-19 excess deaths observed up to 1st May, and possible explanations for the trend of increased non-COVID-19 deaths.¹ Figure 4 below presents the time series of weekly deaths in 2020 both including and excluding deaths involving COVID-19, and how these compare to the average deaths in the corresponding weeks of 2015-2019. The latest published death registration data presents registrations up to Week 26 of 2020, ending 26th June.

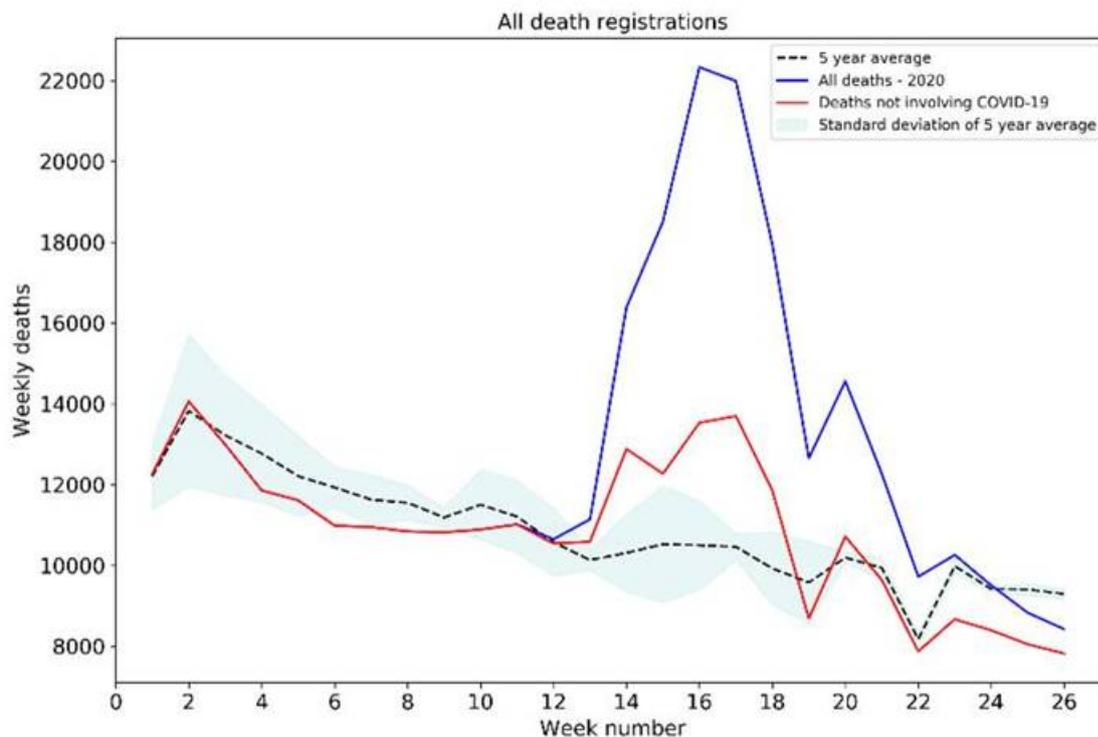


Figure 4. Deaths to week ending 26th June

^{viii} <https://www.gov.uk/government/groups/scientific-advisory-group-for-emergencies-sage-coronavirus-covid-19-response#scientific-evidence-supporting-the-government-response-to-covid-19>

Deaths involving COVID-19 have been registered since Week 11 of 2020 (ending 13th March). Between Weeks 13 and 22 of 2020 (21st March to 29th May), weekly deaths have significantly exceeded the five-year average – even when deaths involving COVID-19 are excluded. Until Week 12 (ending 20th March), the number of deaths registered per week was lower than the five-year average for the same weeks; and since Week 21 (ending 22nd May), deaths not involving COVID-19 have been below the five-year average level. The ONS article discusses the use of five-year average to estimate excess deaths in its “Strengths and limitations” section.

The latest weekly death registrations release (to 26th June 2020)² presents 49,607 deaths registered involving COVID-19 to date. 8,502 of these deaths have been registered in the six latest weeks, within the CSS reference period, starting 18th May.

The ONS paper exploring non-COVID-19 excess deaths in March and April concludes the explanations for increased non-COVID-19 deaths with most supporting evidence in the registration data are the presence of undiagnosed COVID-19, and delayed access to care.

What the official statistics may include which this paper does not estimate

There is a possibility some of the deaths not involving COVID-19 involved undiagnosed COVID-19 as a contributing factor. ONS’s article suggests this is the most likely cause for the excess non-COVID-19 deaths observed up to 1st May, alongside delayed access to care. Combining deaths involving and not involving COVID-19 in official statistics, and comparing with the total impact across all four categories of death this paper presents, is likely the best approach to account for the possibility of undiagnosed COVID-19 in death registrations without quantifying these undiagnosed deaths explicitly.

Another reason to expect an increase in general mortality is conditions related to stress. Both the existence of a global pandemic and Non-Pharmaceutical Interventions (NPIs) could increase the stress experienced by people, and many conditions which can be fatal are associated with increased stress, such as myocardial infarction, hypertension, suicide and substance abuse. The ONS article does not report much evidence supporting increases in deaths due to stress-related causes. Some of these effects of stress are captured within the Category D of excess death investigated in this paper (socio-economic impacts) but not all. Note there are other factors affecting presence of suicide and substance abuse deaths in these data, discussed below.

What this paper estimates which the official statistics do not present

These death registrations are unlikely to represent this paper’s category C(iii) deaths – due to postponement or cancellation of non-urgent elective activity – because these are not expected to materialise in the short-term. There may have been some instances elective procedures would save lives but could not go ahead due to the risk of COVID-19 infections to patients at particularly high-risk such as organ transplants. The ONS paper states there is not enough evidence yet to suggest these deaths have occurred in sufficient numbers in the short-term to identify, which is consistent with this paper’s expectation.

There are causes of death which are more complicated to ascertain, and as such are unlikely to be registered quickly following a death. ONS publishes the registration delays observed for different causes of death which demonstrate some of the differences between these causes. For example, only around 1% of deaths due to suicide or substance abuse are registered within two weeks.³ This has implications for how we compare the weekly deaths statistics, because some causes where we expect an increase in mortality will not be reflected in the data in the short-term.

3. Forward Look: Estimates of excess morbidity and mortality from the pandemic

Overview

The rest of this paper considers the total health impacts as a result of the pandemic, both in terms of excess morbidity and excess mortality across the four categories of impacts:

- A. Health impacts from contracting COVID-19
- B. Health outcomes for COVID-19 worsened because of lack of NHS critical care capacity
- C. Health impacts from changes to health and social care made in order to respond to COVID-19
- D. Health impacts from factors affecting the wider population

A summary of the scenarios modelled is outlined in Table 1 below. Annexes [A](#), [B](#), [C](#) and [D](#) provide detailed methodologies of the calculations for each category of health impact. The Annexes also provide a fuller description of the literature, including many aspects of health impacts that cannot be quantified; this was informed by an ongoing review of the academic literature and media coverage of potential health impacts, the methodology for which can be found in [Annex E](#).

Table 1 Scenarios modelled and key assumptions

	Mortality	Morbidity impacts
Category A: Health impacts from contracting COVID-19	Future numbers of COVID-19 patients are based on the latest COVID-19 Static Scenario (CSS) until March 2021. No estimates have been made beyond this time horizon.	We estimate the short-term health impact on those infected in the CSS, who then recover. We also estimate the medium-term health impacts of COVID-19 patients who have been in critical care and then recover.
Category B Health outcomes for COVID-19 worsened because of lack of NHS critical care capacity	Based on CSS, the current NHS critical care capacity is sufficient to treat all COVID-19 patients that would require it, hence the health impact for this category is zero.	
Category C Health impacts from changes to health and social care made in order to respond to COVID-19	(i) Changes to emergency care	
	Estimates are based on apportioning the non-COVID-19 excess deaths seen in recent weeks across different categories, and assuming they project forward as a constant proportion to direct COVID-19 deaths. Impacts on health and social care staff has been reviewed, however these have not been quantified.	Morbidity estimates for patients health are based on there being an unmet need for emergency care equivalent to 20% of prior volumes of emergency admissions and 25% of accident and emergency attendances to date in the pandemic. Projecting forward we assume unmet demand will continue, and that it will scale in proportion to direct COVID-19 deaths. We also estimate the mental health impacts on health care workers, through increases in anxiety and depression.
	(ii) Changes to adult social care	

	Estimates are based on the non-COVID-19 excess deaths seen in a 5-week window in March/April and assuming they project forward as a constant proportion to direct COVID-19 deaths.	We estimate the mental health impacts on social care workers, through increase in anxiety and depression.
	(iii) Changes to elective care	
	The scenario modelled here assumes that 75% of elective activity will be postponed by 6 months; leading to waiting list challenges for up to 5-years. The impact is expected to be small in the short-term (0-6 months) and spread across the medium and long-term.	The scenario modelled here assumes that 75% of elective activity will be postponed by 6-months and will resume at its usual level afterwards. The scenario considers the impact that deferment might have on the waiting time of patients who have the treatment directly postponed and any longer-term impact on the waiting time experience of future patients.
	(iv) Changes to primary and community care	
	Estimates of excess deaths over a five-year period, from delays to cancer diagnosis in GP referrals and emergency attendances.	
Category D Health impacts from factors affecting the wider population including increased deprivation	(i) Impacts of social distancing	
	The scenario modelled covers immediate, direct impacts of a 2-month lockdown; although some of the effects will be spread over a longer time horizon. The Global Burden of Disease approach incorporates morbidity and mortality impacts. Many of the scenarios are not evidence based but provided to illustrate the potential size of impact.	
	(ii) Impacts of lockdown induced-recession	
	The scenario modelled covers the short and medium-term impacts of lockdown-induced recession. It covers the impacts that would occur within a year of a recession and the impacts between 2 to 5-years after the recession, and therefore a gap of one year between the short and medium-term impacts has not been quantified ^{ix} . We assume a 4 percentage points average increase in unemployment and base the estimates on the cause- and disease-specific elasticities on studies looking at a period between 1978-2006 for short-term and 2002-2016 for medium-term impacts. The Global Burden of Disease estimates are used for morbidity and mortality impacts.	
	(iii) Increased deprivation	
	Two approaches are used: In one, the ONS life tables estimates assume a one percentage point increase in GDP and a -0.3 GDP-to-mortality elasticity and captures the impacts of the one age cohort of the population that has the worst impact. For the other approach, we assume a -1.0 GDP-to-IMD score elasticity per year as long as GDP remains at the low level.	There will be a corresponding impact on long-term morbidity, but this has not been quantified.

^{ix} This gap has not been quantified due to limited evidence in this area.

There is also a comparison of this analysis with an unmitigated RWC scenario, which is presented in [Annex G](#).

Regional coverage

The estimates in this paper represent England only; the reasons for this are outlined below.

In most cases, the data available to us covered England or England and Wales. We have chosen to present estimates for England only as a common denominator across all estimates, meaning that a consistent approach is used across all categories of harm and estimates are comparable. In most categories, this means using data for England in our estimates. On occasion, data was only available for UK level; in these cases, we have scaled down estimates to England level.

Therefore, it has not been possible to present separate estimates for Scotland, Wales and Northern Ireland. There are many differences between the Devolved Administrations (DAs), which will likely impact upon estimates of mortality and morbidity across the categories of harm. This may include, but is not limited to, population characteristics, healthcare capacity, different infection rates, as well as differences in the way that lockdown measures are being lifted. Therefore, based on the available data, we have chosen to limit analysis to England only; using England data to estimate impacts on mortality and morbidity for the other DAs may not take into account the specific characteristics of those nations. The methodology in this paper may be a useful basis upon which to base any specific analysis for each of the Devolved Administrations.

As an illustration of the potential harm across the UK, we have scaled up England estimates to present an estimate for the UK as a whole (see Annex F). It is important to note that these estimates are illustrative, only use a simple scaling factor and do not acknowledge the differences between the DAs noted above. Therefore, they should be interpreted with caution.

Inequalities

In this paper, we consider health impacts at a population level (England). We have not specifically investigated the impact of the different categories of harm by inequality, however, it seems likely that the impact may be more significant for people living in more deprived areas; each category is briefly discussed with regard to inequalities below.

Category A

Mortality

ONS analysis of COVID-19 deaths that occurred between 1st March and 31st May 2020 suggests that COVID-19 has had a proportionally higher impact in the most deprived areas in England. In the least deprived area, there were 59 COVID-19 deaths per 100,000 population, compared to 128 deaths per 100,000 in the most deprived area; this is 118% higher than the least deprived area.⁴

Morbidity:

People living in more deprived areas are more likely to test positive for COVID-19.⁵ Analysis from the Intensive Care National Audit and Research Centre suggests that 25% patients critically ill in intensive care units with COVID-19 were from the most deprived quintile of areas compared to 15% from the least deprived area; this pattern is similar to previous data from patients admitted for viral pneumonia between 2017 and 2019. Patient outcomes from COVID-19 across deprivation categories were similar.⁶

Category B

It is judged that there have been no cases of NHS critical care capacity being breached to date, and none are anticipated within the COVID-19 Static Scenario.

Category C (i)

Service users

Data from before the pandemic suggests that there is a higher rate of emergency admissions in more deprived areas than in less deprived areas.⁷ This may suggest that people living in more deprived areas may be more affected by disruptions to emergency care during the pandemic. Whilst we know that the use of emergency care has reduced during the pandemic, we do not yet know how this differs by level of deprivation. It is possible that the greater need for emergency care has prevailed during the pandemic, meaning that people in lower socio-economic groups could be disproportionately affected in terms of mortality and morbidity from reduced access to emergency care. However, it is difficult to confirm at this stage, without available data.

Healthcare staff

It is possible that healthcare staff may experience impacts on their mental health during and following the pandemic; mental health is linked to many forms of inequality, and therefore it seems likely that some healthcare staff (such as those with lower incomes) may suffer to a greater extent.⁸

Category C (ii)

Service users

We do not know how adult social care services have been affected during the pandemic in different areas; however, it is possible that people in more deprived areas may be more likely to be impacted by changes in adult social care during the pandemic, as evidence suggests that they are more likely to have care needs. For example, the Health Survey for England suggests that a higher proportion of people aged 65 or over in the most deprived areas need help, receive help and have unmet need than people in less deprived areas, for both activities of daily living and instrumental activities of daily living.⁹

Social care staff

Impacts on social care staff are expected to be similar to healthcare staff given their work on the frontline; as such it is possible that social care staff may also experience mental health impacts from the pandemic. As noted above, mental health is linked to inequality; therefore, it seems likely that some social care staff (such as those with lower incomes) may suffer to a greater extent.¹⁰

Category C (iii)

Data from before the pandemic suggests there is little difference between deprivation deciles in terms of elective care admissions.¹¹ However, it is possible that the impacts may be felt disproportionately by individuals in lower socio-economic groups. The Institute of Fiscal Studies has raised concerns that increased NHS waiting times for elective care will increase demand for private care, most likely only available to more affluent individuals, which could exacerbate health inequalities.

Category C (iv)

We do not know how the provision of primary and community care has differed across the country during the lockdown. However, evidence from before the pandemic suggests that primary care may be needed the most in deprived areas, and the pressure on primary care services may be highest in the most deprived areas.

Analysis by the Health Foundation suggests that the number of patients per GP is 15% higher in the most deprived 10% of CCGs than in the least deprived 10%, although this varies by Clinical Commissioning Group.¹² People who live in the most deprived areas are more likely to experience

worse health and have multiple health conditions. Therefore, the increased pressure on and reduction in primary and community services may exacerbate existing health inequalities in England.

Category D

Whilst we do not have timely data to confirm the impact, it seems likely that some of the health impacts related to the lockdown may be more significant for people living in the most deprived areas. For example, certain unhealthy behaviours such as alcohol consumption¹³, drug misuse¹⁴ and smoking¹⁵ are more likely in deprived areas. However, we do not know how these behaviours will have been impacted differentially during the lockdown. The economic impacts of a lockdown induced recession are likely to impact people living in deprived areas to a far greater extent than those in affluent areas. Indeed, analysis suggests that low earners are seven times as likely as high earners to have worked in a sector that has been shut down during the recession;¹⁶ it seems likely that these sectors (non-food retail, hospitality, transport, personal services and arts and leisure) are those that may continue to be affected in the medium to long-term in a recession and with social distancing measures continuing to some extent.

Limitations and uncertainty

The health impacts of COVID-19 are highly dependent on decisions that government makes going forward around measures to control the spread of the disease. Because of this uncertainty, as well as the difficulties in estimating many of the indirect effects for which there is little empirical evidence to date, this paper instead offers a set of modelled scenarios which, taken together, attempt to draw light on the plausible scale of health impact arising from the virus. *They do not attempt to represent the totality of impact, due to the significant uncertainties that exist.* In this regard, these estimates are likely to be conservative given there are likely to be additional impacts over future time periods, which are not factored in here because of the large uncertainty in the future course of the virus.

This analysis brings together a collection of scenarios. Each has its various limitations and uncertainties, which are covered in the individual corresponding annexes. These scenarios have attempted to provide estimates as a range to convey some of the statistical uncertainty within the confines of each scenario. In reality, little of the future course of the pandemic is known with any certainty: government responses, the public's behaviours, the uncertainty of the virus's evolution, and the potential for treatment and vaccines mean that the uncertainty is vast. It is hoped instead that by highlighting these scenarios, government policies can be informed, if imperfectly, of the potential magnitude of impact on health.

As well as quantitative estimates (for a summary, see above Table 1. Scenarios modelled and key assumptions), this paper includes a review of available evidence including academic and media sources; and attempts to outline qualitatively some of the additional health impacts that it is not possible to quantify.

Annex A: Category A: Direct Health Impacts from COVID-19

Summary

Category A health impacts are those that arise as a result of contracting COVID-19, in terms of mortality as well as morbidity for those surviving COVID-19. The key findings from the following annex are summarised below.

Mortality

- There were 47,000 direct COVID-19 deaths in England registered up to week ending 19th June.
- The following annex details methodology using the COVID-19 Static Scenario (CSS) for direct COVID-19 deaths up to March 2021. The methodology applies to the deaths that have already occurred to date, and those that are estimated to occur going forward. Based on 85,000 direct COVID-19 deaths between March 2020 to March 2021, we estimate 67,000 of these are excess deaths – i.e. they would not have occurred within a year without the presence of COVID-19. We estimate these represent 700,000 years of life lost (YLL). For further detail on the methodology used to estimate excess deaths and YLL, see [Section A1](#).
- These excess COVID-19 deaths equate to 530,000 lost QALYs. Further detail on the methodology used to estimate QALYs is found in [Section A2](#).

Morbidity

- There are likely to be health impacts for those surviving COVID-19, particularly for those who are admitted to hospital and spend time in critical care. This may include cognitive, mental and physical health impairments. Further evidence about potential impacts can be found in [Section A3](#).
- Using the CSS, we estimate the lost QALYs to be 40,000 from March 2020 to March 2021. This covers the morbidity for those who have already survived COVID-19, those who currently have COVID-19 and will survive, and those that will contract the virus in the future and will survive. Further detail on the methodology for estimating lost QALYs for COVID-19 survivors can be found in [Section A4](#).

A1: Estimating excess mortality of COVID-19

Aim

The aim of this work is to estimate the excess deaths caused by COVID-19 in the COVID-19 Static Scenario (CSS) provided by Scientific Pandemic Influence Group on Modelling (SPI-M) to the Scientific Advisory Group for Emergencies (SAGE) on 21st May 2020.

We aim to estimate the deaths directly from COVID-19 and the extent to which they are moving forward deaths that would have arisen in the short-term (defined as one year).

There are subsets of the population that may be particularly at risk, both from personal characteristics and due to exposure to the virus such as key workers.^{17,18} For the purposes of this analysis we undertake a whole population level analysis.

Methods

Input data

We use the CSS as our key input for total COVID-19 weekly deaths by age and sex. We also conduct the analysis for the unmitigated RWC scenario dated 31st March.

CSS

The CSS is one of the five scenarios approved by SAGE on 21st May as a collection of plausible scenarios designed for planning purposes. The scenarios were generated by SPI-M based on the information available at the time. They are not official planning scenarios for Government, nor are they forecasts, but they do provide a helpful range of possible outcomes for modelling purposes.

The CSS features a flat-line at 900 deaths per week until the end of the year. Other scenarios include a second peak roughly the same size as the first peak, a smaller peak and two other flat-line scenarios; one at 2,700 deaths per week and the other at 360 deaths per week. For the purposes of the estimates presented in the main body of this paper, we chose the flat-line scenario that was closest to the most recent data on deaths per week (in the week ending 19th June there were 744 COVID-19 deaths registered). Although the scenario approved by SAGE only covers up to 28th December 2020, for the purposes of this paper, we assume R remains at 1 until March 2021. This is demonstrated in the chart below:

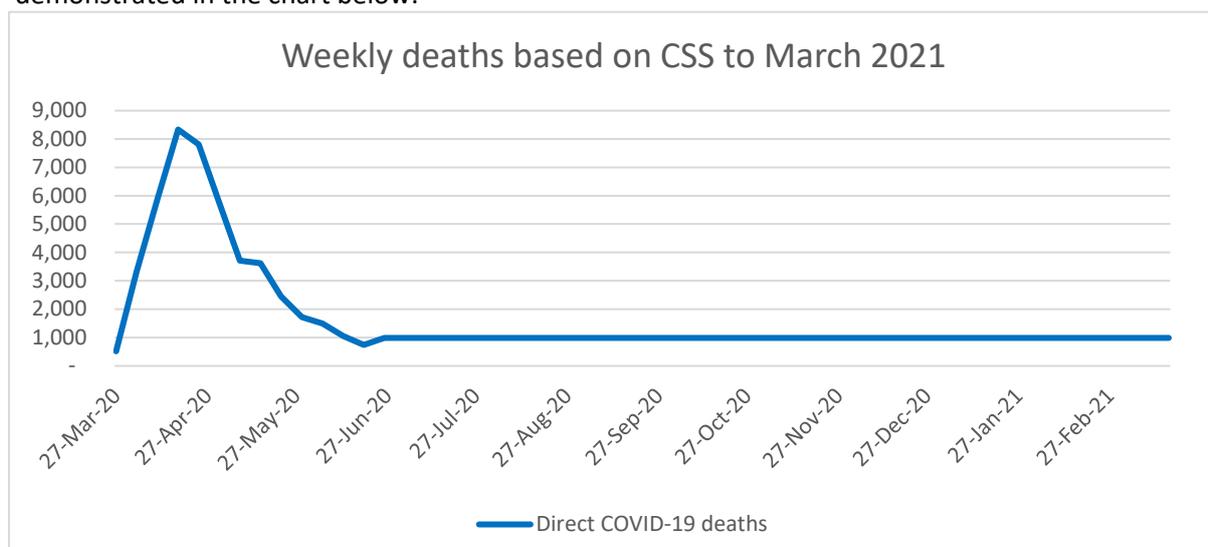


Figure 5 CSS for England

Estimating excess rates based on mortality rates

To estimate the excess deaths due to COVID-19, we assess the mortality in the infected population in two scenarios: first, with a COVID-19 infection; second, under normal conditions. All calculations are computed separately by gender and 10-years age groups.

The excess deaths are given by the difference in mortality between the COVID-19 CSS and the expected deaths in the normal conditions:

$$Excess\ deaths_t = \sum_s \sum_a (C19D_{s,a,t} - ED_{s,a,t})$$

Where $C19D_{s,a,t}$ is the number of deaths expected to occur in the infected population in the CSS, and $ED_{s,a,t}$ is the expected deaths in the infected population under normal conditions.

The expected deaths in the infected population under normal conditions are given by the number of COVID-19 infected multiplied by the standard mortality rate from the UK national life tables. This corresponds to the expected number of deaths in the absence of COVID-19.

For age group a and gender s , the number of expected deaths under normal conditions for those infected in week t is given by

$$ED_{s,a,t} = NInfected_{s,a,t} q_{s,a}$$

where $NInfected_{s,a,t}$ is the number of people of gender s and age a who have been infected by COVID-19 in week t . It is derived by multiplying the weekly infection rates by age from the CSS and the population total by age and gender. We assume that men and women are equally likely to be infected by COVID-19.

$q_{s,a}$ is the annual mortality rate for gender s and age group a in the general population, calculated based on the national life tables for 2016-2018. We calculate the average annual mortality rate by age group and gender, using the hypothetical cohort size as a weight. The resulting abridged life table is shown at the end of this annex.

We then estimate the actual deaths for the population infected with COVID-19. This is equal to the COVID-19 related deaths plus the estimated non-COVID-19 related deaths:

$$D_{s,a,t} = DeathsCOVID_{s,a,t} + (NInfected_{s,a,t} - k_{s,a} DeathsCOVID_{s,a,t}) q_{s,a} p$$

where $DeathsCOVID_{s,a,t}$ is the number of people of gender s and age a who died from COVID-19 in week t . We calculate the COVID-19 deaths by age and gender based on the death rates per 100,000 inhabitants caused by COVID-19 from the CSS. We multiply the deaths rates by 2020 population estimates by gender and 10-year age groups. We then attribute 60 percent of these deaths to men, 40 percent to women. Preliminary data from the UK¹⁹ indicate that about 60 percent of those who die from COVID-19 are men. In Germany, about two thirds²⁰ of COVID-19 deaths are men. A similar ratio is observed in China²¹. We estimate number of deaths by age by multiplying the deaths rates by 2019 population estimates by gender.

p is the proportion of year free of COVID-19. Assuming a recovery period of 4 weeks, we have $p = \frac{48}{52}$.

$k_{s,a}$ is an age and gender-specific constant which represents the ratio in background mortality rate between COVID-19 victims and the general population. $k = 1$ would assume that COVID-19 victims have the same background mortality rate as the general population. Because they are more likely to have underlying conditions, their one-year probability of dying is likely to be larger than that of the general population.

To estimate $k_{s,a}$, we use hazard rates of dying by age groups, gender and number of underlying conditions derived by Banerjee et al (2020)²². Underlying conditions include cardiovascular disease, diabetes, steroid therapy, severe obesity, chronic kidney disease, chronic obstructive pulmonary disease, COPD, chronic liver disease, chronic neurological conditions, splenic disorders, immune disorders and HIV/AIDS.

For the central estimate, we derive age and gender specific multipliers by using the ratio of the hazard rate for individuals with two conditions and the standard mortality rate by single age of age. We also derive multipliers based on hazard rates for individuals with one condition and hazard rates for individuals with three or more conditions to obtain a range of estimates of excess deaths, which we report in the main table.

We compute averages for each 10-year age group, using the size of the hypothetical cohorts from the life tables as weights¹⁰. The hazard rates in Banerjee et al (2020) only cover the population over 35. We use the multiplier for the 35-39 group for the younger age groups. The resulting multipliers by age and gender are presented at the end of this annex. For age groups over 30, the approach is tantamount to using the hazard rates derived by Banerjee et al (2020) ($h_{s,a}$) as the underlying mortality rate of COVID-19 victims (as $k_{s,a} = \frac{h_{s,a}}{q_{s,a}}$, so $k_{s,a}q_{s,a} = h_{s,a}$).

The excess mortality in week t is given by

$$\text{Excess deaths}_t = \sum_s \sum_a (\text{DeathsCOVID}_{s,a,t}(1 - q_{s,a}k_{s,a}p) - \text{NInfected}_{s,a,t}q_{s,a}(1 - p))$$

Note that if we assume that the proportion of year free of COVID-19 is one or 100 percent, then the excess mortality for age group a and gender s is simply given by $\text{DeathsCOVID}_{s,a,t}(1 - q_{s,a}k_{s,a}p)$, that is the difference between the number of COVID-19 deaths and the expected number that would have died in the absence of COVID-19.

This approach may overstate excess deaths for several reasons. First, the COVID-19 victims may have higher background mortality rates than implied by our approach. The hazard rates from Banerjee et al (2020) can be interpreted as the average on-year mortality rates by age group, gender and number of health conditions. If the COVID-19 victims tend to have many comorbidities or are particularly vulnerable, their underlying background mortality is likely to be greater than the hazard rates from Banerjee et al (2020). As a result, our approach is likely to overestimate the excess deaths for the scenarios we are using. In the [Sensitivity Analysis](#) for this section, we show how the estimate of excess deaths varies if we apply a greater multiplier.

Another assumption is that COVID-19 deaths are equally distributed within each age group. This may not be the case, as more deaths may happen at the upper end of the age group. This could bias the estimate of the total excess deaths as the mortality rate of those in the upper end of the band is higher than those at the lower end. This is particularly problematic for the 80+ age group, which is very large and heterogeneous in terms of mortality rate. For instance, the one-year probability of dying is 5.4 percent for an 80-year-old male, 16.5 for a 90-year-old and 26.3 for a 95-year-old.

Estimating years of life lost to COVID-19

We also estimate the years of life lost (YLL) to COVID-19. The YLL is given by the number of excess deaths multiplied by the life expectancy of COVID-19 victims.

¹⁰ We use the size of the hypothetical cohorts from the life tables as weights instead of the population totals so that it is consistent with the derived life expectancies, we use to compute years of potential life lost

To do so, we compute the life expectancy of COVID-19 victims, using mortality rates based on the hazard rates in Banerjee et al (2020). For each single year of age, we upscale the standard mortality rate by the factor $k_{s,a}$ used in the calculation of excess deaths. We use these upscaled mortality rates to compute life expectancy for each single year of age. We then compute average life expectancy for each 10-year age group using the hypothetical cohort size as a weight.

Excess deaths in CSS

The total number of deaths from COVID-19 between March 2020 and March 2021 is assumed to be 85,000. The excess mortality due to COVID-19 is estimated to be 67,000. For this analysis, the background mortality of COVID-19 victims is assumed to match that for individuals with 2 pre-existing conditions. The upper and lower bound estimates for both scenarios are produced by assuming background mortality matches the rate for individuals with 1 condition or 3+ conditions respectively. It is worth noting that this estimate is likely to overstate excess deaths based on the scenario being used: as COVID-19 victims tend to have many comorbidities and be particularly vulnerable, their underlying background mortality is likely to be greater than that assumed in our approach. With different assumptions on the underlying mortality rates, the excess could be much lower, as shown in the [sensitivity analysis for this section](#). For example, if we assume that the COVID-19 victim's underlying mortality is four times greater than the mortality rates we use in our main approach, the number of excess deaths would be estimated to be below XX,000.

Years of life lost in the CSS

The average years of life lost for COVID-19 excess deaths are estimated to be 10.5. The total years of potential life lost over the year covered by the CSS is estimated to be 700,000 years. Applying the same bounds as above, the years of life lost are between 490,000 and 900,000.

Sensitivity Analysis in the CSS

If the COVID-19 victims tend to have many comorbidities or are particularly vulnerable, their underlying background mortality is likely to be greater than the hazard rates from Banerjee et al (2020). Our approach is likely to overestimate the excess deaths. We show how the estimate of excess deaths varies as we scale up the multiplier $k_{s,a}$ by a constant. If we assume that the COVID-19 victims have twice the hazard rates from Banerjee et al (2020) for people with two underlying conditions, the excess deaths would be estimated to be around 67,000, a reduction of 14%. If we assume that the COVID-19 victims' underlying mortality is four times greater, then the excess deaths would be estimated to be around 44,000 (a reduction of 44%).

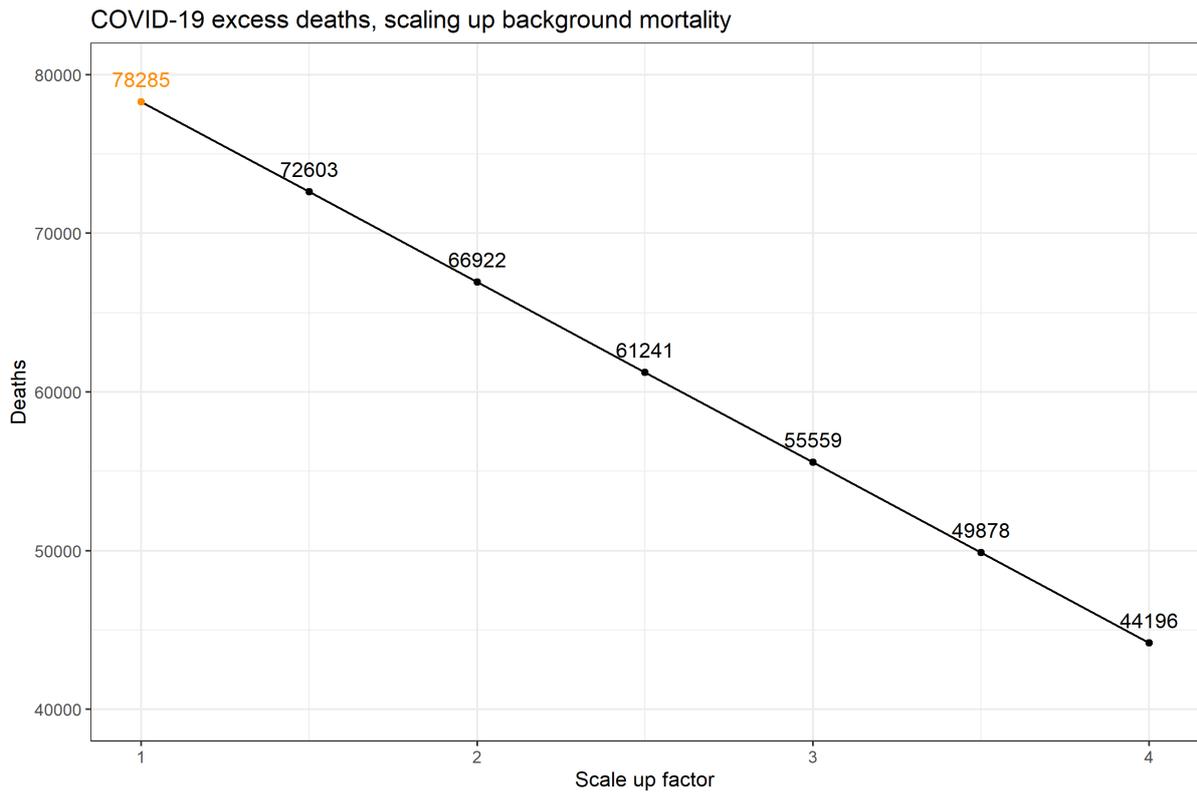


Figure 6 Relationship between estimate of COVID-19 excess deaths and the k factor for scaling background mortality

In the main analysis, we define the excess deaths as the deaths caused by COVID-19 over and above the expected deaths for the infected population within one year. Here we show how the estimates of excess deaths varies depending on the time window we use for estimating the expected deaths.

COVID-19 excess deaths by time window for expected deaths

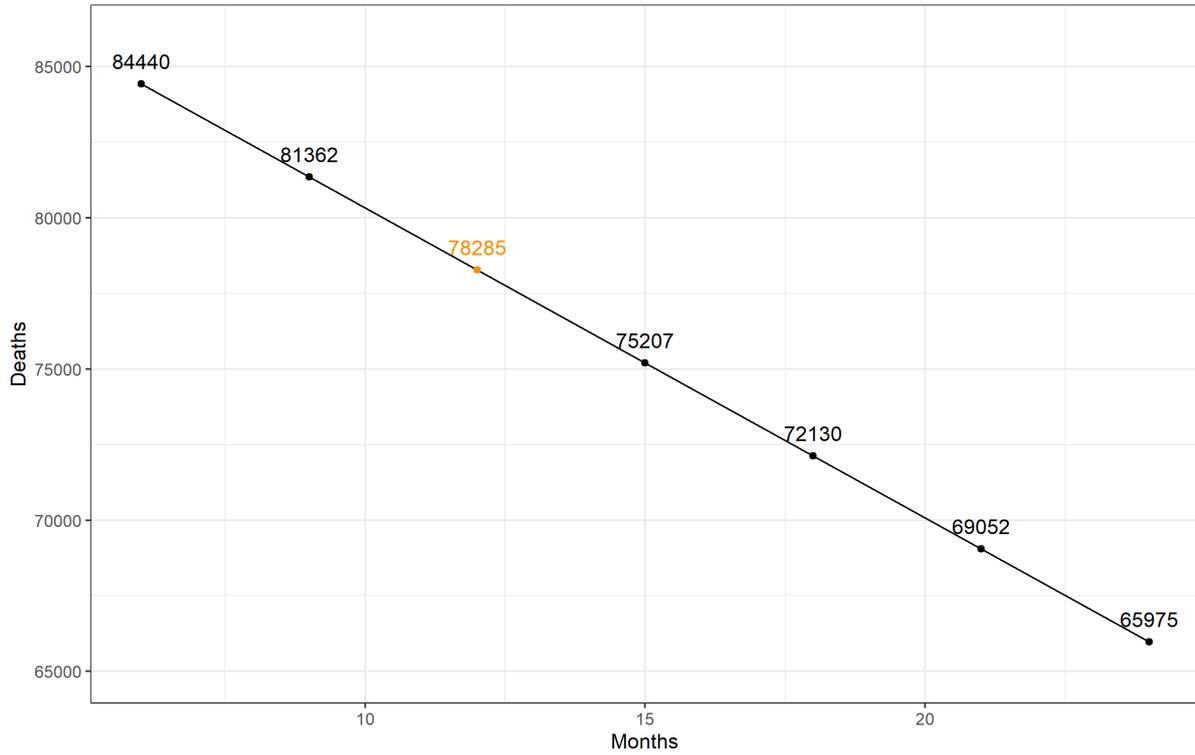


Figure 7 Relationship between estimate of COVID-19 excess deaths according to how the time window is defined

For our main estimate, we assume that a recovery time from COVID-19 of four weeks. In the Figure below we show estimates of excess deaths using alternative recovery times, from one to six weeks. Our estimates are not very sensitive to using alternative recovery times.

COVID-19 excess deaths by recovery time from COVID-19

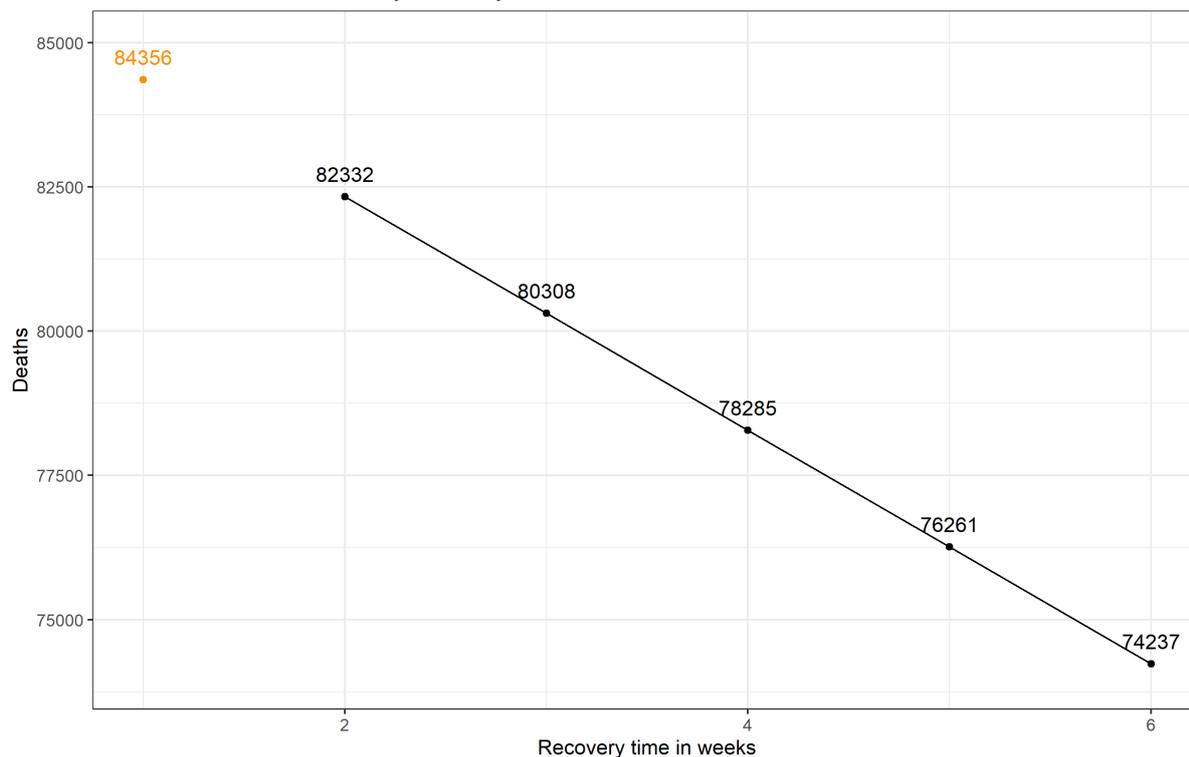


Figure 8 Relationship between estimate of COVID-19 excess deaths and recovery time from COVID-19

Table 2. Abridged life table, with multipliers derived from Banerjee et al (2020)

Sex	Age group	Standard mortality rate (q)	Multipliers			Life expectancy		
			1 condition	2 conditions	3+ conditions	1 condition	2 conditions	3+ conditions
Men	0.to.9	0.0005349	2.99	8.47	33.21	65.32	53.40	38.18
Men	10.to.19	0.0002083	2.99	8.47	33.21	55.55	43.94	29.71
Men	20.to.29	0.0005767	2.99	8.47	33.21	46.17	35.27	23.08
Men	30.to.39	0.0010361	2.99	8.47	33.23	37.13	27.27	18.20
Men	40.to.49	0.0022465	2.78	11.21	22.61	28.61	21.32	14.59
Men	50.to.59	0.0047852	2.89	6.67	9.33	20.94	15.53	11.74
Men	60.to.69	0.011593	2.46	4.62	8.72	14.37	11.21	7.61
Men	70.to.79	0.0291359	2.10	3.25	5.86	8.94	7.15	5.26
Men	80+	0.0862049	1.89	2.44	3.25	5.16	4.34	3.65
Women	0.to.9	0.0004545	3.44	10.46	57.58	69.31	60.01	38.54
Women	10.to.19	0.0001219	3.44	10.46	57.58	59.53	50.61	30.67
Women	20.to.29	0.0002525	3.44	10.46	57.58	49.89	41.50	23.51
Women	30.to.39	0.0005814	3.44	10.46	57.62	40.50	32.98	17.90
Women	40.to.49	0.0013725	3.34	11.43	43.68	31.62	26.03	15.75
Women	50.to.59	0.0032194	3.68	6.09	15.70	23.71	19.74	12.15
Women	60.to.69	0.0077465	2.55	4.29	10.38	16.60	13.51	8.88
Women	70.to.79	0.0205606	2.27	3.55	6.50	10.53	8.67	6.26
Women	80+	0.0744194	1.81	2.41	3.36	5.81	5.07	4.04

Note: The background mortality of COVID-19 victims is assumed to match that for individuals with 2 pre-existing conditions from Banerjee et al (2020). We use mortality rates for 1 and 3+ conditions to derive upper and lower bounds.

Quantifying excess deaths and years of life lost for Unmitigated RWC

The scenario “Unmitigated RWC” (31st March) is an illustrative scenario where no mitigations are put in place to prevent or delay the spread of disease. The unmitigated scenarios only cover a six-month period. These deaths are represented as two sub-scenarios:

- Direct deaths in a scenario where NHS has limitless capacity (i.e. assuming all patients that require ventilated beds can access them). We count these as Category A deaths
- Indirect deaths in a scenario where NHS has restricted capacity to cope (factoring in the additional Nightingale Hospitals and other capacity built within NHS hospitals by freeing up beds and operating theatres). We count these as Category B deaths.

To estimate the Category A excess deaths and Years of Life Lost (YLL), we use the same ratios as provided for the low, central and high estimates, as for the CSS. In this way, we are essentially making the assumption that the background mortality profile for deaths in the two scenarios are similar. The central, low and high estimates are therefore consistent between the two scenarios and correspond with a background mortality equivalent to the age/gender and co-morbidity assumptions as per the table below.

However, for Category B excess deaths and YLL, it is reasonable to suggest that those who die from a critical care bed not being available are healthier than those that die even when they do have access to critical care beds. Therefore, we have assumed that the counterfactual life expectancy is based on fewer co-morbidities, outlined in the table below. Mortality profile for no comorbidities is not available and therefore we have used standard mortality rates.

Table 3. Background mortality assumption

Estimate	Background mortality assumptions for CSS and unmitigated RWC scenario for Category A	Background mortality assumptions for unmitigated RWC scenario for Category B
Low	3 + comorbidities; adjusted for age and gender	2 comorbidities; adjusted for age and gender
Central	2 comorbidities; adjusted for age and gender	1 comorbidity; adjusted for age and gender
High	1 comorbidity; adjusted for age and gender	0 comorbidity; adjusted for age and gender

Key Uncertainties and assumptions

The results are provided in ranges that show the key uncertainty around background mortality. The sensitivity analysis section explores how the results vary according to the parameters around the recovery time, and varying k (relative risk as compared to background mortality).

We assume a recovery time of 4 weeks, with the World Health Organisation (WHO) citing a median time from onset to clinical recovery for mild cases of approximately 2 weeks, and 3-6 weeks for severe or critical cases. Analysis shows that the estimates are not very sensitive to changes in recovery time; a change from 4 to 6 weeks produces a 2.3% decrease in the number of estimated excess deaths.

The multiplier k adjusts for the observation that those dying of COVID-19 are more likely to have underlying conditions, giving this group a larger background one-year mortality compared to that of the general public. The multiplier is calculated using hazard rates derived in Banerjee et al (2020). The paper calculates these hazard rates – average one-year mortality – for the population at high risk of COVID-19 as defined by Public Health England guidelines²³. These guidelines include those over 70, and those with certain morbidities such as diabetes and cardiovascular disease.

The CALIBER research platform was used to find the prevalence of these specified underlying conditions in 3.8 million individuals aged 30+. The data used in CALIBER has been shown to be representative of the general population of England. Kaplan-Meier estimates were used to find one-year mortality of those with 1, 2 and 3+ of the morbidities cited by Public Health England (PHE) by age band and gender. These hazard rates were calculated using England data, and here applied to the UK. This assumes the same one-year mortality as England for each of the underlying conditions for each gender and age band across the UK. Banerjee et al only created hazard rates for those aged 30 and older. This therefore created an additional assumption that the multiplier k for the younger age bands matched that of the 30-39-year-old age group.

We assume a one-year mortality of COVID-19 victims aligns with the estimates of individuals with 2 co-morbidities as given by Banerjee et al. This could create an overestimate of the number of excess deaths if the population of those dying of COVID-19 are particularly vulnerable. Assuming an underlying mortality for individuals dying from COVID-19 four times greater than assumed by the k used produces a 32.3% decrease in the estimate of the number of excess deaths. An additional assumption is that the number of COVID-19 deaths is equally distributed within each of the age groups. This may not be true- especially in the higher age bands. For instance, the one-year probability of dying for an 80-year-old male is 5.4% and 16.5% for a 90-year-old male. This may cause an overestimate in the number of excess deaths.

The COVID-19 scenarios contains large uncertainties due to the characteristics of the virus and how government and society will respond in terms of social distancing measures. If the COVID-19 scenarios overestimate or underestimate the reality of COVID-19's impact, the health impacts estimated here will reflect that difference from the true effect.

Discussion

Data surrounding deaths directly caused by COVID-19 has been collected in some form from the early days of the epidemic. As time has gone by the scope and granularity of this data has been constantly improving and expanding. There are daily counts and weekly summaries; deaths counted by date of notification as well as deaths recorded by date of occurrence. The scope of setting has expanded from deaths in hospitals, to including those occurring in care homes and in the wider community. Analysis has been done breaking down these deaths by factors such as region, age, gender, ethnicity, pre-existing conditions, occupation and more. These provide a useful basis to estimate excess deaths -those that would not have occurred otherwise within one year- caused directly by COVID- 19; although only retrospective analysis of deaths over a long period of time will allow for certain relevant parameters to be accurately estimated.

One such parameter is k . As discussed above k is a multiplier created from hazard rates in the vulnerable population-as derived in the Banerjee et al paper and the standard mortality rate. It adjusts for the fact that the group dying directly of COVID-19 tends to be biased toward the elderly population and over-represented by those with certain pre-existing conditions. Analysis carried out by ONS showed that of the 3,912 deaths that occurred in England and Wales during March 2020

involving COVID-19, 91% had at least one pre-existing condition. ONS defined a pre-existing condition as any health condition mentioned on the death certificate that either preceded the COVID-19 or was a contributory factor in the death but was not part of the causal sequence. There may therefore be a discrepancy between what the ONS counted to be a pre-existing condition and the conditions used in the Banerjee et al paper to create the hazard rates. Banerjee et al created their hazard rates using certain specific pre-existing conditions that PHE specified would put individuals in the vulnerable group.

Analysing the March 2020 COVID-19 deaths for England and Wales, ONS estimated that the mean number of pre-existing conditions in individuals who died of COVID-19 was 2.7. The hazard rates that were used to create the k multiplier were created for individuals with 1, 2 or 3+ morbidities by age band and gender. The main estimates presented in this paper used the hazard rates related to those with 2 underlying conditions, therefore the estimate for excess deaths could be an overestimate according to this mean. However, it seems that the definition given by ONS for a pre-existing condition could be broader than the list of specific underlying conditions used by Banerjee et al.

The hazard rates were only derived for individuals aged 30+. The k value calculated for the 30-39 age band was therefore used for the younger age bands (0-9, 10-19, 20-29.) This assumption isn't likely to skew the estimates for excess deaths significantly, as the number of COVID-19 deaths occurring in these age groups is small. There were 86 deaths of people under 30 from COVID-19 by June 2020 in England and Wales according to ONS²⁴. This represents just 0.18% of total COVID-19 deaths within this period.

The estimates for excess deaths calculated here use appropriate and relevant assumptions surrounding a number of factors (such as age, gender, pre-existing conditions, background mortality, recovery time) as well as reflecting (within each scenario) the impact of government decisions made surrounding social distancing measures, to try and create an estimate for the number of excess deaths occurring directly due to COVID-19.

A2: Estimating lost QALYs and YLL for Category A mortality

Overview

The following section estimates the lost Quality-Adjusted Life Years (QALYs) for people who would not have died in the next year in the absence of contracting COVID-19.

Overall, findings suggest that there may be between 319,000 and 607,000 lost QALYs and between 490,000 and 900,000 years of life lost in the CSS. In the unmitigated scenario, this shows lost QALYs between 1.8m and 3.5m.

Further detail of the methodology can be found in the following section.

Methodology

The methodology to estimate excess deaths and years of life lost is provided in section "A1: Estimating excess mortality of COVID-19". The table below outlines the assumptions on existing conditions used to calculate the excess deaths and YLL. In the CSS, we have included all excess deaths from 21st March 2020 to March 2021.

Table 4. Excess deaths and years of life lost (YLL)

	Description of excess deaths and YLL	Description of life expectancy	Description of QoL
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Low	3+ comorbidities	3+ comorbidities	All individuals have 1 + comorbidity
Central	2 comorbidities	2 comorbidities	Proportion have 1 + comorbidity and the rest 0 comorbidities
High	1 comorbidity	1 comorbidity	Proportion have 1 + comorbidity and the rest 0

A Quality-Adjusted Life Year (QALY) is equal to 1 year of life in perfect health. QALYs are used to measure changes, either in the state of health of a person or group; or in terms of length of life. A QALY representation of a fatality is based on the years of life lost, and the quality of life that person was expected to have lived. A measure of quality of life has been developed, called EQ-5D-5L²⁵, which helps to translate health conditions into a quality of life weighting on an individual, and comprises of 5 dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression.

Counterfactual Quality of Life of a COVID-19 fatality

Certain comorbidities are especially common in victims of COVID-19, including heart disease, respiratory illnesses including asthma, and diabetes²⁶. These diseases are chronic and have a significant effect on quality of life (QoL). To estimate the counterfactual QoL of a COVID-19 fatality, we use the EQ-5D-5L approach, based on what we know to be the prevalence of health conditions for COVID-19 fatalities.

Health Survey for England (HSE) 2017²⁷ asked adults (age 16+) to complete questions on the 5 dimensions in the EQ-5D-5L system²⁸ for which we have a transformation into QoL utility weights²⁹. 10% of adults did not or could not give a valid response to this section of the questionnaire, leaving 7,169 adults with a valid EQ-5D-5L state.

We have assumed an individual is at higher risk of dying from COVID-19 if they had one or more of these conditions:

- cardiovascular diseases including diabetes & high blood pressure
- long-term respiratory conditions
- long-term endocrine & metabolic conditions.

Individuals without one of these conditions have been considered as low risk of catching COVID-19. It was not possible to calculate the QoL for individuals with 2 conditions or 3+ conditions, due to limited number of data points in the HSE data; therefore, the QoL for individuals with 1 or more comorbidity is used in all three scenarios for the 'high risk' group. The HSE data was grouped by age group, sex and risk status, and the average health-related quality of life was calculated for each group, weighted by the survey weighting.

For the 2017 HSE cohort we generated a (quadratic) best-fit line to the average QoL by age (in single years). Linear and cubic trendlines were considered, however quadratic provided the best fit without overfitting. We have assumed that under each grouping, the QoL for individuals under 16 would be the same as a 16-year-old due to the lack of data points and the curve showing a slight dip in QoL for under 16 when extrapolated.

QoL estimates have been discounted¹¹ following the Green book guidelines³⁰. Using life expectancy data for individuals with 1 condition, 2 conditions, 3+ conditions and no condition³¹, the average discounted QALYs are calculated by gender and age (in single years) for the low, central and high scenarios. It has not been possible to calculate the life expectancy of an individual with no condition, and therefore average life expectancy has been used. Therefore, these estimates may present an underestimate, as we could expect life expectancy for individuals with no conditions to be higher than what is included in the analysis. These results have been aggregated to 10-year age bands to calculate the average QALYs by age band and gender using ONS population data.

In order to calculate the gender split on the excess deaths by age, the ONS weekly deaths³² has been used. In order to calculate the proportion of the population that have a pre-existing condition, March and April 2020 data³³ has been analysed. The pre-existing conditions were grouped in categories on whether having the condition would increase the chances of an individual being infected with COVID-19. A weighted percentage is then generated based on these categories, giving an estimate of 73% of individuals who have died from COVID-19 had a pre-existing condition that increased their chance of being infected by COVID-19. These proportions have been used in the central and high scenario below and are outlined in Table 4.

Low estimate:

In this estimate we assumed that all individuals that would not have died in the next year in the absence of COVID-19 had a pre-existing condition. The average QALY is calculated based on an individual's life expectancy with 3+ conditions, as explained in Table 4. Life expectancy and QoL vary by gender, calculations are weighted accordingly.

$$\text{Total discounted QALY lost} = \text{Average discounted QALYS} \times \text{Excess deaths with 3+ conditions} \times \text{Proportion of deaths by gender}$$

Central estimate

In this estimate, we assume that not all individuals have pre-existing conditions, and therefore we use different average QALYs for those in the high-risk group and those with no pre-existing conditions. Unlike the low estimate, the average QALY for the high-risk group is calculated based on an individual's life expectancy with 2 conditions (explained in Table 4) and the average QALY for the low risk group is calculated based on an individual's life expectancy with no conditions.

$$\text{Total discounted QALY lost} = \text{Average discounted QALYS} \times \text{Excess deaths with 2 conditions} \times \text{Proportion of deaths by gender} \times \text{Proportion of individuals with pre-existing conditions}$$

High estimate

The QALYs are calculated using a similar approach to the central scenario, but calculations for the high-risk group are based on an individual's life expectancy with 1 condition (explained in Table 4).

COVID-19 deaths presented in the CSS have been uplifted by 10%. This is to account for the CSS using data on test-confirmed deaths only; hence missing c. 10% of deaths registered with a mention of COVID-19.

$$\text{Total discounted QALYs lost} = \text{Average discounted QALYS} \times \text{Excess deaths with 1 condition} \times \text{Proportion of deaths by gender} \times \text{Proportion of individuals with pre-existing conditions}$$

The CSS extends to March 2021 to cover a time frame of one year.

¹¹ The value of health affects increases over time, and therefore discounting captures the increase in the future value of health effects.

Summary

Table 5 outlines the lost QALYs for people who would not have died in the next year in the absence of COVID-19. This gives lost QALYs between **319,000-607,000 in the CSS and 1.8m-3.5m in the unmitigated RWC scenario.**

Table 5. Lost QALYS from direct COVID-19 deaths in CSS versus unmitigated RWC scenario between March 2020 and March 2021

	CSS		Unmitigated RWC scenario (31 st March)	
	Excess deaths	Lost QALYS	Excess deaths	Lost QALYS
Low	64,000	319,000	410,000	1,800,000
Central	67,000	530,000	439,000	3,000,000
High	68,000	607,000	454,000	3,500,000

A3: Short, medium and long-term health impacts for survivors of COVID-19

Overview

Overall, the evidence highlights that there are likely to be morbidity impacts from being hospitalised, being in critical care and getting the virus itself. Early evidence on mental health impacts from COVID-19 suggests that a significant number of patients suffered from mental health conditions following discharge, which is supported by evidence from previous pandemics. The evidence also demonstrates there are likely to be longer term health implications of becoming severely ill and needing critical care, and this could have an impact on physical health and other social factors like returning to work and needing care from others.

Impacts of intensive care and hospital admission

It is estimated that 14% of people with COVID-19 become seriously ill, requiring hospitalization and oxygen therapy, and a further 5% are moved into intensive care. Patients in intensive care may require the use of a ventilator, which requires sedation although they are not unconscious; in some cases, this can continue for long periods of time, as high as 20 days.³⁴ In severe cases, patients may be placed on Extracorporeal Membrane Oxygenation (ECMO) machines to support the heart and lungs.³⁵

As patients are discharged from intensive care units (ICU), reports highlight that there are a number of potential consequences for individuals' health from the secondary disabilities that result from intensive care treatments. COVID-19 survivors could suffer from 'Post Intensive Care Syndrome' (PICS), which includes cognitive impairment, physical impairment and psychiatric illness. The potential impacts for COVID-19 survivors in terms of cognitive, physical and psychiatric impairment as well as wider social impacts are discussed below.³⁶

Cognitive impairment

Potential impacts of PICS are a range of cognitive impairments, such as memory, attention, visuo-spatial, psychomotor and impulsivity effects.³⁷ Anecdotal reports also suggest there could be an effect on memory and thinking as a result of the sedation drugs used whilst on a ventilator.³⁸

Physical health

For those admitted to intensive care, PICS is linked to a number of physical impairments, including dyspnea¹²/impaired pulmonary function, pain, sexual dysfunction, impaired exercise tolerance,

¹² Shortness of breath

neuropathies, muscle weakness/paresis and severe fatigue.³⁹ PICS can lead to long-term disabilities from organ damage, and brain damage.⁴⁰

Another common complication from PICS is neuromuscular, affecting patients' mobility. Evidence shows that Critical Illness Polyneuropathy (CIP) and Critical Illness Myopathy (CIM) syndromes are seen in approximately 25–45% of critically ill patients during and after intensive care stays with mechanical ventilation. These patients often exhibit severe neurodegenerative complications, including flaccid and symmetric paralysis, limb and respiratory muscle weakness, systemic inflammatory response syndrome, or multiple organ failure.⁴¹

A pre-print systematic review of the long-term clinical problems in adult survivors of COVID-19, Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) after hospitalisation and ICU admission revealed respiratory dysfunction (impaired diffusing capacity for carbon monoxide) and reduced exercise capacity at 6 months with limited improvement beyond 6 months.⁴² Indeed, evidence from survivors of COVID-19 in Wuhan suggests that 16% had a post-hospital discharge cough and 12% were breathless after activity⁴³.

Whilst we do not yet know the long-term effects of COVID-19, evidence from previous coronavirus epidemics suggests that the physical health effects may be long lasting. Exercise capacity and health status amongst SARS survivors who required hospital (and in some cases ICU) admission were considerably lower than that of the general population after 6 months⁴⁴; further studies following hospitalized SARS survivors for a longer time frame (12 and 18 months) showed that psychological and physical functioning was below population norms,⁴⁵ with significant impairment of breathing difficulties documented in 24% of SARS survivors 1 year after illness onset.⁴⁶ Another study looking at impacts after 2 years showed significant impairment of diffusing capacity of the lung for carbon monoxide, exercise and health status persisted with a more marked adverse impact among health care workers.⁴⁷ A study looking at SARS survivors in Hong Kong found chronic fatigue persisted and continued to be clinically significant among the survivors at 4-year follow up; of those who participated in the study less than half had a chronic fatigue problem, and around 30% met criteria for chronic fatigue syndrome.⁴⁸

Mental health

Stays in intensive care and PICS have been linked to impacts on mental health, including anxiety, depression and Post Traumatic Stress Disorder (PTSD).^{49,50} Anecdotal reports from COVID-19 survivors hospitalized in intensive care highlight the mental strain from witnessing others passing away, dependency on staff and the impact of them being in hospital on other family members.⁵¹

Anecdotal reports from health care professionals have highlighted the harms of ICU care, with survivors having profound symptoms of PTSD, especially those who had life threatening COVID-19.⁵² Evidence from China suggests an increase in posttraumatic stress symptoms and the impact this could have on long-term health; a survey of COVID-19 patients in temporary quarantine hospital facilities in China suggested that 96% suffered from significant posttraumatic stress symptoms prior to discharge.⁵³

Recent studies in China have documented anxiety amongst COVID-19 survivors, which was significantly associated with post-discharge respiratory symptoms, worry about recurrence, worry about infection to others and home quarantine lifestyle.^{54,55} Research has also found depression amongst COVID-19 survivors, as well as sleep disorders.^{56,57} Only a small proportion have been documented to have suicidal thoughts after hospital discharge.⁵⁸ Early evidence from China also suggests that depression and anxiety symptoms was more severe amongst COVID-19 patients in an

isolation ward, compared to patients with general pneumonia in an observation ward and a healthy control group.⁵⁹

The effects on mental health may be long-lasting after discharge from hospital.^{60,61,62,63} Research on SARS survivors has found psychiatric morbidities continued among survivors at a 4 year follow up; 40% of survivors had active psychiatric illnesses.^{64,65}

It is possible that certain groups may be more severely affected than others. For instance, evidence from SARS suggests that healthcare workers who survived the illness had higher depression, anxiety and posttraumatic symptoms, as well as poor quality of life than non-healthcare worker survivors.^{66,67} Other factors that may play a role include the severity of symptoms, emotional/social support available to the survivor as well as presence of chronic medical illnesses diagnosed before the onset of SARS.^{68,69,70,71}

Wider social impacts

In general, the longer a patient stays in intensive care, the higher the risk for longer-term physical, cognitive and emotional complications⁷² and the longer their recovery may be, although this will vary from patient to patient.⁷³

Those spending time in intensive care may also require care assistance following discharge from hospital. One study found a quarter of (non-COVID-19) patients who spent more than 48 hours in UK ICUs reported needing care assistance at 6 months, with 22% still needing support at 1 year after discharge.⁷⁴

Reports from COVID-19 survivors also suggest although eating sufficient amounts after discharged, weight loss still occurred. A lack of energy and concentration has made it difficult for survivors to return to work quickly. Doctors have also highlighted that it will take longer than a couple of weeks for COVID-19 survivors' concentration levels to return to normal.⁷⁵

There are varying estimates about the impact of respiratory diseases and stays in ICUs on employment. It has been reported that nearly a third of patients who experience PICS do not go back to work, and another third do not go back to their pre-ICU job, or a job with a similar salary.⁷⁶ There is evidence from SARS, where 17% of survivors had not returned to work a year after hospital discharge.⁷⁷ It is possible that this is higher amongst healthcare workers; one study found 30% of health care workers and 7% of non-health care workers had not returned to work 2-years after onset of SARS.⁷⁸

Health impacts of individuals with symptoms of COVID-19 who are not hospitalised

Some individuals may develop symptoms of COVID-19, but will not require hospital treatment, instead self-isolating at home. Symptoms requiring self-isolation are the recent onset of a new continuous cough and/or a high temperature.⁷⁹ Other noted symptoms of COVID-19 may include tiredness, aches and pains, sore throat, diarrhoea, conjunctivitis, headache, loss of taste or smell, and a rash on the skin, or discolouration of fingers or toes. In more serious cases where hospital care is more likely, individuals may experience difficulty breathing or shortness of breath, chest pain or pressure, and loss of speech or movement.⁸⁰

For those living alone, PHE guidance indicates they should self-isolate at home for 7 days from the first day of experiencing symptoms. For those living with others, the individual with symptoms must self-isolate for 7 days and other household members must self-isolate for 14 days, unless they start showing symptoms, from which point they must self-isolate for 7 days. This means that for some

individuals, they may find themselves self-isolating at home for 21 days (if symptoms show on day 14).⁸¹

Anecdotal evidence from individuals who have self-isolated with symptoms suggest experiences and symptoms vary. Some find themselves able to continue working and may not significantly notice symptoms above and beyond normal coughs and colds⁸² while others may see more significant effects, including for those with underlying health conditions, and the effects may last for several weeks.

It is possible that people self-isolating with symptoms at home may experience wider effects on their mental health as well as social and economic difficulties as a result of not being able to leave their homes. This is likely to vary by household and over time; for example, some relief may be felt once the first symptomatic household member can leave the house, for example to go food shopping, and enabling household members to have their own space for some time. It is difficult to know how different the effects will be for those self-isolating with symptoms and the general population who are following social distancing measures, staying at home for prolonged periods of time. Earlier in the pandemic before lockdown measures were introduced, anecdotal reports suggest that those self-isolating with symptoms found it “frightening” and lonely.⁸³ Others reported finding it stressful keeping children at home, trying to get them to do school work instead of playing video games. It is possible that some of this may be a symptom of staying at home, rather than experiencing COVID-19, but the effects may be more significant for those self-isolating, as they are not allowed to leave their home for any purpose which is quantified in Annex D.

A4: Estimating lost QALYs for Category A morbidity

Overview

The following section estimates the lost QALYs for people who contract and survive COVID-19.

Overall, estimates suggest that there may be between 23,000 to 69,000 lost QALYs for individuals who survive COVID-19 from March 2020 to March 2021. This varies depending on the severity of illness, with a greater number of QALYs lost for those needing critical care, compared to those individuals contracting COVID-19 but not being hospitalised.

Table 6 outlines the assumptions used to calculate the lost QALYs for individuals who have contracted COVID-19, been hospitalised and in need of critical care. To calculate the average QoL impact for someone contracting COVID-19 and being hospitalised, we have used the cross-walk dataset (dataset providing a QoL for a given health state)⁸⁴ which uses the EQ-5D-5L scale, and have assigned a score to each of the 5 dimensions (mobility, self-care, usual activities, pain/discomfort and anxiety/depression). For those in critical care, we have used the lost QALYs from the Mangen⁸⁵ (2017) study.

Table 6 Summary of QALY estimates and assumptions

	QALY assumptions
Individuals who have contracted COVID-19 but not been hospitalised	Moderate issues under 4 of the 5 dimensions of the EQ-5D-5L scale (mobility, usual activities, pain/discomfort and anxiety/depression) and slight issues with self-care.
Patients that are hospitalised (excluding critical care)	Severe issues under all 5 dimensions of the EQ-5D-5L scale.

Patients need critical care	Lost QALY of 0.13 based on Mangen (2017) study
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Further detail of the methodology can be found in the following section.

QALY estimate of morbidity impacts

The evidence highlights that there are likely to be morbidity impacts from being hospitalised, being in critical care and getting the virus itself. Early evidence on mental health impacts from COVID-19 suggests that a significant number of patients suffered from mental health conditions following discharge, which is supported by evidence from previous pandemics. The evidence also demonstrates there are likely to be longer term health implications of becoming severely ill and needing critical care, and this could have an impact on physical health and other social factors like returning to work and needing care from others. The evidence suggests that contracting COVID-19, being hospitalised and going through critical care has an impact on individuals' health and have estimated the morbidity impacts below.

Table 7. Duration, total number of patients and lost QALYs per patient

	Duration	Total patients (excluding deaths)	Lost QALYs per patient
Individuals who have contracted COVID-19 but not been hospitalised	7 days	5,000,000 to 10,900,000	0.001-0.007
Patients that are hospitalised (excluding critical care)	7.6-12.8 days	78,000 to 84,000	0.012-0.031
	2-4 months following discharge		0.005-0.113
Patients need critical care	1 year following discharge	8,000 to 15,000	0.13

QALYs lost from patients contracting COVID-19 but not being hospitalised

To calculate the lost QALYs as a result of contracting COVID-19 but not being hospitalised, we first calculated the QoL of individuals having 1 or more comorbidity and having no comorbidities. The method is outlined in the QALYs section [above](#).

To calculate the average QoL impact for someone contracting COVID-19 we have assumed an individual would have moderate issues under 4 of the 5 dimensions (mobility, usual activities, pain/discomfort and anxiety/depression) and slight issues with self-care. as outlined in Table 6. We have assumed individuals would have symptoms and self-isolate for 7 days⁸⁶. The QoL would vary depending on the severity of symptoms, whether someone has pre-existing conditions, support at home and impacts of being asked to self-isolate, however due to limited data these factors have not been factored into the analysis.

In order to calculate the lost QALYs, we subtract this from the average QoL of an individual in the high risk and low risk group, varied by age and gender.

$$\text{Lost QALYs in high risk group} = (\text{QoL of those in high risk group} - \text{QoL with symptoms}) \times \text{Duration}$$

$$\text{Lost QALYs in low risk group} = (\text{QoL of those in low risk group} - \text{QoL with symptoms}) \times \text{Duration}$$

The range is presented in the Table 7. It is important to note that when using the EQ-5D-5L scale, the changes from different states (e.g. moderate anxiety to severe anxiety) is significant, and therefore estimates should be treated as illustrative.

Individuals who have contracted COVID-19 but not been hospitalised

To calculate the number of people who have contracted COVID-19 but not been hospitalised, we have used the CSS on the number that are infected, CSS assumptions on the proportion of people that are symptomatic and removed the number of people that are hospitalised. There would be a proportion of symptomatic people who would have died outside the hospital setting, and therefore the CSS assumption on proportion of infected people that would die has been used.

To calculate the number of people who have contracted COVID-19 but not been hospitalised to date, we have used data on the number of positive cases⁸⁷ (mainly those in hospital and care settings) to data in addition to assuming that 0.25%⁸⁸ of the community population has been infected so far. It is important to note that this is based on the best information available and should be treated as illustrative.

$$\text{Total symptomatic but not hospitalised} = (\text{Total people that are infected (excluding deaths)} \times \text{Proportion of people symptomatic}) - \text{Total number of people hospitalised (excluding deaths)}$$

We apply the lost QALY outlined in *Table 7* to this estimate to calculate the total lost QALYs.

QALYs lost from patients being hospitalised

To calculate the average (QoL) impact for someone in hospital we have assumed an individual would have severe issues under all 5 dimensions (mobility, self-care, usual activities, pain/discomfort and anxiety/depression) as outlined in *Table 6*. We have assumed that the average hospital stay is 8 days¹³.

$$\text{Lost QALYs in high risk group} = (\text{QoL of those in high risk group} - \text{QoL when hospitalised}) \times \text{Duration}$$

$$\text{Lost QALYs in low risk group} = (\text{QoL of those in low risk group} - \text{QoL when hospitalised}) \times \text{Duration}$$

The range is presented in the *Table 7*. It is important to note that when using the EQ-5D-5L scale, the changes from different states (e.g. moderate anxiety to severe anxiety) is significant, and therefore estimates should be treated as illustrative. We have also assumed this is the QoL if someone is hospitalised, however their QoL would be lower if needing ventilation. We have not quantified these impacts, due to limited data.

Patients who are hospitalised

To calculate the number of people in hospital, we have used the CSS totals on the number of people hospitalised and the CSS assumption on the proportion of people who died in hospital. For the number of people who have been hospitalised with COVID-19 to date, we have used daily hospital admissions, and scaled them up to get UK estimates.⁸⁹ The number in critical care has been removed from these figures¹⁴. We have used the distribution by age of those infected in hospital to calculate the number of people hospitalised by 5-year age band and have used the age distribution of the proportion of infected who die to distribute deaths in hospital by 5-year age band.

$$\text{Total in hospital} = \text{Total hospitalised} - \text{Total deaths in hospital} - \text{Total in critical care (excluding deaths)}$$

We apply the lost QALYs outlined in *Table 7* to this estimate to calculate the total lost QALYs.

Short-term impact patients who are hospitalised.

To calculate the average (QoL) impact for someone once they leave hospital, we again have used the Crosswalk dataset⁹⁰ and have assumed an individual would have slight issues under 4 dimensions

¹³ This is based on the CSS assumption of the number of days a patient is in hospital without ventilation.

¹⁴ See patients in critical care section

(mobility, self-care, usual activities and pain/discomfort) with moderate levels of anxiety/depression. The level of problems a patient faces under all 5 dimensions is an assumption and would vary by patients' ability to recover, support available, length of hospital stay and severity of illness (impact would be higher if patient needed ventilation), and therefore results should be treated with caution.

Lost QALYs (low/high risk group) = (QoL of those in low/high risk group – QoL following hospital stay) x Duration

We apply the lost QALYs to the number of people hospitalised to calculate the total lost QALYs in the short-term.

QALYs lost by patients in critical care

To calculate the lost QALYs, we have used evidence⁹¹ looking at the lost QALYs of patients with pneumonia in critical care, a loss of 0.13 QALYs after a year from being discharged. This study only includes patients over 65, and we expect lost QALYs for younger age groups would be higher. Without further evidence, we have applied the lost QALYs of 0.13 to all age groups. It is important to note that this estimate relates to non-COVID-19 pneumonia. This also only accounts for the impact within the first year and there are likely to be long-term impacts for some patients; as discussed in the evidence above.

Patients in critical care

To calculate the number of people needing critical care, we have used the CSS totals of the number of ICU admissions. As data on number of ICU admissions is not available to date, we have used the CSS assumption of the proportion of those who are hospitalised that need ICU, applied to hospital admissions to date. We have used the distribution by age of those infected in hospital to calculate the number of people in critical care by 5-year age band. We have used the CSS assumption of the fatality rate for people requiring ICU, of 40%-68%.

Total in critical care= Total ICU admissions - Proportion of people dying in critical care

This is then applied to lost QALYs, to calculate the total QALYs lost.

Summary

The table below outlines the lost QALYs for patients who have been symptomatic, hospitalised and those needing critical care, giving a total between **23,000-69,000 QALYs lost**. These calculations do not include:

- The lost QALYs for patients' needing ventilation
- The impact on patients' health in the long-term from being hospitalised (after 4 months following discharge)
- The impact on patients' health in the long-term from having COVID-19 symptoms
- The short-term impact on patients' health whilst in critical care
- The impact on patients' health in the long-term from critical care (>1 year following discharge)
- The impact on members of the household isolating due to household member having COVID-19 symptoms

Therefore, it is possible these calculations are an underestimate of the impact on patients' health, and therefore should be treated as illustrative.

Table 8. Total lost QALYs

	Total lost QALYs
Individuals who are symptomatic but not hospitalised	20,000-58,000
Patients that are hospitalised (excluding critical care)	3,000-8,000
Patients need critical care	1,000-2,000
Total	23,000-69,000

Annex B: Health outcomes for COVID-19 patients, worsened because of lack of NHS critical care capacity

Overview

Considering the experiences of other countries during COVID-19 and the demands on their critical care capacity, there were concerns that the UK's critical care capacity and ventilation provision would not be sufficient. The following section discusses this issue, first considering the potential excess deaths that *could have occurred* in the [unmitigated reasonable worst-case scenario](#), if social distancing measures and increased healthcare capacity measures were not introduced. It then considers [how and whether the healthcare service had sufficient capacity](#) to adequately care for all COVID-19 patients.

International experience

Evidence from countries 'ahead' of the UK in the COVID-19 pandemic prompted concerns that critical care resources would be surpassed⁹², and clinicians would have to make difficult choices in deciding how to allocate resources and care.

The surge of patients requiring ICU admission in Italy was described as 'overwhelming'⁹³, where ICU admission was higher than in China (12% compared to 5%). Although unlikely, it is possible that criteria for ICU admission differs between countries; alternatively, this may relate to population characteristics and predisposing factors such as ethnicity, age and comorbidities.

As a result, there were concerns that without sufficient critical care capacity and ventilation provision in the UK, this could mean some patients would be prioritised for specific types of care, such as ventilation, over others. There is no specific, proven treatment for COVID-19 as of yet, and therefore clinicians can only provide support for organs and hope that the patient recovers.⁹⁴

Estimating Category B deaths in Unmitigated RWC

In the unmitigated RWC the peak of the pandemic is so high that no health service could come close to providing the necessary staffing and ventilated beds to treat every patient that would require it. To estimate the additional fatalities, we make the following assumptions:

- Unmitigated RWC (31st March) is used for rates of infection by week
- CSS is used for hospitalisation and critical care admission rates, lengths of stay and infection fatality rate for those receiving appropriate care
- We assume the NHS makes available 30,000 non-critical and 20,000 critical care beds to treat COVID-19 patients. These are assumed to be available in time for the surge in cases.

We perform a simple calculation to determine the number of patients who would have required non-critical and critical beds if there are none available. For these patients we assume 60% mortality for patients requiring non-critical care beds, and 100% mortality for patients requiring critical care beds. Note, these fatality rates have not been clinically verified but they do give an overall approximately 4% infection fatality rate, which has been suggested by some sources to be the potential impact of an unmitigated scenario¹⁵. These assumptions generate an upper estimate of c. 1.1M additional COVID-19 deaths in patients unable to access the hospital care they require. To estimate excess deaths and years of life lost, we follow a similar methodology as for Category A deaths in the unmitigated scenario (see section Quantifying excess deaths and years of life lost for Unmitigated RWC) but assume different mortality profiles as it is reasonable to suggest that those

¹⁵ Source: Neil Ferguson, Imperial College

who die from a critical care bed not being available are healthier than those that die even when they do have access to critical care beds. From this we estimate up to 1,000,000 (900,000 to 1,010,000) excess deaths, 11,000,000 (9,000,000 to 15,000,000) years of life lost and 7,400,000 lost QALYs (5,400,000 to 9,600,000). The range presented is based on different background mortality rates outlined in Table 4.

Critical care capacity in the UK during the pandemic

Following concerns that the demand for critical care would exceed supply in the UK, a number of changes were made to the healthcare system including increased critical care capacity through the extension of existing provision or the creation of new Nightingale hospitals, the decrease for non-COVID-19 demand of critical care (e.g. through the cancellation of elective surgeries) and the increased production of ventilation equipment.^{95,96,97}

In general, the available data seems to suggest that demand for critical care beds as a result of COVID-19 has not exceeded supply. The proportion of mechanical ventilator beds occupied by COVID-19 peaked at 42% in England⁹⁸ and the proportion of critical care beds occupied by COVID-19 patients peaked at 54% in England (correct as of 18th May).⁹⁹ It is important to note that this only relates to COVID-19 patients, and therefore some additional capacity may be occupied by non-COVID-19 patients. Reports suggest critical care demand has not exceeded supply¹⁰⁰ and clinicians have reported that patients, who would have received critical care before the pandemic, have not been denied it during COVID-19.^{101,102} In mid-April reports suggested that across England, 3,228 patients were in critical care beds, which would represent 78% of previous critical care capacity although this has likely increased as a result of efforts to increase capacity cited above.¹⁰³ Indeed, a recent publication by the Intensive Care Society suggests that there has, to date, been critical care capacity within the NHS and 'CRITCON-PANDEMIC-4' has not been reached at any individual hospital (where services are overwhelmed and delivery of critical care is resource limited).¹⁰⁴

It is important to note that there have been reports of some isolated, short-term incidents of occupancy levels being reached; for example, in late March, Northwick Park Hospital declared a critical incident after it had no critical care capacity left, although it was stood down the next day after the trust was able to open more critical care beds.¹⁰⁵ Indeed, transportation of patients within a critical care network may have also helped to ensure sufficient capacity, including significant increases in capacity in new Nightingale hospitals which have largely not been used¹⁰⁶, although concerns have been raised that these facilities are not suitable for complex patients.¹⁰⁷

Critical care prioritisation?

Within this discussion, it is important to consider the possibility that critical care may have been prioritised for certain patients over others, *in order to* ensure demand does not exceed supply. It should be noted that some concerns were raised about assessment of suitability for critical care earlier in the pandemic. Charities advocating for disabled people emphasised that equal access to healthcare should be provided; existing health conditions or impairments that are unrelated to the potential to benefit from treatment, or social care and support needs, should not play a role in decision making in terms of access to treatment.¹⁰⁸ Charities representing older people have stated that blanket rules, for example based on age without consideration of other factors, such as their capacity to benefit from treatment, are unacceptable.¹⁰⁹ National Institute for Health and Care Excellence (NICE) guidelines do suggest that an individual's ability to recover and benefit from critical care treatment should be borne in mind when considering admission.¹¹⁰ Indeed, sources have suggested that the need to choose carefully which patients would benefit from critical care admission is not new,^{111,112} and as noted above, anecdotal evidence from clinicians have suggested

that patients, who would have received critical care before the pandemic, have not been denied it during COVID-19.^{113,114}

Moreover, there are clear guidelines to help clinicians determine whether to escalate treatment to critical care during the COVID-19 pandemic.¹¹⁵ This states that patient care should be allocated based on *current need*, rather than anticipation of future demand. Referral and admittance to critical care should be based on a patient's frailty (see further discussion [below](#)) and what level of care is likely to provide benefit to the patient; clinicians should consider the clinical situation, the patient's capacity to recover and reserve, as well as the patient's own values and wishes.¹¹⁶ Therefore, there are specific reasons why an individual may not be admitted to critical care: if the level care is not deemed suitable for them, or if they do not want them to be admitted. These are discussed below.

Critical care is not suitable

In some cases, clinicians may decide that critical care is not suitable for certain patients based on their capacity to recover following a stay in the CCU.¹¹⁷ Experts have noted that the decision to admit patients to critical care is complex and difficult. ICU care can be lifesaving, but it can also mean invasive and distressing treatment rather than benefitting from ward based or palliative care.¹¹⁸

Age

As noted above, earlier in the pandemic, there were some concerns that critical care may be prioritised for younger people. Evidence from COVID-19 suggests that patients receiving mechanical ventilation do tend to be younger.¹¹⁹ However, analysis indicates that patients with COVID-19 in ICUs do not differ considerably in age from those admitted for viral pneumonia between 2017 and 2019 (58.6 compared 58.0 years).¹²⁰ This may suggest that similar considerations about ability to recover are considered for COVID-19 as with other infectious diseases, although it is important to note that the two diseases are different, affect people in different ways and may involve different treatment approaches. This finding is also reflected in a survey of ICU consultants from before the pandemic which suggested they were more likely to admit younger patients to the ICU.¹²¹ This could suggest that clinical decision-making regarding admission to ICU is not different during the pandemic and this may also reflect the earlier points that critical care is invasive, distressing and may not be beneficial to all patients. Indeed, Alison Pittard, dean of the Faculty of Intensive Care Medicine, has stated that intensive care doctors are used to taking difficult decisions on when to admit patients, and that the COVID-19 guidance has not changed the decision on whether to admit, rather where the decision occurs within the hospital setting (to free up critical care doctors for treatment purposes).¹²²

Learning disabilities & frailty

NICE advises that for patients under 65 or of any age with stable long-term disabilities, learning disabilities or autism, clinicians should undertake an individualised assessment of frailty when considering critical care admission. Comorbidities and underlying health conditions should be considered in all cases. However, some anecdotal evidence suggests that these guidelines may have been contravened; there have also been concerns about the method of assessing frailty for critical care admission as well as concerns about the application of 'blanket rules' (see above). For example, charities have raised concerns that support needs have been conflated with 'frailty' in assessing suitability for intensive care or ventilation treatment. There have also been reports of people with learning disabilities being told by GP surgeries that they are unlikely to be prioritised for mechanical ventilation because they could be too 'frail', although surgeries have since accepted that this should not have occurred.¹²³ Anecdotal evidence suggests in one case an individual was deemed unsuitable for a ventilator based on her response to how far she could walk without having to stop to catch her

breath. When doctors consulted her family, it became clear the patient had responded on the basis of her current condition rather than how she was before COVID-19; she was later intubated.¹²⁴

Patients do not wish to be admitted to critical care

In some cases, patients may not wish to be admitted to critical care. As previously noted, ICU care can mean invasive and distressing treatment rather than benefitting from ward based or palliative care.¹²⁵ In addition, there are significant physical and psychological impacts on future quality of life as a result of critical care survival which are important to consider in this context.¹²⁶

There may also be considerations for mortality impacts. For patients who are near the end of their life, they may decide they do not want to die in critical care.¹²⁷¹²⁸ Evidence from Wales suggests that one in five ICU survivors die within a year of hospital discharge, with most events within 90 days; advanced age and multiple comorbidities were associated with adverse outcome as well as multiple organ support and length of ICU stay. Almost half of patients who died after critical care discharge died before leaving hospital.¹²⁹

Annex C: Health impacts from changes to health and social care made in order to respond to COVID-19

Overview

In order to ensure there was sufficient critical care capacity to provide care for all COVID-19 patients and manage infection levels in health and social care settings, and to maintain patient safety, there have been substantial changes to the health and social care system. There is evidence of a significant increase in non-COVID-19 excess deaths since the start of the outbreak, which is likely to be due to such changes, at least in part. There may also be morbidity impacts which are not yet apparent from data. In the longer term there are likely to be considerable impacts on those who had elective care postponed, and where primary and community care was not accessed as it otherwise would have been. This section briefly summarises each area for which mortality and morbidity impacts have been estimated; the full explanation of methodology and assumptions for each will follow.

C1. Changes to emergency care

Emergency attendance and non-elective admissions have decreased since the start of the pandemic in the UK, likely for a combination of people being reluctant to attend accident and emergency even with a medical emergency because of fears or perceptions that they should remain at home; and a decrease in some causes due to social distancing measures, such as those resulting from air pollution for example. These impacts as a result of social distancing measures are discussed further in Annex D.

Mortality

- We estimate this accounted for around 6,000 excess deaths in March and April, and, if emergency care in hospitals continues to be low for a full 12 months, we estimate an additional 10,000 excess deaths. This equates to 41,000 lost QALYs over 12 months.

Morbidity

- We estimate the impact of reduced emergency care in hospitals in March and April to be around 31,000 QALYs. If emergency care in hospitals continues to be low for a full 12 months the morbidity impact is estimated to 140,000 QALYs.
- There are also likely to be specific health impacts on health care staff during and following the pandemic, such as those providing care for patients with COVID-19. We estimate that the morbidity impacts on healthcare staff equate to 17,000 lost QALYs.

C2. Changes to adult social care provision

Excess deaths may have occurred for a range of reasons related to changes in adult social care provision, such as a potential impact on the quality of primary and preventative care in care homes, or not being able to attend hospital in the case of non-COVID-19 medical emergencies. As a result of increased pressure on the adult social sector, there may also be health impacts on adult social care staff.

Mortality

- We estimate there were around 10,000 non-COVID-19 excess deaths in care home residents in March and April. If the pandemic continues under a flat-line scenario to March 2021, we estimate there could be an additional 16,000 non-COVID-19 excess deaths. This equates to 73,000 lost QALYs over 12 months in care home residents.

Morbidity

- We have not estimated the potential morbidity impact on service users of changes to adult social care provision although it is likely that these are significant.

- The impact on the mental health of adult social care staff is estimated to equate to 21,000 lost QALYs.

[C3. Changes to elective care](#)

Postponing or cancelling elective treatment may have impacts on mortality and morbidity. We use two top-down methodologies to estimate the impact on excess deaths and morbidity, using expenditure and waiting lists.

Mortality

- Delaying access to care could equate to 12,500 excess deaths, equivalent to 45,000 lost QALYs over 5 years.

Morbidity

- We estimate that morbidity impacts equate to 90,000 lost QALYs by April 2021.

[C4. Changes to primary and community care, including access to screening services](#)

As a result of the pandemic, there have been changes to primary and community care, including screening services. Some services have been stopped during lockdown and others have been reduced to only provide urgent care.

Mortality

- We model the impact of delays to cancer diagnosis as a result of disruption to GP services and emergency presentations; this suggests that this could result in 1,420 excess deaths equivalent to 3,500 lost QALYs. It has not been possible to quantify additional mortality estimates from changes to other primary and community care services.

Morbidity

- The delays to cancer diagnosis as a result of disruption to GP services and emergency presentations would result in a further 300 lost QALYs due to increase in health impacts while alive.
- There are likely to be additional health impacts as a result of some routine services stopping, and the potential backlog of appointments meaning that some health problems may not be identified early and may become more severe, such as dentistry. It has not been possible to quantify these impacts.

The following annexes discuss these 4 impacts on morbidity and mortality from changes to the health and social care system in more detail, including the methodology for quantitative estimates where relevant. To note, C1 and C2 are considered together as a result of a combined methodology for estimating excess deaths.

[C1. Impacts from changes to emergency care \(Category C1\) & C2. Impacts from changes to adult social care \(Category C2\)](#)

Overview

Mortality

The following section presents the [estimates for excess deaths](#) as a result of changes to emergency care (Category C1) and changes to adult social care (Category C2). Separate estimates are provided for these two categories of death but are presented in the following combined section because we use one methodology to produce these estimates. We estimate 15,000 excess deaths in Category C1 and 26,000 in Category C2 over a 12-month period.

Morbidity

We then consider the impact on morbidity from [changes to emergency care](#) (Category C1), in terms of reduced attendance and admission to Accident and Emergency departments, and the potential [health impacts on healthcare staff](#) from coping with increased pressures on the healthcare system. The lost QALYs as a result of impacts on the mental health of healthcare staff is estimated to be between 3,000 and 63,000.

We finally discuss the impact on [morbidity from changes to adult social care](#) (Category C2). We are unable to quantify the impact on service users and those receiving formal care but provide some qualitative discussion. We have provided estimates on the health impacts on social care staff as a result of working in a social care system under increased pressure during the pandemic. The lost QALYs as a result of impacts on the mental of social care staff is estimated to be between 3,000 and 64,000.

Excess deaths for changes to emergency care (Category C1) and changes to adult social care (Category C2)

Estimating categories for non-COVID-19 excess deaths registered since 21st March 2020

As highlighted in the earlier section “What we know about excess deaths from the pandemic so far”, there have been a large number of non-COVID-19 excess deaths registered since the start of this pandemic, with a number of plausible contributing factors to this. Current available data provides some insights, but these are limited. We bring together the existing evidence below, and, with various assumptions, apportion these to the different categories.

Evidence and assumptions for categorisation of non-COVID-19 excess deaths registered to date

Possible contributing factors to the non-COVID-19 deaths could include:

For deaths in care homes:

- Over a third of care homes in the UK have reported experiencing one or more outbreaks of COVID-19. There were around 12,000 deaths involving care home residents occurring between 2nd March 2020 and 1st May 2020 in England making up 37% of all COVID-19 deaths that occurred in England within this time frame.¹³¹ This is quite a significant proportion of total COVID-19 deaths, especially given that elderly care-home residents only constitute about 0.6% of the population of England.
- Care home residents are also experiencing high levels of non-COVID-19 excess deaths, in addition to the high rates of deaths involving COVID-19. We estimate there were around 10,000 non-COVID-19 excess deaths in care home residents in March and April. If the pandemic continues to March 2021, we estimate there could be 26,000 non-COVID-19 excess deaths over 12 months in care home residents (see methodology below).
- Some hospital patients were discharged earlier than otherwise to free up capacity in hospitals.
 - It is possible some patients would have died in hospital, but died in a care home instead (note, this would not be an “excess death”, but one that occurred in one location rather than another)
 - It is feasible that some patients may have been discharged too soon and without the hospital treatments, died earlier than they would have otherwise.
- Some care home residents may be dying of non-COVID-19 medical emergencies who would have survived had they been allowed to go to hospital in the way that would have happened before the outbreak.
- The quality of primary and preventative care being received in care homes may be impacted so there could be some fatalities that were previously prevented through these means.

- There may be other patient safety impacts, especially during an outbreak of COVID-19, for example if staffing levels are reduced.
- Some residents may have expressed a wish not to be transferred to hospital in a medical emergency. In some cases, this action may have been prompted by the pandemic, hence why this may occur more during the pandemic than in typical circumstances.
- A discussion of the potential contributing factors to these excess deaths is provided in the section below.

For deaths at home:

- For domiciliary care users, who have also seen a significant increase in excess deaths (1,990 excess deaths between 10th April 2020 and 8th May 2020)¹³⁰, frail people may be impacted by lower staffing levels or fewer visits for their routine care, and possibly by health care professionals. From Care Quality Commission (CQC) data from 1st March to 24th April, we estimate 6% of excess non-COVID-19 deaths were in domiciliary care users. We have not separated these out from other non-COVID-19 excess deaths due to the complexity of doing so, which means, based on the methodology we have used, these are essentially incorporated into the estimate for C(i) excess deaths. This is something that will be looked at in future updates to this paper.
- For the general population who do not use Adult Social Care services or informal care, many may also be impacted by limited access to primary and community care (some services have been cut, others changed to remote appointments, and there is likely to be a greater reluctance to access medical care). Some fatalities could have been preventable with good access to these services.
- Patients may be delaying or choosing not to attend hospital with a medical emergency. The “stay home” messaging and other perceptions of the risks or experience of attending hospital could be affecting people’s judgement around when it is appropriate to seek medical help.
- There could be changes in response times/protocols of emergency care e.g. longer ambulance response times and more treatment done by paramedics at home instead of transferring to hospital.

Here we consider the categorisation of those non-COVID-19 excess deaths that have been registered and reported to date.

Table 9. Evidence and assumptions around non-COVID-19 excess deaths

Category	Evidence and assumptions around non-COVID-19 excess deaths registered to date
Category A: Health impacts from contracting COVID-19	It is possible that some of the non-COVID-19 excess deaths that have been registered to date may be undiagnosed COVID-19 deaths. For the purposes of this paper, we do not account for any undiagnosed COVID-19 deaths. This is consistent with the methodology for projecting Category A deaths which are based on the trend in diagnosed COVID-19 deaths and hence do not account for any under-diagnosis.
Category B Health outcomes for COVID-19 worsened because of lack of NHS critical care capacity	Due to the definition here, none would fall into this category
Category C(i) Health impacts due to	It is very likely that some non-COVID-19 excess deaths are in this category. This is considered further below. This includes cases where

changes in emergency care	individuals choose not to access emergency care when previously they would have.
Category C(ii) Health impacts due to changes in adult social care	It is very likely that some non-COVID-19 excess deaths are in this category. This is considered further below.
Category C(iii) Health impacts due to changes in elective care	We assume none of the non-COVID-19 excess deaths to date are due to postponement of non-urgent care; owing to these being expected to be longer-term impacts
Category C(iv) Health impacts due to changes in primary and community care	It is very likely that some non-COVID-19 excess deaths are in this category. This is considered further below. This includes cases where individuals choose not to access primary and community care when previously they would have.
Category D Health impacts from factors affecting the wider population including increased deprivation	We had expected a net reduction in some non-COVID-19 causes of death in the short-term because of the lockdown and lockdown induced recession. We factor these into the estimates for non-COVID-19 excess deaths.

Quantification of non-COVID-19 excess deaths to date

Firstly, we use the measure of non-COVID-19 excess deaths, as defined in section “What we know about excess deaths from the pandemic so far”, which is based on the net deaths from all causes compared to the 5-year average, as our estimate of the net Category C and Category D deaths that have occurred to date.

Accepting it is not possible to categorise these deaths due to limited insights on them, by basing our estimate of total excess deaths on this measure, we avoid numerous pitfalls. For example, we cannot double-count deaths that have occurred, and if there are undiagnosed COVID-19 deaths, then this approach mis-categorises them, but they are still included in the total estimate.

The challenge of identifying what category to assign them to is particularly tricky. For example, excess deaths for care home residents due to a medical emergency linked to an underlying long-term condition may be due to C(i), C(ii) or C(iv).

Key facts that we know are:

- For the period 21st March to 1st May, there were 9,767 excess non-COVID-19 deaths in care home residents in England registered as compared to the same period last year¹³¹. Using this as a measure of all excess deaths for care home residents, this accounts for 74 percent of the total non-COVID-19 excess deaths in the same time period, as estimated by comparing to the weekly three-year average count of deaths from all causes.
- We performed an analysis to estimate the plausible number of excess deaths that could credibly be attributed to the reduction in non-elective hospital admissions, see section “Estimating upper estimate of excess deaths from reduction in non-elective admissions” below. A&E visits were 57% lower in April 2020 compared to April 2019 and emergency admissions through A&E had fallen by 37% in April 2020 relative to the same month the year before. There is considerable uncertainty with the current available data on how many excess deaths can be attributed to this reduction – most importantly, we do not know the case-mix for those who attend hospital, and we also do not know what changes to demand

have occurred due to changes to primary care or the lockdown. The range of uncertainty is such that it is possible that, at the upper end, ***all the non-COVID-19 excess deaths could be accounted for by the reduction in non-elective admissions.***

- No analysis was available to estimate the short-term impact of changes in primary and community care.

Given this, the two categories C(i) and C(ii) have the greatest evidence for having a large impact on non-COVID-19 excess deaths. Owing to there being no evidence available to apportion between them, we have decided to assign all excess deaths for care home residents to category C(ii) and those remaining to category C(i). It should be noted that the proportions will not affect the total excess deaths estimates, which is discussed above and further below. We net off the short-term deaths estimated for Category D, as illustrated below and have been scaled up to UK estimates¹³².

Table 10. Total excess non-COVID-19 deaths 12th March to 1st May 2020

Total Excess Non-COVID-19 deaths for 21 st March to 1 st May	13,121
These are apportioned as follows:	
Category C(i) due to changes in emergency care	5,690
Category C(ii) due to changes in adult social care	9,767
Reduction in excess non-COVID-19 deaths from Category D (lockdown)	-1,890
Reduction in excess non-COVID-19 deaths from Category D (recession)	-446
TOTAL non-COVID-19 excess deaths for Category C	13,121

Projections for Category C(i) and C(ii) going forwards

We have taken the approach that the measure of non-COVID-19 excess deaths from the data available to date provides a more reliable basis for estimating future deaths from Categories C(i), C(ii) and C(iv), as compared to other hypothetical modelling approaches. There are different ways of calculating excess deaths that have occurred already. The method favoured by ONS to calculate excess deaths uses the five-year average count of deaths by week for 2015-2019. We therefore create a simple trajectory for non-COVID-19 excess deaths, based on assuming future non-COVID-19 excess deaths will continue at the same proportion of COVID-19 deaths (taken from the CSS), as than seen in the period 21st March to 1st May. Over time, services and individuals can be expected to adapt to manage the risks of COVID-19 more effectively, but the pace of improvement is uncertain; and in the absence of being able to adapt, it is reasonable to assume the greater the risks of COVID-19 infection, the greater the non-COVID-19 deaths, as there is greater possible disruption to services and greater stress and fear factors in accessing healthcare. This paper's definition of "excess" deaths is those deaths that would not have otherwise been expected to occur within one year, but in reality, some of these deaths may have occurred within the next year so have been brought forward by less than one year. To estimate years of life lost (YLL) and QALYs lost, we use life expectancy estimates that are specific for [care home residents](#) and [emergency admissions](#) in the respective calculations (see links for methodology).

Because of the approach to base current and future estimates for Categories C(i) and C(ii) on the total non-COVID-19 excess deaths to date, taken together, these estimates are also likely to be better than theoretical estimates because they avoid pitfalls such as double-counting deaths, and if the current data includes some undiagnosed COVID-19 deaths, for which it is reasonable to expect, this approach factors these into future estimates (albeit categorised wrongly), assuming they would continue at a similar proportion to all COVID-19 deaths. Estimates for Categories C(i) and C(ii) are as

follows:

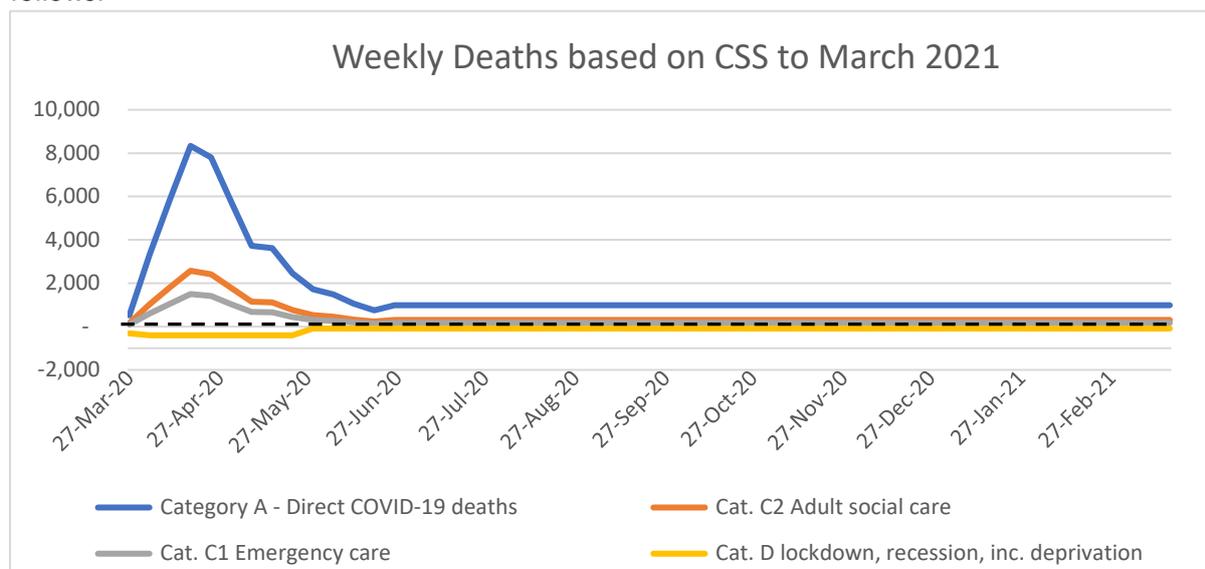


Figure 9 Weekly deaths from March 2020 to March 2021 for Cat A, C and D

Table 11. Excess deaths estimates for C(i) and C(ii)

Excess deaths by category	March to April	May to August	Sept to Feb '21
Cat. C (i) Emergency care	5,690	4,799	4,808
Cat. C(ii) Due to care homes	9,767	8,237	8,253
Total Cat. C	15,457	13,036	13,061

Estimating impact from reduction in emergency admissions on non-COVID-19 excess deaths

The estimate, described above, assigns **30%** (5,690 of the 15,457 excess deaths for Category C for March and April) of the short-term Category C non-COVID-19 excess deaths to the drop in emergency hospital activity. To sense-check this estimate, we use a different methodology that provides an estimate of deaths averted from emergency hospital care in normal times.

A&E visits were 57% lower in April 2020 compared to April 2019. Emergency admissions through A&E fell by less than A&E visits, but were still 37% lower in April 2020 relative to the same month the year before.

To arrive at an estimate of the deaths that might arise if this represents unmet demand, we use an estimate of the cost per death averted at the margin of NHS expenditure from research undertaken by Claxton et al at the University of York¹³³. By analysing the relationship between NHS expenditure and mortality across 152 sub-national NHS commissioning units they estimate the cost per death averted across all programme spending to be around £73,000 in 2008/09 prices, equivalent to around £90,000 in 2020/21 prices.

Using this methodology, we estimate that a 37% drop in non-elective admissions would result in c. 2,500 deaths per week in the six weeks to 1 May, so *more than all the excess non-COVID-19 deaths seen in this period*. In fact, we do not currently know the case mix of this drop in activity, but it is reasonable to expect a larger drop in non-urgent versus urgent cases. Further we have not

attempted to remove care home residents from this estimate, who would make up a proportion of the drop in emergency admissions. Therefore, our estimate of the number of excess deaths due to the drop in emergency care looks reasonable, and the best available estimate in the absence of further detailed data

Estimating YLL and QALYs from reduction in non-elective admissions

This section estimates the YLL and lost QALYs from a reduction in emergency care.

The counterfactual QoL is calculated using HSE data outlined in [A1](#). The assumptions used in each scenario are outlined in Table 12.

We acknowledge that the life expectancy for emergency admissions may differ to the general population, and therefore have used life expectancy estimates derived from this cohort study¹³⁴. It is important to note here that we assume that the mortality rate remains high even if the person survives the first year, which leads to short life expectancies for younger groups. Using this life expectancy data, the average discounted QALYs are calculated by gender and age (in single years) for the low, central and high scenarios. These estimates could be an underestimate as life expectancy could vary by the number of comorbidities. These results have been aggregated to 10-year age bands to calculate the average QALYs by age band and gender using ONS population data. YLL is calculated from the life expectancy and excess deaths by 10-year age bands

The method to calculate the gender split and those with comorbidities is outlined in [A1](#).

Summary

Table 12 outlines the lost QALYs due to reduction in A&E attendances and non-elective admissions. This gives lost QALYs between **38,000-42,000** from March 2020 to March 2021.

Table 12. Summary of QALY impacts

Scenario	QoL assumption	Excess deaths	Years of life lost	Total lost QALYs
Low	All have pre-existing conditions	15,000	54,000	38,000
Central	Proportion of people have pre-existing conditions			41,000
High	No individual had a pre-existing condition			42,000

Mortality impact in the form of YLL and QALYs from changes to adult social care provision (category C2)

The section below estimates the YLL and lost QALYs from changes to adult social care provision. We estimate around 108,000 years of life lost and lost QALYs ranging between 73,000-77,000 from March 2020 to March 2021.

The counterfactual QoL is calculated using HSE data outlined in [A1](#). The assumptions used in each scenario are outlined in Table 4.

We acknowledge that the life expectancy for care home residents differ to the general population, with individuals having more pre-existing conditions and being frailer and requiring additional care compared to individuals of a similar age who are non-care home residents. To estimate the life expectancy of care home residents, we analysed data from the 2011 Census linked to the deaths

register. We computed the one-year mortality rate of people who were living in a care home at the time of the 2011 census using mortality data between 2011-2013. We then used these mortality rates to derived abridged life tables for this population (those over 60).

Using this life expectancy data, the average discounted QALYs are calculated by gender and age for the low, central and high scenarios. The life expectancy (by 5-year age bands) is used with the excess death estimates, to calculate the YLL.

To calculate the gender split we have used the gender split from ONS data on the number of care home deaths by gender and age group¹³⁵. To calculate the proportion of care home residents with pre-existing conditions, we used data by ONS on the proportion of deaths by care home residents involving COVID-19 by main pre-existing condition¹³⁶. Further analysis categorised the pre-existing conditions, in terms of whether having the condition would increase an individual’s chance of being infected with COVID-19. This analysis showed that 82% of male care home residents and 78% of female care home residents had pre-existing conditions across all age groups.

Summary

Table 13 outlines the lost QALYs from changes to adult social care provision. This gives lost QALY between **73,000-77,000**.

Table 13. Summary of impacts

Scenario	QoL assumption	Excess deaths	Years of life lost	Total lost QALYs
Low	All have pre-existing conditions	26,000	108,000	73,000
Central	Proportion of people have pre-existing conditions			73,000
High	No individual had a pre-existing condition			77,000

Morbidity impacts for Categories C1 (emergency care) and C2 (adult social care)

Morbidity impacts from changes to emergency care (Category C1)

Estimating the morbidity impacts from drop in emergency hospital activity

Decreases in emergency department attendances have also been observed in Australia, Canada and Europe. Possible reasons for these decreases in attendances include:

- There is less occurrence of disease, because of the reduced contact between people and less trauma because of lower vehicle use. However, there are also concerns about increases in domestic violence (see Annex D).
- Disease and illnesses are being managed differently; it has been suggested that patients could be being treated in other ways, avoiding going to hospital, for example by using video consultations with GPs.
- People are staying away from hospitals, remaining at home with diseases that need to be treated because of concerns about catching the virus and overcrowding in hospitals. Earlier in the pandemic, doctors in Italy reported patients with myocardial infarction (heart attack) or heart failure arriving later at hospital; they suggest that patients want to avoid going to hospital due to overcrowding with patients with COVID-19, and therefore by arriving later their clinical conditions are worse¹³⁷.

- There are also concerns that symptoms for some illnesses, such as heart attacks, have similar symptoms to COVID-19 such as breathlessness and chest pain. This has made it more challenging for people to identify a heart attack from the effects of the virus.¹³⁸

In England, as previously noted, PHE data suggests that attendances to emergency departments fell significantly after the lockdown. All indicators had decreased in attendances, apart from pneumonia.¹³⁹ Subsequently, senior government figures reiterated that people should still attend hospitals in an emergency and the NHS launched a campaign encouraging unwell people to seek urgent care.¹⁴⁰

Particular concerns have been reported about fewer people coming to hospital when they are having a stroke; similarly, there are reports that attendances for myocardial infarction at emergency departments have decreased, despite ambulance calls for chest pain increasing¹⁴¹.

There are likely to be morbidity impacts due to the drop in accident and emergency (A&E) attendances and emergency hospital admissions. Due to the uncertainty in the level of unmet need in emergency healthcare, we model a scenario that there is unmet need equivalent to 25% of pre-COVID-19 A&E attendances of 20% of non-elective pre-COVID-19 admissions for the 6 week period up to the end of April 2020 (this is equal to approximately half the observed drop in these volumes in that period). We then quantify the health benefit (in lives saved and QALYs gained) that this hospital activity would ordinarily translate into, assuming the activity has the same case-mix as in pre-COVID-19 times. This combination of assumptions was chosen for a mid-point estimate: in reality the unmet need is likely to be higher than modelled (given we have only modelled half the actual drop in activity levels) but the case-mix is likely to be less severe than modelled (given you would expect the more serious cases to seek medical attention over the less severe ones). The methodology and assumptions are provided below.

This approach assumes all missed non-elective admissions/attendances are at the £15,000 per QALY margin, which is a conservative estimate. Further we use the following data:

Non-electives

- As 41.5% of general and administrative (G&A) spend is on non-elective admissions and 53.1% of NHS spend is on G&A 22.0% of NHS spend is on G&A non-electives.
- As 20/21 resource Departmental Expenditure Limit (RDEL) was £141bn (pre additional COVID-19 funds) £31bn would have been spent on non-COVID-19 non-elective activity in 20/21 – equivalent to £2.6bn a month.
- For every £90,000 spent, one death is prevented, with an associated QALY gain of 3.5 QALYs. The remaining QALY gain is in morbidity benefits.

A&E

- As 7.9% of G&A spend is on A&E and 53.1% of NHS spend is on G&A 4.2% of NHS spend is on A&E.
- As 20/21 RDEL was £141bn pre additional COVID-19 funds so £5.9bn would have been spent on non-COVID-19 A&E activity in 20/21 – equivalent to £0.5bn a month.
- For the purposes of this calculation, we assume all this spend would have gone on morbidity improvements (and hence all the QALY gain is all morbidity QALYs).

This provides an estimate of 31,000 quality-of-life (morbidity-only) related QALYs for the period 21st March to 1st May.

To project forwards, we assume that there continues to be an impact on these services as long as there is a risk of infection. We assume the size of impact is a constant proportion of direct COVID-19 deaths. Therefore, we estimate the full impact over a 12-month period March 2020 to March 2021 to be: 140,000 QALYs.

Morbidity impacts for healthcare staff (Category C1)

Evidence of excess morbidity in healthcare staff

It is possible that the additional pressures placed on the healthcare systems from COVID-19 may lead to excess morbidity amongst healthcare staff. The following section discusses the possible areas of impact for healthcare staff during and following the pandemic, including the impact on mental health, burnout, moral injury and violence.

Estimates of affected staff

According to data from across the UK, there are almost 1.5 million health care staff at present¹⁶. Of these, about half were professionally qualified clinical staff.¹⁴² It is difficult to know how this may have changed during the pandemic. We know some staff have not been working, due to self-isolation or sickness. Sadly, some NHS staff have died as a result of COVID-19. Some staff may have moved from their speciality to work on COVID-19 care. Retired medical staff have returned to the NHS and students have seen their degrees finish early to enable them to join the health service during the pandemic.

Overall, it is difficult to know how the workforce has changed since the start of the pandemic, both in terms of total numbers and those who are working on COVID-19. In some cases, it seems likely that staff will remain in their specialities, as a result of ongoing patient care (such as those working in oncology, obstetrics and gynaecology or psychiatry); whilst they may not be working primarily on COVID-19 care, their care may be affected either by changing care protocols as a result of social distancing measures or through caring for a patient with COVID-19 in their ward (e.g. a pregnant woman with COVID-19).

For other medical staff, their professions are likely to be in high demand during the pandemic, such as doctors in pathology, emergency medicine, physiotherapists for their role in recovery from ICU, ambulance staff and anaesthetists. In January 2020, only 13% of anaesthetists worked in intensive care medicine, but it is possible that this proportion may increase.¹⁴³

It is possible that for some medical staff their work may have decreased or changed as a result of the cancellation or postponement of elective or routine care, such as those in dental care, public health medicine and community health, surgery and dermatology. Some of these staff may be deployed to other areas of the NHS.

Taken together, it seems likely that NHS staff have been affected in different ways as a result of the pandemic, with the potential for considerable upheaval. Linked to this, there are concerns that the pandemic has increased the stress and pressure on NHS staff,¹⁴⁴ as a result of increased risk of infection and overworking among other factors.¹⁴⁵ Impacts are likely to include increased mental health problems¹⁴⁶ and burnout, and these effects are likely to be greater than we have seen in

¹⁶See number of health care staff section.

previous epidemics such as SARS and MERS.¹⁴⁷ The possible effects on NHS staff are discussed in turn below.

Impacts for healthcare staff

Family impacts

A pre-print study in China during the COVID-19 pandemic found 34% of family members of healthcare workers showed symptoms of generalized anxiety disorder and 29% showed depressive symptoms.¹⁴⁸ Researchers found that having family members working on the frontline was a risk factor for anxiety symptoms among family members, whilst perception of protective equipment for healthcare workers was a protective factor.

Burnout

We could see increased instances of burnout among healthcare staff working during the COVID-19 pandemic. Burnout is defined as a “syndrome conceptualized as resulting from chronic workplace stress that has not been successfully managed”.¹⁴⁹ It is characterized by feelings of energy depletion; increased negative feels towards or mental distance from one’s job; and reduced professional efficacy.¹⁵⁰

It has been suggested that the COVID-19 pandemic has “upended clinicians’ sense of order and control”, and this disruption can lead to considerable short-term and longer-term increase risk of burnout.¹⁵¹ It is also possible that healthcare staff will be expected to work longer hours, with a greater risk of infection, and this may lead to burnout.¹⁵² Indeed, frontline staff in Hunan during the COVID-19 pandemic tended to believe they had a social and professional obligation to continue working long hours.¹⁵³

However, the evidence of the effect of burnout on specific groups of healthcare workers is mixed with some evidence suggesting lower frequency of burnout to frontline staff¹⁵⁴ whilst other evidence¹⁵⁵ on epidemic outbreaks suggests higher risk burnout to frontline staff. It seems likely that the impact of burnout may relate to local healthcare organisation and provision, in terms of adequate numbers of staff to ensure safe shift rotation patterns. Therefore, it has not been possible to quantify the impacts of burnout.

Moral injury

Moral injury is defined as “the distressing psychological, behavioural, social, and sometimes spiritual aftermath of exposure to... traumatic or unusually stressful circumstances... (where) people may perpetrate, fail to prevent, or witness events that contradict deeply held moral beliefs and expectations”.¹⁵⁶

Frontline healthcare workers as well as non-healthcare staff such as social workers may be at risk of moral injury during the COVID-19.¹⁵⁷ A reduction in available resources, a lack of clear guidance or training may mean that healthcare workers are unable to adequately care for their patients, leading to greater rates of morbidity and mortality.^{158,159} Due to a lack of quantitative evidence in this area, it has not been possible to quantify the impacts of moral injury.

Violence

Healthcare staff may also be at increased risk of injury and assault during the pandemic as a result of necessary changes in their care provision. Staff working on mental health wards have described volatile situations and challenges in providing care, no longer being able to offer therapeutic or group activities, as well as patients no longer being allowed visitors and not comprehending the pandemic itself.¹⁶⁰ The scale of this is unclear, and therefore it has not been possible to quantify the impact of violence on healthcare staff.

Mental health

The COVID-19 pandemic is likely to have an impact on the mental health of healthcare staff, both those on the frontlines caring for a sudden increase in COVID-19 patients and those working elsewhere in a healthcare system that has changed as a result of the pandemic.^{161,162}

Sources of anxiety and stress

Anecdotal reports suggest that healthcare staff experience stress themselves but also absorb the fear and distress of patients as well.¹⁶³ Sources of anxiety and stress are likely to be varied:

- The obligation to work longer hours with risk of infection may lead to mental health issues.¹⁶⁴
- Some may be concerned about their access to appropriate personal protective equipment,¹⁶⁵ and related to that, being exposed to the virus at work and bringing it home to their family.^{166,167,168,169}
- Reports of the COVID-19 mortality rate may also have an impact on healthcare workers.¹⁷⁰
- Some concerns may relate to a lack of rapid access to testing when developing symptoms and subsequent fear of spreading infection at work.¹⁷¹
- There may also be concerns about childcare as well as support for other personal and family needs as work hours and demands increase (food, hydration, lodging, transportation).¹⁷²
- Some staff may also find themselves deployed to new areas and may be anxious about being able to provide competent medical care (see section below).¹⁷³
- Another source of anxiety is a lack of access to up-to-date information and communication.¹⁷⁴

Impacts on frontline staff

Given the changes to the healthcare system as a result of the pandemic and potential for increased work pressures, both frontline and other medical staff may be expected to experience negative impacts on their wellbeing and mental health. However, there is mixed evidence for which group the impact is greatest.

We might expect a greater prevalence of mental health issues among frontline medical staff during and after the pandemic.¹⁷⁵ Indeed, evidence from China during the COVID-19 pandemic as well as a pre-print meta-analysis of epidemic outbreaks suggests that *frontline* healthcare workers may be more likely to experience mental health symptoms, such as depression, anxiety, insomnia, distress, acute and post-traumatic stress disorder, as well as burnout during and after outbreaks.^{176,177,178}

Lower levels of specialized training, preparedness and job experience were risk factors for symptoms of poor mental health. *Medical* health workers in China during COVID-19 have also experienced a higher prevalence of insomnia, anxiety, depression, somatization and obsessive compulsive symptoms than non-medical health workers.¹⁷⁹

However, research from Saudi Arabia during MERS outbreaks found similar anxiety levels for physicians and other healthcare workers, although non-physicians expressed higher levels of anxiety toward the risk of transmitting MERS-CoV to their families.¹⁸⁰ Evidence from COVID-19 in Singapore suggests a higher prevalence of anxiety among *nonmedical* health care workers than medical staff, as well as higher scores for depression, stress and post-traumatic stress. However, this could be explained by reduced accessibility to formal psychological support, less first-hand medical information on the outbreak, less intensive training on Personal Protective Equipment (PPE) and infection control measures.¹⁸¹ It should be noted that this study overall found lower levels of mental health symptoms compared to previous pandemics; the authors suggested this could be due to

increased mental preparedness and stringent infection control measures after Singapore's SARS experience.

Taken together, this may suggest that, whilst the evidence about the relative impact on frontline, medical and nonmedical workers is mixed, factors such as preparedness, training and experience may play a role in anxiety of healthcare workers. This may also have an impact on the family of healthcare workers. The impact on staff has already been acknowledged within the NHS. All staff can now access free apps to cope with insomnia and anxiety,¹⁸² as well as a range of online events and free access to therapy and listening staff.¹⁸³ NHS England has also announced a national mental health support programme to provide NHS staff with evidence-based digital programmes to protect their mental health during the COVID-19 response.

Estimating excess morbidity among healthcare staff

The evidence above highlights the potential impacts on health care staff as a result of the pandemic. Due to limited data and the ability to quantify the impact on staff due to the various factors highlighted above, the analysis below only captures mental health impacts in the form of anxiety and depression. We recognise that anxiety and depression should be analysed separately, however in absence of sufficient data they have been analysed together.

QALYs loss from having severe to mild levels of anxiety and depression

In order to understand the health state of health workers we have used the scores on the EQ-5D-5L measure from the Health Survey for England (HSE) data. We have not been able to split this data up by employment type due to limited data points, and therefore have assumed that the health state of healthcare staff is similar to the general working age adults. Individuals not in the 18-64 age band have been omitted from the results, to capture the working age population only. Individuals who had extreme levels of anxiety/depression (score of 5) were excluded from the sample as evidence was not clear on what proportion of staff may experience severe levels of anxiety and depression. Additionally, we have not captured staff who may experience Post Traumatic Stress Disorder (PTSD) as it may not affect an individual every day and as HSE data captures someone's health state on a given day, a comparison could not be drawn. This therefore gives a sample of 5,000 adults.

To calculate the average Quality of Life (QoL) impact for someone with mild to severe levels of anxiety/depression, we firstly use the HSE data to get a counterfactual QoL. For healthcare staff experiencing severe levels of anxiety/depression (level 4 in the EQ-5D-5L) we calculated the average 5-dimensional score for an adult who had a score of 1-4 to get a counterfactual score. Using the Crosswalk dataset¹⁸⁴, we map the score with the Crosswalk value sets, to get an average QoL of 0.86. We then change the anxiety and depression score to 4, for all adults in the HSE dataset, to get an average score of an individual with severe levels of anxiety/depression of 0.56. changes to QoL would vary depending on whether staff are frontline or not, working in ICU with COVID-19 patients, whether staff have pre-existing mental health conditions, other co-morbidities, support available either at work, at home or by a clinical specialist, timing of support, and change in working environment. Due to limited data, these factors have not been included in the analysis. It is also important to note that when using the EQ-5D-5L scale, the changes from different states (e.g. moderate anxiety to severe anxiety) is significant, and therefore due to these limitations with the analysis, results should be treated as illustrative.

This method is repeated for staff with slight and moderate (score of 2 and 3 respectively) levels of anxiety/depression and QoL estimates are outlined in the table below. This method assumes that the health state under the four other dimensions on the EQ-5D-5L measure (mobility, self-care, usual activities and pain/discomfort) stays the same.

Table 14. Quality of Life (QoL) by levels of anxiety/depression

	Severe levels of anxiety/depression	Moderate levels of anxiety/depression	Slight levels of anxiety/depression
Counterfactual QoL	0.86	0.89	0.90
QoL with given level of anxiety/depression	0.56	0.78	0.82

In order to calculate the lost QALYs, we subtract the revised average QoL based on severity of anxiety/depression from the counterfactual QoL for that group.

$$\text{Lost QALYs} = (\text{Counterfactual QoL} - \text{Revised QoL based on severity of anxiety/depression}) \times \text{Duration}$$

The duration of an episode of anxiety/depression is an area with very limited evidence, as it can vary on an individual basis due to a number of factors: previous conditions, severity of condition, support available, reoccurrence of an episode, timing of treatment and type of work. This list is not exhaustive and would vary for both anxiety and depression.^{185,186,187,188,189} Due to limited evidence and to align this with the EQ-5D-5L dimensions, we have grouped anxiety and depression together. As a proxy, a mixture of evidence on depression and clinical diagnostic criteria¹⁷ has been used under the three scenarios.

For the low scenario, we assume a duration of 2 weeks. This is based on the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)¹⁸, which states the diagnosis of a Major Depression Episode (MDE) requires five or more symptoms to be present within a 2-week period¹⁹⁰. Additionally, the International Classification of Disease (ICD-11), which also states that a depressive episode is characterized by a period of almost daily depressed mood or diminished interest in activities lasting at least two weeks accompanied by other symptoms,¹⁹¹ has been used to inform our assumption. It is important to note that these are both based on depression, and therefore a lower bound for the duration of anxiety may differ but is used as a proxy for both depression and anxiety under this scenario.

For the central scenario, we assume a duration of 3 months. This is based on ICD-11 which states that generalised anxiety disorder is characterized by marked symptoms of anxiety that persist for at least several months¹⁹².

For the high scenario, we assume a duration of 8.7 months¹⁹³. This is based on evidence suggesting that the average duration of for subclinical depression is 8.7 months and can vary depending on physical and mental health before depression, and that longer duration is associated with comorbid dysthymia or anxiety disorder. DSM-5 also states that excessive anxiety and worry (apprehensive expectation), occurs more days than not for at least 6 months¹⁹⁴ and therefore an upper bound of 8.7 months has been used.

¹⁷ The International Classification of Diseases (ICD-11) and the Diagnostic Statistical Manual of Mental Disorders (DSM-5) are two main sources produced to guide medical professionals when diagnosing and treating diseases and disorder. The DSM (produced by the American Psychiatric Association) focuses mainly on mental health, whereas the ICD (produced by the WHO) is broader and covers physical and mental health. More information here: <https://icd.who.int/browse11/l-m/en#/http://id.who.int/icd/entity/1712535455>

¹⁸ The International Classification of Diseases (ICD-11) and the Diagnostic Statistical Manual of Mental Disorders (DSM-5) are two main sources produced to guide medical professionals when diagnosing and treating diseases and disorder. The DSM (produced by the American Psychiatric Association) focuses mainly on mental health, whereas the ICD (produced by the WHO) is broader and covers physical and mental health.

Number of health care staff

The total number of health care staff covers England. The number of health care staff in England is from the NHS Digital HCWS Workforce statistics¹⁹⁵ and from the respective NHS websites for the Devolved Administrations, given a total of 1.5m staff (see [annex F](#)). The number of staff who have sadly passed away have not been removed from these figures. Retired medical staff who have returned to the NHS and students who have seen their degrees finish early to enable them to join the health service have also not been included in these estimates. This assumption has been adjusted in the low and high scenario, to capture the uncertainty in the assumption.

The proportion of staff that are frontline staff is based on data DHSC have about secondary care workforces and we assume the same split of frontline/non-frontline staff. In the absence of a better data source, the assumption of 84% has been used.

To estimate what proportion of staff have different levels of anxiety and depression, results from a study looking at mental health outcomes among health care workers in China exposed to COVID-19¹⁹⁶ have been used. The results of this study show what proportion of healthcare staff experienced different levels of anxiety (using the GAD-7 scale) and depression (PHQ-9 scale). Given we are using these estimates against the EQ-5D-5L dimension that doesn't separate out anxiety and depression, we have averaged the proportions for anxiety and depression under the two scales. We also have assumed that mild levels are associated with slight levels of anxiety/depression in the EQ-5D-5L dimensions. The scales may not align as clearly as we have assumed, but without alternative data, this is used as a proxy.

The results are varied by front line and second line staff¹⁹. Due to lack of data on non-frontline staff, we have used the proportions for second line staff as a proxy and therefore results should be interpreted with caution. The table below shows the number of staff with different levels of anxiety and depression.

Table 15. Anxiety and depression in front-line and second-line staff

Levels of anxiety and depression	Proportion of frontline staff split by severity	Number of frontline health care staff	Proportion of second-line staff split by severity	Number of non-frontline health care staff
Mild	38%	273,000-409,000	31%	37,000-149,000
Moderate	10%	73,000-110,000	6%	7,000-29,000
Severe	7%	49,000-73,000	5%	6,000-24,000

The lost QALYs are applied to these estimates to calculate the total lost QALYs. Given limited data, these estimates are not varied by gender or age.

Summary

The table below outlines the lost QALYs for health care workers who have severe to mild levels of anxiety/depression, giving a total between **3,000-63,000 QALY loss**. The wide range in estimates is due to the uncertainty around how long a health worker may have anxiety and depression. The

¹⁹ Those that are considered as frontline staff are those that are directly engaged in clinical activities of diagnosing, treating, or providing nursing care to patients with elevated temperature or patients with confirmed COVID-19. Those who do not fall under this criteria are considered second-line staff.

duration of an episode would be dependent on support available and would impact whether the episode of anxiety/depression reoccurs.

Given the high level of uncertainty and limited evidence, the estimates should be treated as illustrative.

Table 16. Front-line staff total list QALY anxiety/depression - healthcare

	Proportion of frontline staff	Duration of anxiety/depression	Total lost QALY
Low	60%	2 weeks	3,000
Central	84%	3 months	17,000
High	90%	8.7 months	63,000

Morbidity impacts from changes to adult social care provision (Category C2)

Overview

We have not estimated the morbidity impact of change to adult social care provision on patients although it is likely to be considerable, and there is evidence below of this. We estimate the morbidity impact on social care workers.

Evidence of morbidity from additional pressures on the social care system

Overview

There are a range of potential impacts as a result of additional pressures on the social care system:

- **Adult social care workforce:** The mental health of staff may be impacted as a result of additional pressures on the system.
- **Carers:** Survey evidence suggests most carers are providing more support during the pandemic; health impacts may include burnout (linked to a lack of respite from closures of day centres), exhaustion, bereavement and mental health. There may be a specific impact on young carers, such as not being able to access support services.
- **Adult social care users:** There is the potential for reduction in support due to staff sickness, self-isolation, reduced care services or domiciliary care users not wanting care staff to enter their home, due to fear of infection. There may be an impact on service user mental health due to social isolation.
- **People receiving informal care:** There is limited evidence about the impacts on people receiving informal care, but some anecdotal evidence suggests there may be reductions in support due to social distancing measures or self-isolating, and concerns that this may impact on the health and wellbeing of older people in particular.

Adult social care users

It is important to acknowledge that changes to the adult social care system, as well as the healthcare system, will also likely have impacts on morbidity for some people.

During the year 2018/19, 293,000 working age (18 to 64-year olds) and 548,000 older adults accessed long-term support from local authorities in England. A smaller number of adults receive short-term support; there were 5,000 episodes of short-term support for working age adults in 2018/19.¹⁹⁷ The number of people receiving care is likely to be greater than these estimates, as some individuals receive privately funded formal care or informal care (for the latter see [below](#)).

Most people who receive care (both informal or formal) receive continuous care (41%); about a fifth receive care several times a day (21%) and a small proportion receive care once or twice a day (15%), several times a week (16%) or once a week (6%).¹⁹⁸

Reduction in adult social care support

The social care workforce is likely to be affected in similar ways to healthcare workers, as a result of self-isolation and sickness, leading to a reduced workforce; Skills for Care estimate that 25% of frontline workforce were unable to work as at 31st March 2020.¹⁹⁹ It is possible that this may have an effect on patient care. Past research has linked the reduction in the number of older people receiving publicly funded social care in their own home with increased A&E attendance amongst older people;²⁰⁰ however, it is difficult to know how this would play out during the pandemic given the suggested reluctance of individuals to attend hospitals in order to reduce the risk of contact with COVID-19 patients and also reducing the impact on the health service (see above).

CQC reported that some care providers have not been able to accept people due to staff being off sick or self-isolating.²⁰¹ Some agencies won't provide staff to domiciliary care agencies leading to an increase in vacancies; in some cases, local authorities have had to support some care providers due to significantly reduced staff numbers. A recent BBC investigation suggested that thousands of people across Scotland have lost their home care support or had the level of support reduced during the pandemic. Some providers have cited needing to concentrate resources on 'critical care' for the most vulnerable service users. For example, Glasgow Health and Social Care Partnership said it was running at a reduced capacity of almost 40% as a result of staff illness and isolation.²⁰² Conversely, there are also anecdotal reports of some clients turning care workers away due to fear of infection.²⁰³

Anecdotal evidence suggests some adult social care users have had to move back to their family homes in order to ensure they have access to informal care. This has meant losing independence as well as access to adapted equipment, which can have impacts on physical. There are also reports of a lack of access to specific drugs for their needs where service users have had to move away from their homes to rural areas to be cared for by relatives during the pandemic.²⁰⁴ Some have also raised concerns that some autistic adults may be impacted by a reduced social care workforce as a result of social distancing, self-isolation or staff sickness; this could lead to a loss of support for food and hygiene.²⁰⁵ Concerns have been raised about the financial sustainability of the care sector, with some suggesting that the financial pressures of the pandemic as well as increasing costs of PPE could lead to the closure of home care providers, meaning that "vulnerable adults could face being abandoned to die alone at home".²⁰⁶

Mental health

There may also be an impact on the mental health of services users as a result of a reduction in adult social care services. Research conducted before the pandemic suggested that care users who have little social contact with people and feel socially isolated were more likely to feel extremely anxious or depressed, compared to those with at least some social contact with other people.²⁰⁷ These issues may be exacerbated by the pandemic due to the implementation of social distancing measures *and* the closure adult social care services, such as day and community settings.²⁰⁸ The use of day centres also provides respite for both the person receiving care and an informal carer, where available.²⁰⁹ It is also possible that some care users will need more assistance as a result of increased mental health needs during the pandemic, and therefore need more care support.²¹⁰

Changes to care provision could be particularly challenging for people with autism. One case study of an individual with autism reports that he gets very confused and frustrated with any changes to his

timetable or daily routine. During the pandemic his two long-term carers resigned, one for health reasons, the other to look after their own children, which has left him with no support, and he is unable to receive the personal care he needs. "The longer this goes on, the more anxious he's becoming, the more unconfident he's becoming, the more he's losing what we've built up with him over the years."²¹¹ This is echoed in other anecdotal evidence, where care worker visits have stopped or reduced to a phone call or knock at the door; family members have cited concerns about a loss of social skills and potential increased risk of depression.²¹²

Impacts on those receiving informal care

A 2019 survey of adult social care users found 48% reported receiving regular practical help from someone living in another household, and 41% reported receiving help from someone living in their household.²¹³

There is limited evidence of the impacts on people receiving informal care during the pandemic. A recent ONS survey conducted between 24th April and 3rd May suggests that, among those who said they were worried or somewhat worried about the effect that COVID-19 was having on their life right now, 3% said their access to paid or unpaid care is being affected by the pandemic.²¹⁴ A YouGov survey of healthcare professionals found that 12% said their unpaid care of a family member or a loved one had deteriorated as a result of the COVID-19 crisis. This may relate to wider impacts of working in the healthcare sector during the pandemic, and it is possible that the impact on carers in the general population is different.

Anecdotal evidence suggests that those receiving informal care from family and friends have witnessed impacts during the crisis. They may be coping without extra support from family and friends as a result of social distancing measures²¹⁵ or because loved ones are self-isolating with symptoms. There have been concerns about vulnerable and older people being able to wash themselves, take medication and the potential for falls if informal care is not available.²¹⁶

Summary

Overall, there is relatively limited evidence of the impact of the additional pressure on social care services for service users and those receiving informal care. However, anecdotal evidence does suggest some impacts on morbidity may occur, such as on mental health. As a result of the lack of evidence in this area, it has not been possible to quantify the impacts on this group.

Evidence of excess morbidity in adult social care staff and unpaid carers

Informal care workforce: Carers

The 2011 census found that 6.5 million people (about 1 in 8 adults) in the UK are carers providing unpaid care to older or disabled people.²¹⁷ However, Carers UK estimate that this may be as high as 8.8 million adults in 2019.²¹⁸ Care can be a few hours a week, helping with shopping, collecting medication and taking someone to medical appointments, or full time.²¹⁹ Almost half of informal carers care for someone within their household (47%), most likely to be a son or daughter, or a spouse or civil partner. Just over half (56%) of informal carers said they care for a non-household member, most likely a parent. Almost 1 in 10 informal carers (8%) said they care for more than one person.²²⁰

The health of carers

Carers already experience health impacts as a result of their caring responsibilities.²²¹ According to evidence collected before the pandemic, most surveyed carers said they had suffered mental (72%) or physical ill health (61%) as a result of caring.²²² In 2018/19, most carers reported that caring had

caused them feelings of stress (61%), feeling tired (78%) and disturbed sleep (66%). Carers have also reported feeling depressed (45%) and short tempered or irritable (43%).²²³

Impacts on carers

It seems likely that carers' health could be impacted during the pandemic, from indirect harm due to additional pressures on the health and social care system, unable to maintain previous standards and unable to adequately treat and care for patients with COVID-19 and other conditions. An ONS survey conducted between 9th and 20th April 2020 suggests that, of those who were very or somewhat worried about the effect that COVID-19 was having on their life right now, 11% of the population said their caring responsibilities had been affected by the pandemic.²²⁴ Carers may be impacted by lockdown measures (Category D), from additional pressures on their caring responsibilities as a result of social distancing measures. It has not been possible to quantify the health impact for carers and it is challenging to isolate the effects of pressures on the system from social distancing measures; however, instead the impacts of carers are discussed in general here.

Between 3rd and 14th April, Carers UK carried out an online survey of 4,830 current and 217 former carers about their experiences during the COVID-19 outbreak. Unless otherwise stated, the following section details key findings from that survey.²²⁵

Changes to caring during the pandemic

Quantity and frequency of care

Most carers report providing more care due to the coronavirus outbreak (70%), because local services had reduced or closed (35%), because they are worried about paid staff having contact with the person they care for (22%), because paid staff have reduced personal care (10%), or because their working arrangements have changed allowing them more time for caring (10%).

However, almost 1 in 10 carers said they were providing less care during the outbreak (9%). Respondents cited a range of reasons; some were reducing their social contact in line with government guidelines, whereas a smaller proportion said they are no longer spending as much time with the person they care for, not being able to visit a care home or needing to step back from caring responsibilities due to their own health reasons. Carers cited changing the way they care in response to the crisis, through the use of video calls, or phone calls from the garden; however, others were unable to provide care as those they cared for were unable to use technology.

About a fifth of carers have not changed the level of care since the pandemic (22%), which might particularly be the case for those living with the person they care for and caring for those with long-term conditions.

Nature of care

The nature of care provided may also change during the pandemic. Two thirds of carers (69%) say they are providing more help with emotional support, motivation or keeping an eye on someone either in person, phone or online during the pandemic. About half say they are providing more practical help in person, such as preparing meals and doing shopping or laundry (53%), whereas two fifths (40%) said they were providing more practical help at a distance (e.g. arranging food and medicine deliveries). Other help that had increased in some cases was taking people for exercise, personal care, arranging and coordinating care and support, helping people move around, with paperwork and financial matters, with medication or with medical care.

Health impacts for carers

Most carers surveyed during the pandemic (55%) agreed that they felt overwhelmed and worried that they would burnout in the coming weeks. Almost a fifth (18%) said they already felt unable to manage their caring role due to an increase in hours and a reduction in local service provision.

It seems likely that sources of anxiety and stress for carers are likely to reflect those of healthcare and adult social care staff. Carers' biggest concern was what would happen if they themselves become ill. The overwhelming majority (87%) of carers agreed or strongly agreed with the statement "I am worried about what will happen to the people I care for if I have to self-isolate or become ill".²²⁶ Similarly there were concerns about the person they care for becoming infected. A third of carers said they were unable to look after their own health and wellbeing (33%); over two fifths said they were 'lonely and cut off from people' (44%). Anecdotal reports from carers suggests that isolation and being a full-time carer, without any breaks or the ability to go anywhere, could have an impact on low mood, and therefore have an impact on the ability to care.²²⁷

Carers have also cited exhaustion from providing constant care, such as mental health support. This may be compounded by a lack of respite as a result of the closure of day services and specialist provision for specific groups, such as those with learning disabilities, autism or dementia.

Research also describes how for some carers, the person they care for had recently died either due to COVID-19 or from a pre-existing condition. Carers UK suggests that this is likely to increase during the pandemic and this may have longer term implications for carers' mental health, as they find themselves unable to grieve in the usual way.

For young carers, they may face particular challenges. Charities have highlighted several potential problems^{228,229}:

- Caring for family members who are volatile or present challenging behaviours, which may be exacerbated by the pressures of isolation.
- Support workers in Wales have reported that it is proving difficult for them to support young carers as effectively.
- Young carers may be concerned about their family members contracting coronavirus and how to access support without putting their family at risk.
- The impact of isolation is also likely to have an impact on these young people.
- Anecdotal evidence suggests young carers may be worried to leave the house and leave the person they care for unattended.

Formal care workforce: Adult social care staff

In England, most adult social care jobs are in residential (685,000) and domiciliary (685,000) settings; about 210,000 jobs are in community settings and 36,000 are in day settings.²³⁰ Most roles in adult social care involve direct care (76%), estimated to be about 1,225,000²³¹; this would include care workers and support workers. In addition to this, about 5% are attributed to regulated professions, about 84,000 jobs; this would include social workers, occupational therapists, registered nurses, safeguarding and review officers and allied health professionals. About 7% of adult social care staff are in managerial and supervisory roles, estimated to be 118,000 roles. A remaining 12% of jobs include administration, ancillary jobs (catering, cleaning, transport, maintenance) and other jobs not directly involved in providing care.

Impacts on adult social care staff

Similar to frontline staff in the NHS, adult social care staff are likely to be affected as a result of additional pressures on the health and social care system, unable to maintain previous standards and unable to adequately treat and care for patients with COVID-19 and other conditions. Many adult social care staff work in care homes, where many elderly people have contracted and died with COVID-19. It seems likely that they will be affected in similar ways to healthcare staff, in terms of their mental health and burnout.

There is a lack of quantitative data on the impact of the pandemic on adult social care staff, apart from evidence from surveys commissioned by trade unions, although it is not clear how representative this is of the adult social care workforce. There are also anecdotal media reports of impacts on the care sector. The evidence presented below is a summary of findings, but we cannot be certain how reflective this is of the whole UK adult social care workforce at the moment.

Sources of anxiety and stress

80% of over 900 social care staff surveyed by the GMB Scotland union said they felt that their work during COVID-19 has had a negative impact on their mental health.²³² Sources of stress and concern for care workers are likely to be similar to their counterparts in healthcare,^{233,234,235} including:

- Concerns that they would pass COVID-19 onto their family or household, or their patients,^{236,237,238}
- Fear for their own safety
- Not having enough personal protective equipment (PPE)
- Bereavements, including witnessing the deaths of people they have supported as well as colleagues; concerns about post-traumatic stress amongst staff²³⁹
- Concern about the high number of deaths in care homes²⁴⁰
- Increased workload due to staff sickness and self-isolation and lack of access to testing²⁴¹
- Financial pressures, including concerns that the amount of sick pay received by care workers (£90 a week, compared to six months full pay for NHS staff) may mean that staff are unwilling to stay at home, self-isolating, due to a lack of money.²⁴²
- Reports that care home staff were frightened about COVID-19²⁴³, at the prospect of trying to contain COVID-19 in care homes, if residents opt to not be admitted to hospital and staff are unable to isolate patients with dementia in their rooms.²⁴⁴
- Uncertainty about and challenges in accessing testing²⁴⁵
- Concerns about accepting people discharged from hospitals
- Lack of parity with the NHS.²⁴⁶

It is possible that health impacts may be felt differently by different parts of the adult social care workforce. For instance, there may be considerable stress for Registered Managers as they lead their organisations through the pandemic; similarly, personal assistants who are loan workers may not have much of a support network in many instances. Furthermore, some parts of the workforce may be more affected by the virus, such as older people and those from black and minority ethnic backgrounds, which may be a considerable source of anxiety and concern for those individuals.

Other impacts on adult social care staff

There have also been anecdotal reports of staff receiving abuse as part of their work, with one chief executive of a care organisation looking after older people in their own homes reporting that workers were abused for seeing clients without personal protective equipment.²⁴⁷ There are also reports that it has proved challenging to communicate the gravity of the situation and the necessary change in routine to some people with autism; for some there has been much upset, distress and

outbursts which has left staff “on edge, anticipating behaviours of concern and trying to defuse situations before they happen”.²⁴⁸

Estimating excess morbidity among social care staff

The evidence above highlights the potential impacts on social care staff as a result of the pandemic. Due to limited data and the ability to quantify the impact on staff due to the various factors highlighted above, the analysis below only captures mental health impacts in the form of anxiety and depression. We recognise that anxiety and depression should be analysed separately, however in absence of sufficient data they have been analysed together. When quantifying the impacts, we have assumed impacts are similar to healthcare workers due to lack data on social care staff.

QALYs loss from having severe to mild levels of anxiety and depression

In order to understand the health state of social care workers we have used the scores on the EQ-5D-5L measure from the HSE data, the same approach outlined in the QALY loss to health care workers.

Similar to the approach for health care workers, the HSE data is used to calculate a counterfactual QoL and anxiety/depression score is then changed to calculate the average score of an individual with severe, moderate and mild levels of anxiety/depression. The results are outlined in table 14. The QoL could vary compared to healthcare workers, however due to limited data we have assumed that it is the same for both workers.

In order to calculate the lost QALYs, we subtract the revised average QoL based on severity of anxiety/depression from the counterfactual QoL for that group.

Lost QALYs = (Counterfactual QoL – Revised QoL based on severity of anxiety/depression) x Duration

The duration of an episode of anxiety/depression is an area with very limited evidence. A range between 2 weeks to 8.7 months has been used and is outlined in the health care section.

Number of social care staff

The total number of social care staff in England used here is from the annual Skills for Care report²⁴⁹. We estimate that there are 1.5m social care staff in England at present. The number of staff who have sadly passed away have not been removed from these figures. These figures also do not include informal carers.

In England, it is estimated that about 76% of roles in adult social care involve direct care, including care workers and support workers. In addition to this, about 5% are attributed to regulated professions, which includes social workers, occupational therapists, registered nurses, safeguarding and review officers and allied health professionals. We therefore assume that 81% of staff are frontline staff. This assumption has been adjusted in the low and high scenario.

To estimate what proportion of staff have different levels of anxiety and depression, results from a study looking at mental health outcomes among health care workers in China exposed to COVID-19²⁵⁰ have been used. No alternative evidence was available for social care staff, and therefore these estimates have been used as a proxy. Explanation of how these estimates are used is outlined in the healthcare section.

The lost QALYs are applied to these estimates to calculate the total lost QALYs. Given limited data, these estimates are not varied by gender or age.

Summary

The table below outlines the lost QALYs for social care workers who have severe to mild levels of anxiety/depression, giving a total between **3,000-64,000 QALY loss**. The wide range in estimates is due to the uncertainty around how long a social care worker may have anxiety and depression. The duration of an episode would be dependent on support available and would impact whether the episode of anxiety/depression reoccurs.

Given the high level of uncertainty and limited evidence, the estimates should be treated as illustrative.

Table 17. Front-line staff total lost QALY anxiety/depression - social care

	Proportion of frontline staff	Duration of anxiety/depression	Total lost QALY
Low	60%	2 weeks	3,000
Central	81%	3 months	21,000
High	90%	8.7 months	64,000

C3. Changes to elective care

Overview

We consider two top-down approaches to estimate the impact of changes to elective care on excess deaths and morbidity.

NHS expenditure

- The first approach is based on research which has estimated the health impacts associated with NHS expenditure at the margin.
- This approach estimates there could be around 12,500 excess deaths as a result of changes to elective care, equivalent to a mortality impact of 45,000 QALYs (185,000 QALYs across morbidity and mortality) for all disease programmes. This is the total impact, likely to occur in the next 5-years.

Waiting times

- The second approach uses a model of elective waiting times to produce estimates of the increase in waiting times resulting from a deferment of elective activity and applies this to an assumed relationship between deferred treatment and extended duration in a pre-treated health state to arrive at an estimate of the associated health impact.
- It is suggested that this equates to around 90,000 QALYs lost as a result of morbidity impacts by April 2021.

The NHS is trying to reduce risks from COVID-19 to patients and increase its ability to respond to the crisis by continuing to treat urgent elective patients, such as most cancer treatments, and de-prioritising non-urgent care, with an emphasis on risk management. This should avoid short-term deaths but there will be a longer-term knock-on impact from delaying so many non-urgent services. There may be some life-saving treatments, such as organ transplants,²⁵¹ that have needed to be postponed in order to protect vulnerable patients from the risk of contracting COVID-19 and to avoid patients becoming particularly vulnerable while in their recovery phase. We are unable to provide a detailed, bottom-up estimate of the impact of these changes to healthcare activity as it is unclear

precisely what activity will be postponed and for how long. Instead, we have taken two top-down approaches to modelling a scenario whereby we assume 75% of elective care activity is stopped for a period of 6 months. This is supplemented by a bottom-up estimate for a specific subset of activity, relating to referrals for suspected cancer (see [Section C4](#)).

Our first approach is based on research which has estimated the health impacts associated with NHS expenditure at the margin. This research has already been used to make an initial estimate of the mortality impact, based on the deaths averted by a level of expenditure equivalent to 75% of elective activity over a 6-month period. However, refinements to this approach (described below) have significantly lowered the initial estimate.

Our second approach uses a model of elective waiting times to produce estimates of the increase in waiting times resulting from a deferment of elective activity and applies this to an assumed relationship between deferred treatment and extended duration in a pre-treated health state to arrive at an estimate of the associated health impact.

Where necessary we have used evidence on the number of QALYs per averted death to convert the estimated excess deaths into a QALY loss.

Estimates of health impacts using NHS expenditure

This section summarises:

- Revisions to an earlier estimate of the excess mortality arising from the postponement of elective activity due to the COVID-19 response; and
- Consideration of morbidity impacts so that the overall impact can be denominated in Quality-Adjusted Life-Years (QALYs).

Revisions to earlier estimates of excess mortality

Previous analysis²⁵² estimated the excess mortality from postponement of elective activity at around 185,000. This was based on the following assumptions:

- That any interruption to elective services would, in any event, not impact urgent elective activity. Using various approaches, 25% of elective activity was assumed to continue.
- The remaining 75% of activity was assumed to be deferred for a period of 6 months.
- The expenditure relating to a 75% postponement of activity was estimated across all possible stages and settings of the elective pathway – i.e. incorporating more than simply the elective hospital admission.
- The overall value of the deferred activity was thus estimated at around £17bn of expenditure in 2020/21 prices.
- To arrive at an estimate of the deaths this level of expenditure would otherwise avert (and therefore the deaths likely to arise were such expenditure curtailed) we use an estimate of the cost per death averted at the margin of NHS expenditure from research undertaken by Claxton et al at the University of York²⁵³. By analysing the relationship between NHS expenditure and mortality across 152 sub-national NHS commissioning units they estimate the cost per death averted across all programme spending to be around £73,000 in 2008/09 prices, equivalent to around £90,000 in 2020/21 prices.

It is important to note that this approach to estimating the excess deaths from postponement of elective activity is actually equivalent to a *cancellation* of activity rather than postponement. In other words, 185,000 deaths are estimated to be associated with an equivalent block of NHS expenditure.

In practice, and irrespective of whether or not such expenditure is replaced at some point in the future, the stock of patients who would otherwise have received treatment are likely to simply be added to the usual flow of new patients once services return to normal, rather than being completely denied treatment. Therefore, any associated mortality impact may take a number of years to be fully realised and, depending on how successfully the relative needs of both the stock and flow of patients are prioritised, the actual number of deaths may be significantly fewer than the estimated 185,000 (as the burden of deferment in treatment is borne by those least likely to be negatively impacted).

This draw-back of using an expenditure-based approach to estimate the excess mortality impact remains even in the revisions we have since made. However, it has at least been possible to refine our earlier estimate to account for two additional limitations, namely:

- that the cost per death averted used to generate the earlier estimate is based on the cost per death averted at the margin of NHS expenditure, taking account of the disease programmes shown to be most sensitive to marginal changes in the availability of NHS resources;
- that the cost per death averted covers expenditure on both elective and non-elective services, which may overstate the mortality impact if spending on emergency services has a greater life-saving impact than elective services (which may be more aimed at improving quality rather than length of life).

In an attempt to overcome these limitations, two approaches have been taken to refining the earlier estimate.

First, by analysing elective activity at programme budget level it has been possible to more specifically identify the urgent activity most likely to continue and that most likely to be postponed for each disease programme. This has been done by assuming that services to patients whose waiting time from decision to admit to treatment is 15 days or longer are most likely to be subject to postponement. Overall, this accounts for roughly 75% of activity, which is consistent with the earlier estimate – although this proportion varies by disease programme.

It is by using the programme-specific mix of activity relevant to the elective postponement, rather than the mix of activity most sensitive to small changes in NHS commissioning budgets, and by using programme-specific estimates of the cost per death averted that we are able to refine the measure of deaths associated with the deferred elective expenditure.

Since the mix of activity subject to elective postponement is weighted more heavily towards disease programmes with a higher than average cost per death averted, the resulting estimate of excess deaths is significantly lower – around 12,500 deaths as opposed to 185,000. If only the 11 disease programmes in which expenditure was found to be significantly related to mortality are considered – accounting for 2/3rds of the assumed elective activity postponement but around 1/3rd of change in expenditure observed in the York research – the estimate of excess deaths is around 6,000.

Secondly, by observing the relationship between cost per death averted and the percentage of activity which is elective versus non-elective it has been possible to impute the cost per death averted for spending that is 100% elective²⁰. Applying the imputed elective-only cost per death

²⁰ It should be noted that this analysis was based on a small number of observations. Programme-specific estimates of the cost per death averted are available only for the 11 programmes for which the research found a significant relationship between expenditure and mortality. Furthermore, disease programmes for maternity

averted to the £17bn of deferred activity results in an estimated number of excess deaths of around 8,000.

In summary, then, refining the earlier estimate of excess deaths to take better account, on the one hand, of the mix of deferred elective activity across disease programmes and the programme-specific cost per death averted, and on the other hand imputing an estimate based on an assumed 100% elective mix of activity, has substantially reduced our earlier estimate from around 185,000 to around 12,500.

Estimating morbidity impacts

The earlier estimate focused solely on a measure of excess deaths. However, the York research on which the earlier and subsequently-refined estimates are based also estimated the quality of life impacts associated with marginal changes in spending by disease programme – both the quality of life of additional years associated with prolonging life and the ‘pure’ quality of life impact on years spent with the disease.

Using the QALYs per death averted reported by the research, the refined excess deaths of 12,500 become around 185,000 QALYs for all disease programmes (of which, 45,000 QALYs are associated with mortality), around 130,000 QALYs for only the 11 programmes with a significant association with mortality or around 120,000 QALYs for an imputed 100% elective mix of activity. The scenario presenting the higher estimates has been used to stay on the side of cautious, given the limitations with the estimates.

Estimating the health impact from increased waiting times

This section presents an alternative approach to estimating the health impact on elective patients brought about by NHS resources having to be re-deployed to the management of the COVID-19 pandemic in England. It complements the earlier (and subsequently refined) estimate based on the deaths associated with a level of expenditure equivalent to the elective activity most likely to be postponed, but it adopts a different approach to estimating the impact – one based on the impact that deferment might have on the waiting time of not just those patients who have the treatment directly postponed but also any longer term impact on the waiting time experience of future patients.

Approach and initial results

The main element of the NHS’s redeployment of resources is the cancellation/postponement of routine elective activity. It is difficult to know how much elective activity will be cancelled, particularly since some urgent elective activity is likely to have to continue. For the purpose of arriving at an initial estimate of the health impact we have assumed that 75% of elective activity will be postponed for a period of 6 months from April 2020. We have also assumed that after this 6-month period activity will resume at its usual level from October 2020 to April 2021.

It is possible that, if social distancing measures more broadly are relaxed at some point before the end of the 6-month period due to successful management of the outbreak, a lower percentage of elective activity will need to be cancelled or postponed.

and neonates were excluded because this activity is neither elective or emergency, similarly for infectious diseases.

To understand the effect of delaying treatment, we need to understand two elements: one, what level of delay a temporary reduction of elective activity can lead to and two, how to translate a delay in care into a quantifiable health effect.

COVID-19 impact on average elective waiting times in the next year

DHSC models how hospital waiting lists for elective care are projected to change in the short-term. Considering the difference between the assumed COVID-19 scenario – where 75% of elective activity that would normally occur in the April to October 2020 period does not go ahead but where demand remains unchanged – and a status quo scenario, we have projected how average waiting times for elective care might change in the near future. By October 2020, the average patient could be waiting an additional 2 months whilst by April 2021 the delay could rise to around an additional 7 months.

The profiles of activity used to model this estimate are based on historical behaviour with more of the elective activity delivered to treat patients waiting weeks rather than months – this historical pattern is being refined but it is likely to currently lead to an overestimate of the delays in treatment. This will tend to overestimate the impact on health benefits.

Health impact of COVID-19-related delays to elective care in the next year

Treatment tends to improve the quality of life and/or life expectancy chances of a patient. A delay in treatment therefore diminishes the benefit a patient will receive over their lifetime. Evidence from York University suggests a patient's health state will be 80% of its post-treatment state prior to the health intervention. For an average elective patient, receiving treatment at 54 years of age and with a life expectancy of 80 years, a delay of 7 months in treatment could reduce their expected health benefits by around 2%. A delay of 2 months would have a more modest impact of around 0.5%.

As elsewhere in this paper, we have used quality-adjusted life years (QALYs) to estimate health benefits. Based on research conducted by Claxton et al at the University of York, we assume that NHS spending at the margin generates QALYs at a cost of £15,000, and that average NHS spending generates QALYs at a cost of £7,000. The average cost per QALY is a less robust metric than the marginal one, and likely to be an overestimate of the true average QALY cost.

We have taken high-level categories of NHS expenditure and estimated that elective activity represents around a third of overall expenditure; the value of elective activity is around £49bn per year in 2020/21 prices. Dividing the value of elective activity by the estimated cost of a QALY produces an estimate of health benefits (measured in QALYs) that elective activity delivers per year – circa 4m QALYs. It is important to note the cost per QALY used was estimated at £12,000 (between the margin and average for NHS expenditure) as spending equivalent to £49bn is significant and will include activity beyond the margin. To the extent that the NHS will choose to defer the least urgent/valuable activity ahead of more urgent/valuable activity, some of the spending curtailed as a result of the cancellation of elective activity would be more cost-effective than at £12,000 per QALY. This means we would be underestimating the total health benefit associated with elective activity.

If the reduction in health benefits that the average patient experiences (2% for a 7-month delay) is applied to all elective activity, circa 90,000 QALYs could be lost by April 2021.

Health impact of COVID-19-related delays to elective care beyond the next year

Although the potential impacts to morbidity and mortality of COVID-19-related delays to elective care in the next year are significant, future impacts may be higher if COVID-19-related delays to treatment are not removed. In other words, to avoid a significant loss in health benefits it will not only be required to resume normal activity but to compensate for the 6 months of activity lost – otherwise, patients might continue to observe worse health outcomes.

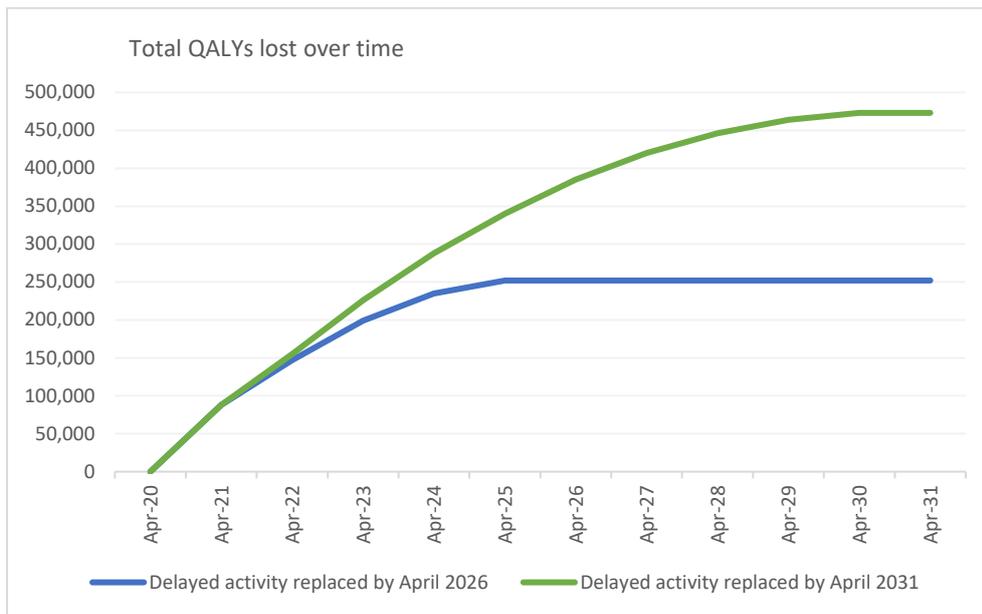


Figure 10 Total QALYs lost over time from delayed elective activity

If it takes the NHS five years to eliminate the COVID-19-related delay in treatment, we might observe a loss of 160,000 QALYs, in addition to the 90,000 estimated above. If it takes the NHS ten years instead, the additional QALY loss could be closer to 380,000. In both cases, this assumes the reduction in delay occurs evenly over time.

C4. Changes to primary and community care, including screening services

Overview

As a result of the pandemic, there have been changes to primary and community care, including screening services. Some services have been stopped during lockdown and others have been reduced to only provide urgent care. The following section outlines some of the changes that have occurred, including stopping NHS health checks, reductions in non-urgent primary care and some screening programmes.

Estimates of excess deaths due to delays in GP referrals and emergency presentations for cancer are also provided as an example of the potential health impact from changes to primary and community care, using different illustrative scenarios. Overall, the analysis estimates between 820 and 2,010 excess deaths occurring over a five-year period from a six-month reduction in cancer diagnosis equivalent to 1,920 and 5,130 lost QALYs.

Summary of changes to services during the pandemic

Advice has been issued by NHS England/Improvement to healthcare providers and commissioners, listing some specific health services to be suspended, or partially suspended, during the pandemic; the latest guidance can be found here²⁵⁴.

The overarching principle of the guidance is to de-prioritise non-urgent care, with an emphasis on risk assessment. Care postponement judged to be of lowest risk should/will generally be the first to

be deprioritised. Some services have been designated as services which can/will be completely stopped; these include:

- NHS health checks
- Non-urgent primary care, such as dental and GP services
- Some screening and vaccination programmes.

Emergency admissions (see [Section C1](#)), cancer treatment and other clinically urgent care should continue unaffected.

Suspending 'non-urgent' care is expected to have a short-term health impact in itself, since patients not receiving treatment will have reduced quality of life whilst not receiving these healthcare services. In the longer-term their condition is likely to deteriorate without treatment and some could die earlier than otherwise. Cutting screening, prevention services and primary care services will mean that life-threatening diseases will go undetected and hence untreated, resulting in more avoidable deaths. The longer the services are deprioritised for, the more impact this will have, and this will not be a linear relationship as healthcare problems will escalate over time.

Across all the non-urgent services that are cut, larger waiting lists will exist when services resume so patients seeking care in the future are likely to experience far longer delays to treatment than they would have otherwise.

NHS health checks

NHS health checks are offered to adults in England aged 40 to 74 (who do not have certain pre-existing conditions) every five years. These are designed to help early identification of stroke, kidney disease, heart disease, type 2 diabetes or dementia.

NHS health checks have been stopped until at least 31st July 2020.²⁵⁵ In 2017-18, around 1.1m patients attended an NHS health check, 41% of those invited.²⁵⁶ Take-up can depend on a range of factors, including NHS health check availability, appointment inconvenience and perceived lack of personal relevance.²⁵⁷

One study suggests that the NHS health checks programme only offers clinically modest benefits for early identification of cardiovascular disease.²⁵⁸ NHS health checks reduced the 10-year risk of cardiovascular disease by 0.21 per cent, equivalent to one cardiovascular event (e.g. stroke or heart attack) being avoided every year for every 4,762 people who attend a health check. It also noted very small improvements in cholesterol levels, blood pressure and body mass index, and no increase in the number of people who stopped smoking. The authors suggested that the programme resulted in significantly more diagnoses of vascular diseases among health check attendees (3% for hypertension and 1% for type 2 diabetes mellitus).

Based on 2017-18 data and assuming NHS health check appointments are evenly distributed over the course of a year, stopping the programme for four months between April and July may result in 37,000 appointments not taking place. We do not know whether the NHS will attempt to 'catch-up' on those missed appointments once the programme resumes. Given the relatively low take-up of health checks, the relative infrequency of health check appointments (every 5 years) and the modest benefits noted in the research above, it is possible that stopping NHS health checks for four months may have relatively limited health impacts, provided that those who miss appointments because of the pandemic are offered new checks once services resume.

GP services

Although primary care services have been reprioritised, there is likely to be an impact on supply of services as a result of changes in the way that general practices operate (i.e. remotely) as well as deferred demand from patients delaying seeking treatment. As a result, total activity in general practice has likely decreased; in the first 7 days of March, there were around 6.0m appointments in England compared to 4.2m in the last seven days of the month, which represents a reduction of almost 30%. Face to face appointments, home visits and video/online consultations decreased over the course of the month, whereas telephone appointments generally increased in frequency.²⁵⁹

Whilst GPs have seen a stable number of COVID-19-like consultations over recent weeks, consultations for a number of other illnesses have remained below baseline levels;²⁶⁰ some of this may be explained by actual lower incidence as a result of social distancing measures, but it may also be due to delayed attendance.

However, there may be specific pressures on GP services during the pandemic, for example in the need to manage patients in the community who would have received treatment in secondary care. This is additional pressure to GP services and access to these services is expected to be impacted. In addition, community health services will be supporting patients recovering with COVID-19, having been discharged from hospital.²⁶¹

There have also been calls to ensure that people, in particular children, attend regular vaccination appointments with their GPs.²⁶² Missing regular vaccination appointments may not have a significant long-term impact given the reduced social contact as a result of social distancing measures, and provided that vaccines are 'caught-up' in due course; however, this may depend on how and when lockdown measures are lifted, e.g. schools returning. We do not have up to date data on the take-up of vaccination appointments during the pandemic, but according to Imperial College London and YouGov data from late May 2020, 3% of respondents said that someone in their household delayed or missed getting any vaccines because of COVID-19.²⁶³ This might be the respondent themselves (37%), someone else (20%), a child aged 2-4 years (19%), a child aged 5-17 years (17%) or a baby aged 0-23 months (6%). Reasons for missing or delaying getting vaccinated included:

- A healthcare provider recommended delaying or missing vaccines (16%)
- The vaccination clinic is closed or not giving vaccines due to COVID-19 (16%)
- The government said that people can leave home only for essential services (15%)
- Worry about getting COVID-19 at the vaccination clinic (11%)
- It's hard to get an appointment even though the vaccination clinic is open (8%)
- Couldn't afford it (6%)
- Worry about getting COVID-19 by leaving the house (6%)
- Worry about giving COVID-19 to other people at the vaccination clinic (6%)
- Something else (15%)

For those people not being seen for non-urgent GP services, there will be a worsening of conditions that would ordinarily be prevented through these services such as worsening health conditions. Further discussion and quantification of the impact on delays to GP referrals for cancer care is included [below](#).

Cancer screening services

According to guidance from 2nd April, provision of breast cancer, bowel and cervical screening are currently under review in England;²⁶⁴ however, there are reports of disrupted services, invitations not being sent out from screening hubs and cervical cancer screening being postponed.^{265 266 267}

Cervical cancer screening covers around 70-75% of females aged 25 to 64 (approx. 15 million women). Females have a cancer incidence of around 9.36 per 100,000 person years, so within 6 months approximately 700 women would be expected to be diagnosed with cervical cancer.

Generally, 5% of cancer diagnoses are diagnosed through screening. In addition, other methods of diagnosis are also far less likely to occur during the pandemic. Around 56% of diagnoses usually come from GP referrals (and non-urgent GP work is being stopped). A further 12% are usually diagnosed from inpatient admissions/outpatient treatment, again these are likely to be reduced. Further discussion and quantification of the impact on delays to cancer diagnosis can be found [below](#).

Other screening services

According to guidance from 2nd April, diabetic eye screening is currently under review in England.²⁶⁸ Abdominal aortic aneurysm screening is currently under review in England.²⁶⁹

Pregnancy and maternity services

Antenatal and postnatal care should be considered as essential during the pandemic and individuals are therefore encouraged to attend appointments. Some changes may be made to care, such as including routine care and essential tests in one appointment to prevent multiple visits to hospitals and clinics, individuals attending appointments alone, without partners, conducting consultations over the phone or by video link, and no longer being able to give birth at home or in a midwife led unit.²⁷⁰ There were also anecdotal reports of antenatal classes being cancelled earlier in the pandemic,²⁷¹ although National Childbirth Trust (NCT) have offered live online antenatal classes.²⁷²

Dental services

The provision of all routine, non-urgent dental care including orthodontics has been stopped in England until further notice.²⁷³ Local Urgent Dental Care systems may still provide urgent care for some patients, such as those suffering from life threatening emergencies, trauma, oro-facial swelling and severe/facial pain not possible to be controlled by the patient.²⁷⁴ A significant minority of dentistry is provided privately, which was also suspended during the pandemic and we do not hold data on this; these patients are entitled to access urgent dental care services.

Tooth decay is easier and less expensive to treat in earlier stages and the NHS advises regular dentist appointments to ensure early treatment and prevention of future decay.²⁷⁵ For those people not being seen for routine dental appointments, there will be a worsening of conditions that would ordinarily be prevented through these services such as oral hygiene and worsening health conditions. The full range of treatments should theoretically be available as part of urgent dental care if the patient is symptomatic (i.e. experiencing pain); in some cases, there is a risk that a small, asymptomatic issue (e.g. a small filling) may become more significant and is not picked up until it has worsened (e.g. larger filling, root canal, canal). Once services resume, morbidities may decrease but continue to have an effect, depending on the backlog of appointments that need to be rescheduled.

Optometry Services

Since 1st April 2020, all routine optical services (where the patient is not complaining of any new symptoms or loss of sight) have been suspended until advised otherwise.²⁷⁶ Urgent and essential eye care should still be delivered from a limited number of optical practices. This may include any patients which are not considered emergencies but where the practitioner judges that a delay in examination could be detrimental to a patient's sight or wellbeing (such as broken or lost glasses). Urgent or emergency eye care is also allowed to continue. In general, NHS provision is only available to a minority of the population and the rest is private, for which we do not hold data.

There is a risk that more serious problems may not be picked up as a result of suspending routine eye tests; harm to health may occur as a result of delayed referral to secondary care (assuming patients attend eye tests once services are available again). Once services resume, morbidities may decrease but continue to have an effect, depending on the backlog of appointments that need to be rescheduled.

Audiology services

Audiology services have been partially stopped during the pandemic until at least 31st July 2020.²⁷⁷ Routine assessment should be delayed. Certain services are prioritised, including the repair, replacement and supply of hearing aids, spare parts and specialist batteries. Other services are permitted to continue if considered essential based on clinical judgement and if appropriate precautions are taken, if the patient is at risk of future urgent care needs, or if hearing aid wearers are dependent on their instruments for social contact, personal safety and/or avoiding distress.

Estimating excess deaths and lost QALYs due to delay in cancer diagnoses

Background

There are three main routes by which cancers are diagnosed:

- GP referrals, via the urgent “two week wait” route or non-urgent referral;
- Emergency presentations; and
- National cancer screening programmes.

NHS England reported that the number of urgent GP referrals had fallen by 70% over March²⁷⁸. (It would seem reasonable that there is a similar fall in non-urgent referrals, and anecdotal evidence would support this.) The number of A&E attendances in April 2020 was less than 50% of that for April 2019, and the corresponding number of resulting admissions just over 50%²⁷⁹. We do not have equivalent information on the levels of cancer screening activity and the guidance from NHS England is not entirely clear on the expected new level of activity.

There is concern that the delay in cancer being diagnosed may possibly lead to a deterioration in patient outcomes.

The following sections provide estimates of excess monthly mortality for each of the three routes to diagnosis in turn. Our approach focuses on the delay in patients being diagnosed, and does not directly allow for further extra delays between diagnosis and treatment. As a result, the estimates of excess deaths are conservative.

National Cancer Screening Programmes

Methodology

Most of the cancers detected through the cancer screening programmes are at a very early stage and would not be affected by a six-month delay in the screening process. Furthermore, many of the cancers are at a stage where there is a very high survival rate. As a result, we expect the impact of the deferral to any deferral to cause limited excess mortality.

Nevertheless, there will be cases where the cancer would progress during a six-month deferral. We therefore model the impact of 1%, 2% and 4% of patients diagnosed at stage 1, 2 or 3 progressing to the next stage by the time they are diagnosed. The modelling covers cancer patients covered by the national screening programme for whom the stage at diagnosis was available, including roughly 7,000 out of 8,000 screened in a six-month cohort (74%²⁸⁰).

Results

The results presented assume a total suspension in the cancer screening programme in order to show the maximum number of excess deaths that we might expect from a reduction in screening.

Table 18. Excess deaths over a five-year period expected from a six-month suspension of the national screening programme

Cancer	Rate of progression		
	1%	2%	4%
Breast	5	10	20
Cervix	0	0	5
Colorectal	5	5	15
Total	10	20	35

This shows that we would expect the actual number of excess deaths from the actual reduction in screening activity to be very low, and so we do not include this in our overall assessment.

GP Referrals

Methodology

Cancer patients receiving an urgent referral benefit from a swift diagnosis, and subsequent first treatment, compared to patients with a normal GP referral, leading to a greater chance of survival. We would therefore expect to see a higher survival rate among urgent referrals, and we use this difference in survival rates as the basis for estimating the number of excess deaths.

In general, urgent referrals tend to be more advanced than normal referrals, so we use survival information broken down by “stage at diagnosis” to make some allowance for this. However, the stages have quite broad definitions, and so the different mix of cases can result in a lower survival rate for normal than for urgent referrals. We have therefore developed a methodology²¹ to allow for such cases, assuming that enough of the data does follow the expected pattern.

This has enabled us to model the impact of the delay for the following cancers: bladder, breast, colorectal, hodgkin lymphoma, kidney, larynx, lung, melanoma, prostate and uterus. Using a six-month cohort, we are able to model 36,000 patients out of a total of around 51,000 (70%).

We use the weighted²² average of the two survival rates for the first year and the modelled non-urgent referral survival rate for the later four years. We compare these results with results for the same cohort and the urgent referral survival rates to estimate the number of excess deaths.

For non-urgent GP referrals, we do not have an alternative route to diagnosis against which to compare survival rates. We therefore assume that the change in survival is equivalent to the change that we have calculated between urgent and non-urgent referrals. We present results for three different assumptions about how the changes will compare. This covers approximately 19,000 out of 36,000 patients (53%) for a six-month cohort.

For both types of referral, we present results with three alternative assumptions for the reduction in the number of patients that are diagnosed compared to normal levels of activity, and for non-urgent

²¹ The approach is based on linear interpolation and extrapolation but ensuring that the result remains positive. We also assume that the difference is minimal where both urgent and normal referral survival rates are extremely high.

²² We assume that the deterioration happens over the first six months of the year, and so assume three months of the original survival rate and nine months of the adjusted rate.

referrals we also present three scenarios for the percentage difference between survival of urgent to non-urgent referrals that is assumed to apply to deferred non-urgent referrals – giving a total of 9 excess death estimates for each cancer site.

Results

The tables below show the total difference in the expected numbers of deaths over the five-year period for each of the four major cancers, and the other six modelled cancers combined, for each of the different modelled scenarios.²⁸¹

Table 19. Excess deaths over a five-year period expected from a six-month reduction in urgent GP referrals for cancer

Cancer	Reduction in diagnoses		
	75%	70%	50%
Breast	250	240	170
Colorectal	250	230	170
Lung	20	20	10
Prostate	150	140	100
Other	270	250	180
Total	950	880	630

Note: In this and subsequent tables, figures are rounded to the nearest ten and so may not always sum correctly. Furthermore, the figures presented above relate only to those cancers for which this approach is feasible – i.e. in this case it only covers around 7/10ths of overall cancer diagnoses.

Table 20. Excess deaths over a five-year period expected from a six-month reduction in non-urgent GP referrals for cancer

Cancer	50% of difference between urgent and non-urgent			100% of difference between urgent and non-urgent			200% of difference between urgent and non-urgent		
	Reduction in diagnoses			Reduction in diagnoses			Reduction in diagnoses		
	75%	70%	50%	75%	70%	50%	75%	70%	50%
Breast	20	20	10	40	30	20	70	70	50
Colorectal	80	80	60	160	150	110	300	280	200
Lung	10	10	10	20	20	10	30	30	20
Prostate	40	40	30	80	80	50	160	150	110
Other	80	80	50	160	140	100	280	260	190
Total	230	220	160	450	420	300	840	780	560

Emergency presentations

Methodology

We have not identified a methodology that specifically relates to the emergency presentation situation, and so take the simple approach to maximise the number of patients that we can model. of reducing the most recent survival rates by a fixed proportion. We reduce the most recent survival rates by 2%, 5% and 10% (so 50% survival would become 49%, 47.5% and 45% respectively).

As a cross-check, this approach is broadly equivalent to adapting the GP referral approach to reducing the emergency presentation rates by 10%, 25% and 50% of the difference between GP non-urgent referral and emergency presentation rates for the same ten cancers.

Results

The following table shows results for eighteen cancers (Bladder, Bone cancer, Brain, Breast, Cervix, Colorectal, Gallbladder, Hodgkin lymphoma, Intracranial endocrine, Kidney, Lung, Non-Hodgkin lymphoma, Oropharynx, Ovary, Prostate, Stomach, Testis, Uterus) modelled in the GP referral model, covering roughly 14,000 out of 27,000 patients (51%) in a six-month cohort.

Table 21. Excess deaths over a five-year period expected from a six-month reduction in emergency presentations resulting in cancer diagnosis

Cancer	2% reduction in survival rate			5% reduction in survival rate			10% reduction in survival rate		
	Reduction in diagnoses			Reduction in diagnoses			Reduction in diagnoses		
	75%	70%	50%	75%	70%	50%	75%	70%	50%
Breast	0	0	0	10	10	10	20	20	10
Colorectal	10	10	10	30	30	20	60	60	40
Lung	0	0	0	0	0	0	0	0	0
Prostate	10	10	10	30	30	20	60	60	40
Other	20	20	10	40	40	30	80	70	50
Total	50	50	30	120	110	80	220	210	150

Summary

We have estimated the number of excess deaths over a five-year period from a six-month reduced level of activity in the main pathways that lead to cancer diagnosis.

Setting aside screening, where the anticipated level of excess deaths is very low, we estimate the following range of excess deaths from reduced GP referrals and emergency presentations from modelling 70,000 out of a total 115,000 patients.

Table 22. Excess deaths over a five-year period expected from a six-month reduction in cancer diagnosis

Cancer	Upper estimate	Central estimate	Lower estimate
Breast	340	280	180
Colorectal	610	410	230
Lung	50	40	20
Prostate	370	250	140
Other	630	440	250
Total	2,010	1,420	820

We estimate the numbers of life years lost by assuming that each excess death occurs half way through the corresponding year. We further assume that cancer patients lose 0.7 QALY per life year lost²⁸² to give the number of QALYs lost through mortality and, as Claxton identifies that 93% of the benefit from cancer expenditure is from reducing premature death and 7% is from reducing disability while alive²⁸³, we assume a further $0.7 \times (7/93) = 0.05$ QALYs are lost in morbidity.

This gives the following corresponding table of years lost, summed across 2 weeks wait, GP referral and emergency presentation routes to diagnosis for all modelled cancers:

Table 23 Excess deaths, LY lost and QALYs over a five-year period expected from a six-month reduction in cancer diagnosis

Cancer	Lower estimate	Central estimate	Upper estimate
Excess deaths	820	1420	2010
LY lost	2750	4930	7320
QALYs Lost (mortality)	1920	3450	5130
QALYs lost (morbidity)	140	260	390
Total QALYs lost	2070	3710	5510

Annex D: Indirect COVID-19 impact from (1) social distancing measures and (2) economic downturn

Overview

In addition to morbidity and mortality as a direct result of COVID-19 (Category A) and an indirect result from changes in the healthcare system (Category B and C), it is possible that there may be some health impacts as a result of wider social and economic factors. The following annex aims to discuss and quantify the impacts on morbidity and mortality, considering the effect of social distancing measures and a potential economic downturn.

Firstly, we consider the impact of social distancing measures on mortality and morbidity in a range of different social factors by using the Global Burden of Disease approach (see [D1](#)). We then review all the economic evidence on the impact of an economic downturn and consider the short- and medium-term impacts on mortality and morbidity (see [D2](#)).

We then consider the impact of the economic downturn on mortality in the long-term, using two different methodologies. A comparison of the methodologies is outlined in [D4](#):

- [D3](#): Long-term impacts on those who are aged between 16-25 years during the recession using GDP-to-mortality elasticity, based on a study looking at a period between 1978-2006, and ONS life tables.
- [D4](#): Estimating excess deaths due to increased deprivation using an Index of Multiple Deprivation approach

The methodology underlying the impacts of social distancing measures (D1) and recession (D2 and D3) through the use of the Global Burden of Disease study is detailed in [D5](#).

Timescales

In the following section, we have conceptualised the 'lockdown' as a defined 2-month period, which would then be lifted. However, in reality lockdown and social distancing measures have not been in place for a distinct period and then lifted, leaving the country to return to its previous state. Instead, lockdown measures are being lifted gradually, impacting different people at different rates.

Lockdown started on 23rd March and was first eased on 13th May 2020, where some workers were allowed to return to work (if they could not work from home), and people in England were allowed to exercise outside as much as they wanted and meet up with one person from another household as long as they socially distanced outside. Since then, lockdown has been further eased with some children returning to school, groups of up to 6 people able to meet up outside and shielded people allowed to go outside.²⁸⁴

For simplicity, we have assumed a 2-month period of lockdown, which largely reflects the initial period of lockdown before it started to be eased. However, we acknowledge that the lockdown and its effects may be experienced for a longer period of time, given the gradual easing that is taking place; for instance, shielded people were not able to leave their homes for 10 weeks and some may have opted to stay indoors despite the lockdown easing to be cautious.

Scope

In the following section, we have attempted to discuss and quantify the main health impacts that may occur as a result of lockdown measures. However, it is important to note that this is not

exhaustive and there may be other impacts which could have wider or longer-term effects on health, such as reductions in health research funding and impacts on funding of public services.

D1: Estimates of impact using a Global Burden of Disease approach

Summary of estimated impacts

This section estimates the wider morbidity and mortality impacts of the COVID-19-related 'lockdown' and the resulting recession. All of these estimates are based on arbitrary, purely illustrative, assumptions (see below for details), and therefore their reliability and robustness are considered to be very low.

The paper distinguishes two non-overlapping time periods (1. lockdown and 2. lockdown-induced recession) and separately estimates the health impacts corresponding to each of the two phases. While it may be the case that, in real life, the lockdown-induced recession would start before the lockdown ends, for the purposes of this modelling the two time periods are treated as non-overlapping.

In some cases, impacts corresponding to one phase (e.g. the lockdown) would only be 'realised' later (e.g. during the subsequent recession, or perhaps many years after the recession has ended). Nevertheless, impacts believed to have been caused by either of the lockdown or the lockdown-induced recession are discussed under the respective sections regardless of when the impacts are thought to be realised²³. Every care has been taken to avoid double-counting impacts presented under sections 1 and 2, but potential double-counting cannot be completely ruled out.

The impacts of the lockdown-induced recession are separated into short-, medium- and long-term impacts accruing within 2 years, between 2-5 years, and between 5-45 years following the start of the recession. Again, by construction, none of the impacts presented under these sub-sections are assumed to overlap with impacts estimated for other phases, but potential double-counting cannot be completely ruled out.

As mentioned above, the assumed duration of the lockdown is 2 months in the model. The summary table below presents the total health impacts corresponding to the full 2-month assumed duration of the lockdown, whereas the tables in section 1 show the estimated health impacts per month of lockdown. The assumed magnitude of the recession and resulting health impacts are both functions of the duration (and stringency – if applicable) of the lockdown and wider social distancing measures. As previously discussed, in reality easing of lockdown measures has been gradual and therefore it is possible that impacts of the lockdown are longer than the assumed 2-months; it is important to note that a longer duration of lockdown and social distancing measures could impact the estimates not only for the lockdown but also for the resulting recession.

The main estimated impacts are:

Lockdown

- The main mortality impacts of the lockdown are expected to come from an estimated reduction in the number of fatalities due to **better air quality**, with further, smaller, reductions expected due to **lower alcohol misuse, lower road injuries and lower childhood infectious diseases**. These impacts are somewhat counterbalanced by an estimated increase in the number of fatalities due to **lower physical activity, increased home accidents, increased self-harm, and increased musculoskeletal conditions**.

²³ For example, it is likely that some of the mortality impacts of the lockdown (e.g. due to better air quality) would only be realised after the lockdown has ended, but these impacts are still presented under the section on lockdown (section 1).

- The main morbidity impacts of the lockdown are expected to come from an estimated **increase in musculoskeletal conditions, increased domestic abuse, and increased mental health problems.**

Short-term impacts of the lockdown-induced recession

- The main short-term mortality impacts of the lockdown-induced recession are expected to come from an estimated reduction in the number of fatalities due to a **reduction in cardiovascular diseases, dementias and respiratory diseases.**
- The main short-term morbidity impacts of the lockdown-induced recession are expected to come from an estimated **increase in mental health problems**, counterbalanced by a **reduction in unintentional injuries (mostly occupational injuries), reduction in chronic respiratory diseases, and reduction in transport injuries.**

Medium/long-term impacts of the lockdown-induced recession

- The main medium-term mortality impacts of the lockdown-induced recession are expected to come from an estimated increase in the number of fatalities due to **increased cardiovascular diseases.**
- The main medium-term morbidity impacts of the lockdown-induced recession are expected to come from an estimated **increase in musculoskeletal disorders and mental health problems.**
- The main long-term mortality impact of the lockdown-induced recession is expected to be a slightly **elevated all-cause mortality impact for younger people** who would enter the labour market a few years before, during, and a within a few years after the recession.

In terms of relative magnitudes, the health impacts of the recession, especially on the medium/long-term, are expected to be several times greater than the health impacts of the lockdown. It is not possible to break down the impacts by age or other group characteristics.

The tables below present a detailed summary of the estimated impacts under the central, pessimistic and optimistic scenarios, respectively. The negative estimates represent the positive health impacts (QALYs, deaths and YLL saved) and the positive estimates represent negative health impacts (QALYs, deaths and YLL lost). The methodology for these estimates is detailed later in the annex.

Table 24. Summary table - central estimates

	<u>Change in morbidity (QALYs)</u>	<u>Change in Deaths</u>	<u>Change in Years of Life Lost (for those who die)</u>	<u>Change in mortality (QALYs)</u>	<u>Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]</u>
Estimated impacts of a 2-month lockdown					
Alcohol use	-3,100	-240	-7,700	-4,900	-7,900
Drugs misuse	-3,000	-80	-3,200	-2,000	-5,000
Tobacco	0	0	0	0	0
Air pollution	-17,300	-2,950	-42,300	-28,700	-46,000
Low physical activity	+600	+220	+2,700	+1,800	+2,400
Child malnutrition	+1,200	+20	+1,400	+700	+1,900
Occupational injuries	-1,500	-20	-800	-500	-1,900
Road injuries	-2,400	-70	-2,700	-1,700	-4,100
Musculoskeletal disorders	+72,100	+120	+1,600	+1,100	+73,200
Sexually transmitted infections	-1,500	-30	-1,400	-800	-2,300
Other infectious diseases	-1,500	-100	-3,100	-2,000	-3,400
Anxiety disorders (adults)	+7,600	0	0	0	+7,600
Depressive disorders (adults)	+15,300	0	0	0	+15,300
Self-harm (adults)	+300	+200	+8,200	+5,000	+5,300
Anxiety disorders (children)	+1,700	0	0	0	+1,700
Depressive disorders (children)	+1,300	0	0	0	+1,300
Self-harm (children)	0	0	0	0	0
Interpersonal violence	-1,200	-20	-800	-500	-1,600
Lower calorie intake	0	0	0	0	0
Domestic abuse	+53,100	0	0	0	+53,100
Home accidents	+12,200	+220	+3,000	+2,100	+14,200
sub-total	+133,900	-2,730	-45,100	-30,400	+103,800
Estimated short-term impacts of the lockdown-induced recession					
Cardiovascular diseases	-4,900	-2,100	-27,300	-18,600	-23,500
Neoplasms	+1,900	+1,500	+26,400	+17,800	+19,600
Chronic respiratory diseases	-15,000	-1,400	-18,400	-12,500	-27,500
HIV/AIDS and STIs	-500	0	-300	-200	-700
Alzheimer's disease and other dementias	-3,700	-2,000	-16,200	-11,000	-14,700
Chronic kidney disease	-1,700	-200	-2,400	-1,600	-3,300
Transport injuries	-8,700	-200	-9,800	-6,000	-14,800
Unintentional injuries	-17,500	-400	-6,000	-4,100	-21,600
Self-harm	+500	+300	+11,100	+6,800	+7,200
Interpersonal violence	-700	0	-400	-200	-900
Nutritional deficiencies	-400	0	0	0	-400
Depressive disorders	+21,900	0	0	0	+21,900
Anxiety disorders	+12,300	0	0	0	+12,300
sub-total	-16,500	-4,500	-43,300	-29,600	-46,400
Estimated medium-term impacts of the lockdown-induced recession					
Mental disorders	+182,100	0	0	0	+182,100
Musculoskeletal disorders	+187,000	+300	+3,900	+2,600	+189,600
Cardiovascular diseases	+32,800	+14,300	+182,200	+123,900	+156,700
Chronic respiratory diseases	+36,200	+3,300	+44,200	+30,000	+66,200
sub-total	+438,100	+17,900	+230,300	+156,500	+594,600
Estimated long-term impacts of the lockdown-induced recession					
Long-term mortality of labour entrants		+14,600	+464,500	+293,800	+293,800
Total	+555,500	+25,270	+606,400	+390,300	+945,800

Table 25. Summary table - pessimistic estimates

	<u>Change in morbidity (QALYs)</u>	<u>Change in Deaths</u>	<u>Change in Years of Life Lost (for those who die)</u>	<u>Change in mortality (QALYs)</u>	<u>Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]</u>
Estimated impacts of a 2-month lockdown					
Alcohol use	0	0	0	0	0
Drugs misuse	0	0	0	0	0
Tobacco	+11,700	+2,000	+32,900	+22,200	+34,000
Air pollution	-9,200	-1,600	-22,500	-15,300	-24,500
Low physical activity	+1,400	+500	+6,400	+4,400	+5,800
Child malnutrition	+3,700	0	+2,800	+1,400	+5,100
Occupational injuries	-800	0	0	0	-800
Road injuries	-1,600	-100	-2,000	-1,200	-2,800
Musculoskeletal disorders	+144,300	+200	+3,100	+2,100	+146,400
Sexually transmitted infections	-1,100	0	-700	-400	-1,500
Other infectious diseases	-1,100	-100	-2,500	-1,600	-2,700
Anxiety disorders (adults)	+15,100	0	0	0	+15,100
Depressive disorders (adults)	+30,500	0	0	0	+30,500
Self-harm (adults)	+700	+400	+15,700	+9,600	+10,300
Anxiety disorders (children)	+3,500	0	0	0	+3,500
Depressive disorders (children)	+2,500	0	0	0	+2,500
Self-harm (children)	0	0	+1,200	+600	+600
Interpersonal violence	-300	0	0	0	-300
Lower calorie intake	+1,400	+200	+2,200	+1,500	+2,900
Domestic abuse	+74,300	0	0	+500	+74,800
Home accidents	+19,500	+300	+4,700	+3,200	+22,700
sub-total	+294,500	+1,800	+41,300	+27,000	+321,600
Estimated short-term impacts of the lockdown-induced recession					
Cardiovascular diseases	-3,400	-1,500	-19,000	-12,900	-16,400
Neoplasms	+2,300	+1,900	+32,700	+22,000	+24,300
Chronic respiratory diseases	-9,600	-900	-11,800	-8,000	-17,700
HIV/AIDS and STIs	+100	0	0	0	+100
Alzheimer's disease and other dementias	-900	-500	-3,800	-2,600	-3,400
Chronic kidney disease	-600	-100	-900	-600	-1,200
Transport injuries	-7,400	-200	-8,500	-5,200	-12,600
Unintentional injuries	-14,800	-300	-5,000	-3,400	-18,100
Self-harm	+400	+200	+8,700	+5,300	+5,700
Interpersonal violence	-200	0	0	0	-200
Nutritional deficiencies	+600	0	0	0	+600
Depressive disorders	+17,100	0	0	0	+17,100
Anxiety disorders	+9,700	0	0	0	+9,700
sub-total	-6,700	-1,400	-7,600	-5,400	-12,100
Estimated medium-term impacts of the lockdown-induced recession					
Mental disorders	+227,600	0	0	0	+227,600
Musculoskeletal disorders	+233,700	+400	+4,900	+3,300	+237,000
Cardiovascular diseases	+41,000	+17,800	+227,700	+154,800	+195,900
Chronic respiratory diseases	+45,200	+4,200	+55,300	+37,600	+82,800
sub-total	+547,500	+22,400	+287,900	+195,700	+743,300
Estimated long-term impacts of the lockdown-induced recession					
Long-term mortality of labour entrants		+29,200	+929,100	+587,600	+587,600
Total	+835,300	+52,000	+1,250,700	+804,900	+1,640,400

Table 26. Summary table - optimistic estimates

	Change in morbidity (QALYs)	Change in Deaths	Change in Years of Life Lost (for those who die)	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Estimated impacts of a 2-month lockdown					
Alcohol use	-9,200	-700	-23,100	-14,700	-23,800
Drugs misuse	-8,900	-200	-9,000	-5,600	-14,500
Tobacco	-11,700	-2,000	-32,900	-22,200	-34,000
Air pollution	-23,000	-3,900	-56,100	-38,100	-61,100
Low physical activity	0	0	0	0	0
Child malnutrition	0	0	0	0	0
Occupational injuries	-1,900	0	-800	-500	-2,300
Road injuries	-4,000	-100	-4,700	-2,900	-6,900
Musculoskeletal disorders	+28,900	+100	+700	+500	+29,300
Sexually transmitted infections	-1,700	0	-1,400	-800	-2,500
Other infectious diseases	-1,700	-100	-3,600	-2,300	-4,000
Anxiety disorders (adults)	+3,000	0	0	0	+3,000
Depressive disorders (adults)	+6,100	0	0	0	+6,100
Self-harm (adults)	+100	+100	+3,400	+2,100	+2,200
Anxiety disorders (children)	+700	0	0	0	+700
Depressive disorders (children)	+500	0	0	0	+500
Self-harm (children)	0	0	0	0	0
Interpersonal violence	-1,400	0	-800	-500	-1,900
Lower calorie intake	-1,400	-200	-2,200	-1,500	-2,900
Domestic abuse	+21,200	0	0	0	+21,200
Home accidents	+4,900	+100	+1,200	+800	+5,700
sub-total	+500	-6,900	-129,300	-85,700	-85,200
Estimated short-term impacts of the lockdown-induced recession					
Cardiovascular diseases	-6,400	-2,800	-35,700	-24,300	-30,700
Neoplasms	+1,400	+1,200	+20,100	+13,500	+14,900
Chronic respiratory diseases	-20,300	-1,900	-24,800	-16,900	-37,200
HIV/AIDS and STIs	-1,000	0	-1,000	-600	-1,700
Alzheimer's disease and other dementias	-6,600	-3,600	-28,700	-19,400	-26,000
Chronic kidney disease	-2,800	-300	-3,900	-2,700	-5,500
Transport injuries	-10,100	-300	-11,500	-7,100	-17,200
Unintentional injuries	-20,300	-400	-6,800	-4,600	-24,900
Self-harm	+600	+300	+13,500	+8,300	+8,800
Interpersonal violence	-1,100	0	-800	-500	-1,600
Nutritional deficiencies	-1,400	0	0	0	-1,400
Depressive disorders	+26,700	0	0	0	+26,700
Anxiety disorders	+15,000	0	0	0	+15,000
sub-total	-26,300	-7,800	-79,600	-54,300	-80,800
Estimated medium-term impacts of the lockdown-induced recession					
Mental disorders	+91,000	0	0	0	+91,000
Musculoskeletal disorders	+93,500	+200	+2,000	+1,400	+94,800
Cardiovascular diseases	+16,400	+7,100	+91,100	+61,900	+78,300
Chronic respiratory diseases	+18,100	+1,700	+22,100	+15,000	+33,100
sub-total	+219,000	+9,000	+115,200	+78,300	+297,200
Estimated long-term impacts of the lockdown-induced recession					
Long-term mortality of labour entrants		+4,900	+154,800	+98,000	+98,000
Total	+193,200	-800	+61,100	+36,300	+229,200

Health impacts of the COVID-19 lockdown

The social distancing measures (as well as the likely resulting economic recession) are expected to have a range of direct and indirect impacts on health, wellbeing and mortality. Some of these effects may move in different directions with potentially opposing impacts, and it is difficult to reach a definitive conclusion about the net impacts of some of these influences.

Adult social care users and people with disabilities

Social distancing measures may have specific impacts on some people with adult social care needs and disabilities. The evidence below is anecdotal, mostly collated by charities, but it does suggest some unintended consequences of the social distancing measures for specific groups. It should be noted that the findings related to the shielded list may have changed over time, as it is possible that more people have been identified and added to the list or have been helped to access supermarket deliveries through voluntary schemes. Because of the lack of quantitative evidence in this area, it has not been possible to quantify the health impacts.

Disruption to routine

Many people with autism find that part of their diagnosis involves restricted and repetitive patterns of behaviours, activities, interests or routines.²⁸⁵ People with autism have described the impacts of disruption to routine as a result of the lockdown measures.²⁸⁶ Suddenly removing the structure, they previously relied on has led them to feeling overwhelmed, confused, unmotivated, anxious and distressed.^{287,288} Others have mentioned forgetting to take their medication, experiencing disrupted sleep as a result of changes to their routine,²⁸⁹ as well as disruption to medical appointments and service users not liking the change to teleconferences.²⁹⁰

As a result of these disruptions, some autistic people have mentioned experiencing meltdowns, described by the National Autistic Society as “an intense response to overwhelming situations”, potentially including shouting, screaming and physically lashing out.²⁹¹ There is also the potential for shut downs, which are muted responses to stress, being unable to move, silent or needing to withdraw somewhere quiet.²⁹²

Access to food

People with autism have also described the impact of social distancing measures when food shopping. The sudden change to socially distanced queueing systems outside shops had led some to feel overwhelmed and confused, and to have a meltdown.²⁹³ Some autistic people have mentioned being able to attend the designated shopping hours at supermarkets for those who are older and disabled people; however, they have cited feeling guilty for being there as a result of not having a visible disability.²⁹⁴ The process of shopping has also caused stress, worry and dread;²⁹⁵ as a result of the panic buying and stockpiling particularly at the start of the lockdown measures, some people with autism have cited much upheaval to shopping routines, distress, feeling overwhelming and agitated as the shelves were empty.²⁹⁶

There are instances of some people with disabilities not being included on the Government’s shielded list.²⁹⁷ This has led to them not being able to access food without leaving their home, leaving them vulnerable to COVID-19 if they venture outside, or not being eligible for council schemes to collect prescriptions.²⁹⁸ As a result, some have felt fearful or desperate, and have experienced disrupted sleep. Some people with physical disabilities, not on the shielded list, have no access to transport or friends or relatives nearby. Some have had to walk to small local shops, which causes considerable pain; the queueing outside supermarkets has been described as ‘impossible’.^{299,300} Many blind and partially sighted people are struggling to get access to shopping as

they are not on the Government's priority list for delivery slots, despite the additional challenges many may experience with social distancing.³⁰¹

The financial implications for disabled people should also be noted; this could have implications for health in terms of diet. A survey of over 200 disabled people by Disability Rights UK found that 95% had witnessed an increase in their costs due to the pandemic. 92% said they were struggling with additional food costs. Some needed to find money to pay others to collect food and medicine for them. Staying at home had also led to higher heating and water bills.³⁰² The Disability Rights Consortium has noted that disabled people are more likely to have a lower income, which may mean they rely on affordable food options which may not have been available during the lockdown.³⁰³

For some, going to shops in person is not possible due to physical disabilities and being unable to carry shopping; due to the high demand for supermarket deliveries, this has led some to rely on take away deliveries³⁰⁴ or to use deliveries from smaller shops which are more expensive,^{305,306} particularly for those on restricted medical diets.³⁰⁷ Similarly, for those who are considered "shielded", supermarket deliveries often have a minimum spend which is higher than the individual's normal shopping expenses. The strain on finances has also meant some have had to purchase inexpensive, unhealthy food for some parts of the week, which could have impacts on health.³⁰⁸

Other impacts

For some people with autism, rules on social distancing and maintaining 2-metres have proved confusing and challenging. Carers have said they have been judged by the public and challenged by the police when helping autistic people with their daily exercise.³⁰⁹ Concerns have also been raised about the impact of isolation on some people with dementia; social care staff in care homes have noted "We are seeing them going downhill without visits from their families".³¹⁰

Specific challenges have been noted for people who are deaf or having hearing loss, when working from home. Those with hearing loss have cited feeling embarrassment, stress or fear that it might affect their job prospects in terms of needing adjustments for home working amid the lockdown.³¹¹

Air pollution

Air pollution is the top environmental risk to human health in the UK and one of the greatest threats to our health after cancer, heart disease and obesity. It affects people of all ages, but particularly at the beginning and later stages of life. Due to the drastic reduction in road traffic³¹² and industrial activity, air pollution is likely to have considerably improved during the lockdown, leading to positive health impacts.

It is estimated that long-term exposure to pollution in the UK is responsible for between 28,000 and 36,000 premature deaths per year³¹³. Short-term episodes of elevated levels of pollutants have also been linked to considerable health impacts^{314,315,316}. Exposure to particulate matter over shorter time periods has been associated with increases in respiratory and cardiovascular disease events, potentially leading to increased risk of mortality and hospitalisation, and exacerbation of conditions such as asthma^{317,318,319,320,321,322,323}. One UK study³²⁴ estimated that a 10-day spike in particulate matter (PM) in 2014 would have brought forward around 600 premature deaths, approximately double the burden associated with typical urban background levels of PM2.5. It has also been suggested that high levels of pollution could worsen both the spread³²⁵ and outcomes of COVID-19 based on an earlier study on SARS³²⁶.

Health impacts

Evidence shows that there have been significant improvements in air quality following the implementation of social distancing measures^{327,328}, with some key air pollutants, such as NO₂,

dropping by 50% (40% meteorological conditions have been taken into account) in many cities. At the same time, there is little evidence of significant widespread change to concentrations of PM.

The reduction in premature deaths due to lower air pollution during lockdown is based on estimates by the Centre for Research on Energy and Clean Air (CREA)³²⁹. CREA's figures relate to a 30-day long reduction in pollutants. Proportional changes are assumed in morbidity, years of life lost²⁴ and years lived with disability due to air pollution. These latter values are calculated by sourcing the corresponding ratios from the Global Burden of Disease Study³³⁰. It is acknowledged that the GBD estimates correspond to long-term exposures to PM 2.5, and given PM concentrations have remained largely unchanged, this methodology is not fully applicable in the current context, and it is only chosen in the absence of better methodology. Illustrative ranges around the central estimate (as provided by the CREA study) are also provided. The table below presents the estimated morbidity and mortality impacts per month of lockdown with pessimistic, central (in bold), and optimistic estimates, respectively.

Table 27. Air pollution QALYs

	Change in morbidity (QALYs)	Change in Deaths per month of lockdown	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Air pollution	-9,200	-1,600	-22,500	-15,300	-24,500
	-17,300	-2,950	-42,300	-28,700	-46,000
	-23,000	-3,900	-56,100	-38,100	-61,100

Alcohol consumption

Consumption of alcohol is related to a number of health issues. In the short-term, this can include accidents and injuries requiring hospital treatment, violent behaviour and being a victim of violence, unprotected sex that could potentially lead to unplanned pregnancy or sexually transmitted infections (STIs), and alcohol poisoning, leading to vomiting, seizures and falling unconscious. In the long-term, persistent alcohol misuse can also increase risk of serious health conditions, including heart disease, stroke, liver disease, pancreatitis as well as bowel, liver, mouth and breast cancer. It is also related to social issues such as unemployment, divorce, domestic abuse and homelessness.³³¹

Alcohol consumption in the UK

In 2018, it was estimated that 49% of adults aged 16 or over in England drink alcohol at least once a week, with 7% indicating they drink alcohol almost every day. This was higher in men, with 10% of men drinking alcohol almost every day compared to 5% of women.³³² 22% of adults in England drink more than 14 units a week, the recommended limit for men and women in the UK.³³³

Alcohol consumption under social distancing measures

The closure of pubs, bars and restaurants, and the lockdown measures in general, mean people have been socialising less frequently. This may mean that people are currently consuming less alcohol, which could have benefits for health, such as fewer instances of social binge drinking, reduced pressure on A&E, decreases in violent crime and less drink driving, as well as wider impacts such as less pressure on the justice system.

At the same time, it is possible that consumption of alcohol may have increased as a result of social distancing measures in a number of ways. Stress is a prominent risk factor for alcohol misuse, both

²⁴ The years of life lost concept covers the difference between the age of premature mortality and life expectancy for those who die.

its onset and maintenance³³⁴. Stress levels may increase amongst the general population as a result of lockdown measures from:

- Job losses and/or reduced income, causing stress as a result of economic uncertainty
- Reduced socialising with peers and family members
- Overcrowding in households
- Concern about procuring medicines/groceries as a shielded individual, or on behalf of a shielded individuals.

Alcohol consumption has also been used as a way to cope with traumatic events; individuals with a history of alcohol use disorders are more likely to report drinking to cope with traumatic events³³⁵. Isolation as a result of the social distancing measures may result in alcohol misuse, relapse and development of alcohol use disorders in at-risk individuals. This could lead to physical and mental health problems, and a greater need for alcohol support services during and following the pandemic³³⁶.

Sales data suggests that in 2017, about a third (31%) of all alcohol was sold in licensed premises like pubs, bars and restaurants.³³⁷ In recent years, there has been a decline in the number of pubs in the UK, but the number of licensed premises (such as off-licenses, bars, pubs, restaurants) increased between 5.1% between 2000 to 2016. It is suggested that this increase is related to off-licenses, potentially reflecting a shifting preference of the population for purchasing alcohol in shops to consume at home.

In recent years, alcohol consumption has been declining amongst young people. Young people who drink are most likely to do so in their own home (66%), but other common locations are at parties with friends (40%) or someone else's home (41%)²⁵³³⁸. Young people who drink alcohol are most likely to drink with their parents (66%) or friends (58%). It is possible that since young people have been less able to meet their friends under lockdown measures, we may see a reduction in consumption as a result of peer pressure.

Overall this suggests that about a third of adult alcohol consumption occurs in licensed premises, which have now been closed to the public under social distancing measures. It is possible that some of this consumption:

- Has stopped, as people have been unable to go to pubs and bars where they would consume alcohol
- Has continued, through increased purchase of alcohol from supermarkets or takeaway facilities, in people's homes as they move to socialise with their own household or online with their friends.

As such, some people may find themselves drinking less and others may find themselves drinking more.

From 20th March, pubs, bars and restaurants in the UK were ordered to close in line with government guidelines on social distancing, but "off-licences and licenced shops selling alcohol, including those within breweries" are permitted to stay open.

Nielsen data suggests that supermarket sales peaked in the week ending 21st March 2020, with a 67% surge in alcohol sales as pubs and bars closed in accordance with social distancing measures on 20th March³³⁹. However, no subsequent statistics are available and therefore it is unclear whether this surge in purchases was due to people drinking more or due to stockpiling as a result of fear of

²⁵ Multiple answers were possible, therefore the percentages would not add up to 100%.

shortages and/or consumers wanting to avoid shopping during the peak weeks of the outbreak. Indeed, 24% of people aged 16 to 69 in Great Britain said they had purchased extra supplies of groceries and toiletries because of the COVID-19 outbreak in the week between 27th March and 6th April 2020³⁴⁰.

A recent survey commissioned by Alcohol Change UK³⁴¹ found that 21% of drinkers have been drinking more frequently, and 35% of drinker have been drinking less frequently, since the lockdown. The research also found that 38% who have previously drunk alcohol at some point are taking steps to manage or stop drinking during the lockdown: 14% had adopted drink-free days, 9% were being careful with the amount of alcohol they buy and 6% said they had stopped drinking entirely. In fact, Alcohol Change UK witnessed a 355% increase in visits to their ‘Get help now’ webpage compared to the same time period last year. However, the research also suggested that those who did not drink frequently before the social distancing measures came into place were more likely to reduce or stop drinking – with 47% of people who drank once a week or less have cut down or stopped consuming alcohol, compared to 27% of people who drank two to six times a week, and 17% of daily drinkers.

The quantity of alcohol people had been and are now drinking is not clear; is it possible that someone who drank once a week consumed a greater number of units of alcohol than someone drinking every day. YouGov data suggests that as of 24th March, 17% of drinkers said they were drinking a bit or much more since lockdown, and 24% of drinkers were drinking a bit or much less³⁴².

Health impacts

It is not possible to determine whether harmful drinking has increased or decreased during lockdown, but surveys provide tentative evidence of a possible decrease in the number of people consuming alcohol, its frequency, and the amount consumed. Due to a lack of robust evidence in this area, we present an illustrative scenario considering alcohol-related morbidity and mortality to decrease by 10% [range: 0% - 30%] during lockdown. This rate is arbitrary and should only be considered as illustrative. The assumption is applied on estimates of deaths, years of life lost, and years lived with disability produced by the Global Burden of Disease Study³⁴³.

Table 28. Alcohol use QALYs

	Assumed change in morbidity and mortality during lockdown	Change in morbidity (QALYs)	Change in Deaths per month of lockdown	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
	0%	0	0	0	0	0
Alcohol use	-10%	-3,100	-240	-7,700	-4,900	-7,900
	-30%	-9,200	-700	-23,100	-14,700	-23,800

Blood donation

The lockdown, and the COVID-19 outbreak in general, have resulted in some disruptions to blood donation. Regular donors are not allowed to donate if they are, or suspect to be, infected by COVID-19, and some non-infected groups, such as people in the ‘vulnerable’ group or those over the age of 70, are also not allowed to give blood in line with new guidelines³⁴⁴. Nevertheless, by 7th April, blood and platelet levels were still adequate³⁴⁵³⁴⁶³⁴⁷. There is not enough information to estimate the health impacts of disruptions in blood donation during lockdown.

Community pharmacy access

Individuals' access to pharmacies and therefore medication may have been impacted by social distancing measures. This could especially impact those who are in the 'shielded'³⁴⁸ group. This issue may be mitigated by the NHS Volunteer Responders scheme³⁴⁹. The resulting health impacts are unknown.

In England, 45% of the medicines prescribed for long-term conditions are for one-month duration, 41% are for two months and 7% for three months³⁵⁰. Shielded patients, around 1.5 million individuals, most of whom with long-term conditions, have been asked to stay at home during a period of 12 weeks³⁵¹. This means that many of these people would run out of their medicine supply before their self-isolation ends.

The Government advised vulnerable patients to have their prescription medicines delivered or collected by family members, friend or neighbours, or, if that is not an option, they will be supported by a national network of volunteers. At the beginning of April, NHS Digital added the 'Shielded Patient Flag' to the SCRa portal³⁵² to enable community pharmacy teams to recognise shielded patients and decide how to best support them. Some pharmacy chains increased their prescription delivery capacity. The pharmacy chain, Boots, delivered an average of 150,000 prescriptions a week, compared to 90,000 before the lockdown³⁵³. Nevertheless, some providers were facing delivery delays of up to 7-10 days³⁵⁴.

There is not enough information to estimate the health impacts of the lockdown via community pharmacy access.

Crime

The lockdown is likely to have led to a drop in crime rates. Up to 40% reductions in violent crimes have been reported both in the UK³⁵⁵ and other countries³⁵⁶, with gang rivalries, stabbings and weapon offences falling since the lockdown was introduced^{357,358}. Petty offences have also decreased during lockdown, likely as a result of fewer people being on the streets. Apart from the direct health impacts, violent crime also affects the mental wellbeing of victims, their family members, and their wider community³⁵⁹. Hence, reductions in violent crime rates due to social distancing could positively impact both mental and physical health.

Domestic burglaries are also likely to have decreased as a result of more people staying at home. At the same time, there appears to have been an increase in distraction burglaries by fraudsters posing as NHS workers³⁶⁰ or thefts by people pretending to be volunteers and offering to do shopping for elderly people, then stealing their money³⁶¹. Thefts of masks and other protective equipment have also been reported^{362,363,364}.

Also, as fewer people are using their vehicles during lockdown, large increases in vehicle thefts have been reported^{365,366}. Similarly, a marked increase in plant and tool theft from vehicles, construction sites, and farms, has been reported^{367,368}. In addition, there has been a marked increase in online frauds and cybercrime since the start of the COVID-19 outbreak^{369,370,371}.

Health impacts

It is not possible to establish the net health impacts of changing rates across different types of crimes during lockdown. In line with reported reductions in violent crime rates, a 40% [range: 10% - 50%] reduction in the health impacts of interpersonal violence is assumed. This rate is arbitrary and should only be considered as illustrative. The assumption is applied on estimates of interpersonal violence prevalence, incidence, deaths, Years Lived with Disability and Years of Life Lost by the Global Burden of Disease Study³⁷². The table below presents the estimated morbidity and mortality

impacts per month of lockdown with pessimistic, central (in bold), and optimistic estimates, respectively.

Table 29. Interpersonal violence QALYs

	Assumed change in incidence during lockdown	Change in incidence per month of lockdown	Change in morbidity (QALYs)	Change in deaths per month of lockdown	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Interpersonal violence	-10%	-940	-300	0	0	0	-300
	-40%	-3760	-1,200	-20	-800	-500	-1,600
	-50%	-3760	-1,400	0	-800	-500	-1,900

Diet

Children's diet

From 20th March, schools, colleges and early years settings were closed, other than for children of key workers and vulnerable children³⁷³. Most children who usually had daily school meals, which must follow nutritional guidelines³⁷⁴, would have consumed food prepared in the household at lunchtime, which could be less nutritious³⁷⁵. Lunches prepared in the home may contain double the amount of sugar and 50% more sodium and saturated fat than school lunches, however they may also contain more calcium, iron and fruit³⁷⁶.

The government has tried to mitigate the risk of undernutrition by providing a national voucher scheme so that schools can electronically provide a £15 weekly supermarket voucher to the families of children eligible for free school meals³⁷⁷. However, a YouGov survey, conducted on 25th and 26th March, found that 50% of parents with eligible children who responded to the survey said that they had not yet received vouchers or substitute meals to keep their children fed³⁷⁸. This means that 650,000 children³⁷⁹, or around 8%³⁸⁰ of children between the ages of 5 and 15, may not have received the daily sustenance typically obtained³⁸¹.

Health impacts

It is not possible to establish the impacts of food insecurity on children during the lockdown measures. Due to a lack of evidence in this area, we present an illustrative scenario considering child malnutrition related morbidity and mortality to increase by 5% [range: 0% - 15%] during lockdown. This rate is arbitrary and should only be considered as illustrative. The assumption is applied on estimates by the Global Burden of Disease Study³⁸² of child malnutrition-related deaths, years of life lost, and years lived with disability. The table below presents the estimated morbidity and mortality impacts per month of lockdown with pessimistic, central (in bold), and optimistic estimates, respectively.

Table 30. Child nutrition QALYs

	Assumed change in morbidity and mortality during lockdown	Change in morbidity (QALYs)	Change in Deaths per month of lockdown	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Child malnutrition	15%	3,700	0	2,800	1,400	5,100
	5%	1,200	20	1,400	700	1,900
	0%	0	0	0	0	0

Low income households' diet

In addition, the food security of some low-income households and individuals in vulnerable groups (e.g. the elderly, those with underlying health conditions, and pregnant women who have been asked to follow stringent social distancing) has been threatened by the COVID-19 crisis due to a drop in incomes, new childcare requirements, reduced working hours, or job losses³⁸³, as well as due to just-in-time food supply chains and stockpiling by those who can afford it. These factors are likely to exacerbate diet-related health inequalities³⁸⁴ and lead to suboptimal nutrition (i.e. micronutrient consumption) during the lockdown for many.

The Food Foundation reports that, of those in the higher risk categories for COVID-19, over 860,000 people were already struggling to afford enough food before the crisis, and at least 1 million of higher risk individuals report always or often being lonely, meaning that they may struggle to find family members or volunteers to deliver their food³⁸⁵. In addition, around 4 million the people in lower risk categories are also believed to be affected by food insecurity³⁸⁶. During the crisis, individuals who struggle to afford food may be financially unable to stockpile, or to purchase the available products, especially if cheaper versions (e.g. own brand) are not available³⁸⁷.

While some food banks have been reporting a surge in demand³⁸⁸, food insecurity may be to some extent mitigated by the NHS volunteer scheme³⁸⁹, community volunteer schemes³⁹⁰, and the government food parcel scheme³⁹¹. There is not enough information available to estimate the impacts of the lockdown on low income households' diet.

Fast food consumption

On 20th March, the UK Government announced that "all pubs, bars and restaurants to close from tonight" as part of social distancing measures but allowing "pubs and restaurants to operate as hot food takeaways during the coronavirus outbreak"^{392,393}. Restaurant and takeaway meals are associated with a higher total energy intake, a higher energy contribution from fat in the daily diet, and a lower intake of micronutrients, particularly vitamin C, calcium and iron, than home cooking³⁹⁴. It is believed that the social distancing measures may have reduced takeaway and restaurant meal consumption during the lockdown, and that this may have improved the diet of the UK population. At the same time, it is unclear whether improved eating habits would continue after lockdown, and therefore these changes could be short lived; it is possible that unhealthy eating may increase once individuals are able to purchase from fast food restaurants again (as noted in the long queues observed once McDonalds reopened its drive-thru branches in May and June)³⁹⁵.

We do not know to what extent takeaway and restaurant meal consumption has been reduced during the lockdown, but there are reasons to believe that the reduction has been considerable. All major fast food chains closed their restaurants during the lockdown^{396,397,398,399}, due to:

- The anticipated impact of the COVID-19 outbreak on staff absences
- The impacts of social distancing measures on staff's ability to travel to work and customers' ability to visit these restaurants (i.e. for takeaway)
- The inability to maintain the recommended personal distance between staff and between customers, and,
- The around a 60% reduction⁴⁰⁰ in people travelling to work, far fewer people are expected to be out and about to use these outlets.

Even if some of these reductions would be counterbalanced by increased food delivery, the effect is not expected to be large, due to many restaurants closing down completely, and those who stay open may not have built up the necessary infrastructure to facilitate an equivalent increase in food

delivery. Plus, a considerable proportion of food delivery is associated with social events, which would be severely limited during the lockdown. On these bases, it is assumed that takeaway and restaurant meal consumption would fall by 60% during the lockdown.

It has been estimated that, each week, the UK population consumes around 22 million⁴⁰¹ takeaways meals, and 42 million⁴⁰² restaurant meals. Although the robustness of these estimates is not known, these figures are largely consistent with the £49bn annual spend²⁶ on eating and drinking out (not including alcohol) in the UK.

A BMJ study⁴⁰⁴ estimated that the average fast food meal contains 751 calories (Kcal) while the average full-service restaurant meal contains 1033 calories. In fact, the study found that 47% of meals were “excessive” in energy content (≥ 1000 Kcal), and only 9% were in line with public health recommendations for main meal energy consumption to be ≤ 600 Kcal. However, it is difficult to establish what would have been the calorie content of the alternative home cooked meals by people who eat more fast food or eat out more often, as it is believed that these people might not be as experienced in cooking, and might rely more on ready meals than the average person, leading to higher energy and less nutritious home cooked meals, all other things equal. A study⁴⁰⁵ examining the impacts of fast-food and full-service restaurant consumption on daily energy and nutrient intakes in US adults estimated that fast food and full service restaurant consumption, respectively, were associated with a net increase in daily total energy intake of around 190 Kcal and 187 Kcal, total fat of 11 g and 10 g, saturated fat of 3 g and 2 g, cholesterol of 10 mg and 58 mg, and sodium of 297 mg and 412 mg.

Health impacts

Based on the above, the assumed 60% reduction in fast food and full-service restaurant meal consumption could result in an around 110 Kcal²⁷ reduction in adults’ daily calorie intake (assuming no substitution). However, many of these meals would be substituted by in-home meals⁴⁰⁶. It is not known to what extent these meals would be substituted, and what the replacement meals’ calorie content would be. Plus, even if people have consumed lower calories during lockdown, it is likely that any lost weight would be regained shortly after the lockdown is lifted to the extent that people can attend restaurants. For this reason, zero net impact is assumed for the central scenario. The illustrative ranges correspond to a + / - 50 Kcal change in adults’ diet per person per day and are evaluated using the DHSC Calorie Model⁴⁰⁷.

Table 31. Lower calorie intake QALYs

	Assumed change in calorie consumption per adult during lockdown	Change in morbidity (QALYs)	Change in Deaths per month of lockdown	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Lower calorie intake	50	1,400	200	2,200	1,500	2,900
	Zero net impact	0	0	0	0	0
	-50	-1,400	-200	-2,200	-1,500	-2,900

The above result only takes into account the modelled change in calorie consumption. It is expected that better nutrition (e.g. increased micronutrient consumption) would result in additional health benefits. At the same time, it is possible that these impacts are counterbalanced by the limited

²⁶ making it around £15 per meal (including drinks)

²⁷ $190 \times 60\% = 114$

availability of (affordable) good quality food in supermarkets; reduced financial security leading to lower purchasing power and less nutritious food choices; and other factors²⁸. It is also important to note that, for some, restaurant and fast food meals provide a more nutritious and healthier option than their alternative (e.g. for people who lack cooking skills, or less educated in the importance of a well-balanced diet). Also, we do not know how this new relationship with the food environment will affect people's food practices, and thus the risk of obesity and related complications, in the medium or long-term (i.e. post-lockdown). The analysis assumes the impacts to be temporary only while social distancing measures in place.

Domestic abuse

Domestic abuse is expected to have increased during lockdown because:

- economic and health uncertainty may have led to destabilisation of unstable households and may lead to increased domestic abuse⁴⁰⁹⁴¹⁰⁴¹¹;
- individuals who are in abusive households would have to spend more time at home with their abusers;
- there may be fewer opportunities to move out of abusive homes during lockdown because escape routes such as shelters or staying with friends or family may be restricted. Older women and pregnant women may be especially vulnerable due to their shielding requirement;
- those who were unable to work during lockdown would find it more unaffordable to move out of abusive homes, and this is more likely to be the case with low-paid workers, young people and women⁴¹²;
- abuse may go on undetected for longer while individuals were not leaving the house to go to places where physical abuse could be detected (e.g. school or work).

The National Domestic Abuse Helpline, operated by the charity Refuge, reported a 25% increase in calls and a 150% increase in website traffic in the week commencing 30th March compared to an average week prior to lockdown⁴¹³. Some concerns have been raised that individuals would find it harder to report abuse while on lockdown with their abuser⁴¹⁴, which may explain the disproportionately higher website traffic. Unpublished data suggest that call volumes to Refuge reached 57% higher levels by w/c 13th April compared to w/c 16th March. In the same period, the volume of online support requests and webchats increased by 73%. The 'Counting Dead Women' project has identified 16 possible domestic abuse killings between 23th March and 12th April, which is 11 more than the 10-year average of the same period⁴¹⁵. It has also been suggested that children may have been more likely to be abused during lockdown⁴¹⁶, and that children might also be harmed by witnessing more abuse during lockdown⁴¹⁷.

Health impacts

A recent study estimated the health impacts of domestic abuse (including physical and emotional harms) to be around 676,000 QALYs per year, or 0.35 QALY on average for each of the 1,946,000 adult victims per year (2016/17 figure)²⁹⁴¹⁸. This includes around 27.5 QALYs on average (or 34.6 life years lost) for each of the 108 fatalities per year (2016/17). Using the study's estimates, and

²⁸ People lose some of their consumer surplus by not being able to purchase as much restaurant and fast food meals as they would otherwise choose. The food environment is important in ways that go beyond sustenance, (e.g. as a social space to spend time with family, or to provide affordable pleasures), which means that the closure of shops and restaurants is likely to impact family and social life in a broader sense.

²⁹ The study only reports the monetised QALY estimates, but states that it uses £70,000 cost per QALY, which is used to re-express the estimates in QALYs here.

assuming a 50% [range: 20% - 70%] increase in domestic abuse during lockdown, the table below presents the estimated morbidity and mortality impacts per month of lockdown with pessimistic, central (in bold), and optimistic estimates, respectively.

Table 32. Domestic abuse QALYs

	Assumed change in morbidity and mortality during lockdown	Change in (surviving) victims per month of lockdown	Change in morbidity (QALYs)	Change in Deaths per month of lockdown	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Domestic abuse	70%	113520	74,300	0	0	500	74,800
	50%	81080	53,100	0	0	0	53,100
	20%	32430	21,200	0	0	0	21,200

Domestic accidents and injuries

There may be an increased number of domestic accidents due to more people staying home for longer periods of time during lockdown. Due to school closures, children have stayed at home, potentially unsupervised for long periods of time while parents carry on working (including remotely) leading to a greater risk of accidents⁴¹⁹. For example, there had been reports in the US of increased accidental exposures to cleaning products among children since the lockdown⁴²⁰. Also, there have been reports of increased eye injuries in the UK due to more DIY activities during lockdown^{421,422}.

Withal, there was a reduction in A&E figures from 1,954,000 (February 2020) to 1,531,000 (March 2020)⁴²³; the lower number of attendances reported are likely to be as a result of citizens response towards the call on avoiding unnecessary visits. This drop may also be partially explained by a reduction in some of the accident categories due to the lockdown, such as traffic or work-related injuries. Both effects combined may prevent us from seeing the expected increase on domestic accidents (40% of the total⁴²⁴) at the aggregate level data.

Health impacts

It is not possible to determine the extent to which domestic accidents have increased during lockdown. Due to a lack of evidence in this area, we present an illustrative scenario considering domestic accidents to increase by 25% [range: 10% - 40%] during lockdown. This rate is arbitrary and should only be considered as illustrative. The assumption is applied on estimates by the Global Burden of Disease Study (GBD)⁴²⁵ of incidence, deaths, years of life lost, and years lived with disability due to falls, fire and heat injuries, (unintentional) poisoning, and other unintentional injuries³⁰. The table below presents the estimated morbidity and mortality impacts per month of lockdown with pessimistic, central (in bold), and optimistic estimates, respectively.

Table 33. Home accidents QALYs

	Assumed change in incidence	Change in incidence per	Change in morbidity (QALYs)	Change in deaths per	Change in years	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
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³⁰ Since the GBD does not distinguish between injuries happening in homes and outside, the statistics from the GBD are reduced proportionally using the ratio of the number of home deaths (6,000; see <https://www.rospa.com/Home-Safety/Advice/General/Facts-and-Figures> to the number of deaths as presented by the GBD due to these causes (8,550).

	during lockdown	month of lockdown		month of lockdown	of Life Lost		
Home accidents	40%	102460	19,500	300	4,700	3,200	22,700
	25%	64030	12,200	220	3,000	2,100	14,200
	10%	25610	4,900	100	1,200	800	5,700

Drugs misuse

Drug misuse can have serious implications for health, including paranoia, comas, seizures and, in some cases, death. Different drugs have different effects, and these vary depending on the method of administration.⁴²⁶⁴²⁷

Drugs misuse in England

In 2018/19, 9.4% of adults aged 16 to 59 had taken an illicit drug in the last year, which equated to around 3.2 million people in England and Wales.⁴²⁸ This was higher in the 16 to 24 age group at 20.3%, which equated to around 1.3 million people. In the last month, 5% of adults aged 16 to 59 had taken a drug in the last month in England and Wales, and 2.4% had taken a drug more than once a month in the last year; cannabis was the drug most likely to be frequently used.

Men, younger people, people living in urban areas and those with lower self-reported levels of happiness were more likely to have taken drugs in the past year.⁴²⁹ Higher prevalence of drug use is also associated with higher frequency of visits to pubs, bars and nightclubs; use of any Class A drug in the last year was around 11 times higher among those who had visited a nightclub at least four times in the past month compared with those who had not visited a nightclub in the past month.

In 2018/19, there were 7,376 hospital admissions in England for drug related mental and behavioural disorders with admissions around 6 times more likely in the most deprived areas compared to the least deprived areas.⁴³⁰ There were 18,053 hospital admissions for poisoning by drug misuse, with admissions 5 times more likely in the most deprived areas compared to the least deprived areas.

ONS data also suggests that there were 4,359 deaths related to drug poisoning registered in England and Wales in 2018, with two thirds (2,917) of drug-related deaths related to drug misuse. The male drug poisoning rate has significantly increased from 89.6 per million males in 2017 to 105.4 in 2018; while the female rate increased for the ninth consecutive year to 47.5 per million females in 2018, the latest increase was not statistically significant compared to 2017.⁴³¹

Drugs misuse under social distancing measures

As a result of social distancing measures, including travel restrictions, we may expect there to be a decrease in illicit drug use. At the same time, supply issues or changes in drug use (e.g. switching to other drugs) may lead to increased harm.

As noted above, higher prevalence of drug use is associated with higher frequency of visits to pubs, bars and nightclubs; use of any Class A drug in the last year was around 11 times higher among those who had visited a nightclub at least four times in the past month compared with those who had not visited a nightclub in the past month.⁴³² The closure of these establishments may have curbed the use of illicit drugs.

We could expect drug dealers to struggle to deal drugs to users inconspicuously given the reduction in the number of people travelling and the police measures in place to potentially penalise those breaking social distancing measures.⁴³³ At the same time, there had been reports in the press of drug dealers doing home deliveries as they are more noticeable being out on the streets. As a result,

we may expect the number of deals and drug use in general to have decreased. It has also been suggested that the use of children and young people to deal heroin and crack cocaine continued despite the lockdown; in the week ending 12th April, the British Transport Police county lines taskforce made 10 county lines arrests and seized two consignments of drugs, three lots of weapons and £8,000 in cash.⁴³⁴

There have been reports of a reduction in drug supply⁴³⁵. Indeed, border guards have noted a decrease in seizures as traffic into the country subsided⁴³⁶, suggesting fewer drugs entered the country. This may have led to an increase in price of some substances^{437,438,439}. Users of recreational drugs may have tried to stockpile drugs in the same way as with groceries. A consequence of increased stockpiling behaviour may be that people have taken more drugs than they usually would, increasing the risk of overdose. Drug users may also consume more drugs due to boredom, or poor mental health as a result of social distancing. This could lead to increased drug dependency which could mean withdrawal symptoms when they are no longer able to source sufficient quantities of the drug. Alternatively, they may switch to an alternative which could lead to further harm (see below).⁴⁴⁰

A potentially more likely scenario, as a result of the increased cost and supply issues, is that drug users may have been forced into abstinence. Indeed, this is reflected in reports from the US⁴⁴¹ which indicate that people may have been forced into abstinence because of supply chain disruptions, potentially suffering lethal withdrawals or overdosing when using again. In addition, disruption in drug addiction/misuse services as a result of social distancing measures as well as self-isolation/staff sickness could impact mortality rates⁴⁴².

There are concerns that a reduction in supply of illicit drugs has led to users considering other more dangerous alternatives. This may include switching to high-strength alternatives such as benzodiazepines, or heroin users switching to fentanyl. Fentanyl is 50 to 100 times stronger than heroin; it also overcomes the issue of borders and imports as it can be produced in the UK⁴⁴³, and it is easier to store and move around as a small quantity is required compared to heroin.⁴⁴⁴ Experts have suggested that even if users know they are taking fentanyl instead of heroin (see below for discussion of drug purity), it can be challenging to identify a safe dose.⁴⁴⁵

A decrease in supply is reported to have led dealers to cut drugs with different chemicals in order to increase quantities for sale. This is particularly dangerous as users do not know what they're taking, which can increase the chance of overdose⁴⁴⁶, although indicative data on ambulance call-outs shows a drop in the number of overdose calls.

The National Crime Agency reported a decline in serious violent crime in the four-week period to 12th April, but there was an increase in the following week. Concerns have been raised that offences increased as a result of people being unable to get hold of drugs⁴⁴⁷. Also, visits to prisons have been stopped as a result of the social distancing measures, and these are a major route for drugs entering prisons.⁴⁴⁸ There could be serious health impacts due to withdrawal in these cases.

The European Monitoring Centre for Drugs and Drug Addiction⁴⁴⁹ have outlined some short-term risks of COVID-19 which include the risk that sharing equipment used to take drugs may increase the risk of infection and risks of disruption in access to drug services, clean drug-using equipment and vital medications. It is possible that treatment services may have moved from face-to-face provision to telephone support, which may have an impact on relapse; indeed, there are anecdotal reports from people in recovery that the move from face-to-face to virtual meetings are "not the same" and have highlighted the challenges and potential risk of relapse.⁴⁵⁰

Health impacts

It is not possible to determine whether drugs misuse, and related harms, would increase or decrease during lockdown. Social drug use (and related accidental poisonings) could have decreased, at the same time, supply issues may have impacted the health of users due to withdrawal and/or some users turning to alternative drugs, or the same drugs now being cut with other, more dangerous, substances, with a further risk to overdose and harm.

Due to a lack of evidence in this area, we present an illustrative scenario considering drugs related morbidity and mortality to decrease by 10% [range: 0% - 30%] during lockdown. This rate is arbitrary and should only be considered as illustrative. The assumption is applied on estimates by the Global Burden of Disease Study⁴⁵¹ of deaths, years of life lost, and years lived with disability. The table below presents the estimated morbidity and mortality impacts per month of lockdown with pessimistic, central (in bold), and optimistic estimates, respectively.

Table 34. Drug misuse QALYs

	Assumed change in morbidity and mortality during lockdown	Change in morbidity (QALYs)	Change in Deaths per month of lockdown	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
	0%	0	0	0	0	0
Drugs misuse	-10%	-3,000	-80	-3,200	-2,000	-5,000
	-30%	-8,900	-200	-9,000	-5,600	-14,500

Mental health

Adults' Mental Health under social distancing measures

Baseline prevalence of Mental Health problems in England⁴⁵²:

- Lifetime prevalence of serious mental illness (SMI)
 - Psychotic 0.7 in 100 people
 - Bipolar 2.0 per 100 people
 - Antisocial personality disorder 3.3 per 100 people
 - Borderline personality disorder 2.4 per 100 people
- Incidence of common mental health conditions
 - Overall: 1 in 4 people in a year or 1 in 6 in a given week.
 - Generalised Anxiety Disorder (GAD) 5.9 in 100 people
 - Depression 3.3 in 100 people
 - Phobia 2.4 in 100 people
 - Obsessive Compulsive Disorder (OCD) 1.3 in 100 people
 - Panic disorder 0.6 in 100 people
 - Post-Traumatic Stress Disorder (PTSD) 4.4 in 100 people
 - Anxiety & Depression 7.8 in 100 people

Impact of social distancing and social isolation

The COVID-19 outbreak, and the social distancing measures, could lead to increased levels of depression and anxiety. This may be exacerbated by possible disruptions in the accessibility of mental health services. At the same time, reduced anxiety during the social isolation period may be experienced by those who find elements of routine life stressful (e.g. daily commutes, social interaction, lack of time for childcare and household chores). Some individuals may have more time for relaxation and social interaction with family members, benefiting their mental health.

The lockdown is likely to impact most determinants of good mental health, such as engagement in usual activities, social interactions, physical exercise, and financial stability⁴⁵³. A Lancet study⁴⁵⁴ of the psychological impacts of quarantines, reviewing 24 academic papers, found that quarantined individuals experience severe psychological symptoms including post-traumatic stress, confusion, and anger. Stressors included longer quarantine duration, infection fears, frustration, boredom, inadequate supplies, inadequate information, financial loss, and stigma. The review showed that most of the effects come from a restriction of liberty through stricter quarantine measures, and that voluntary quarantine is associated with less distress and fewer long-term complications.

Evidence⁴⁵⁵ also shows that, of those who attempted suicide, 22% had sought general support from friends/family/neighbours. As sources of support may be less accessible during lockdown, this could potentially exacerbate outcomes of suicidal thoughts and intentions. There have been reports⁴⁵⁶ of COVID-19-related suicides globally, however it is not clear whether the suicide was committed due to lockdown measures or other reasons. It can be assumed that suicide rates may increase due to the negative psychological impacts of lockdown. Reports from the US⁴⁵⁷ show an increase in demand for suicide prevention services and anecdotal evidence from the UK shows similar trends in demand.

Information about COVID-19

Increased anxiety among the general population has been reported both due to the restrictions on daily life, as well as due to perceptions about the disease; the government handling of the situation; reports of shortages of beds, ventilators, and PPE; and “infodemic” – an over-abundance of mis/information on social media^{458,459}. Due to rolling media coverage of the pandemic, “health anxiety”⁴⁶⁰ is likely to have been higher than usual. Large amounts of media (especially social media) information and mis-information about the pandemic (aka “headline stress disorder”) can lead to immediate physical symptoms such as heart palpitations and depression^{461,462}.

Individuals with high health anxiety may suspect they are ill when they are not, and they may avoid healthcare settings believing them to be a source of infection, need excessive reassurance e.g. via NHS 111 or 999, or engage in excessive hand washing or stockpiling of items. On the contrary, individuals with low levels of health anxiety may fail to take the guidance seriously and not comply with e.g. good hand hygiene believing themselves to be low risk. It has been suggested that people with serious mental health disorders may be more susceptible to COVID-19 infections and complications^{463,464} due to their cognitive impairment and reduced perception of risk, increased difficulty in accessing their regular healthcare; or treatment non-compliance.

Vulnerable groups

With regards to specific population groups, there have been some reports of young people who identify as LGBTQ+ moving back in with parents who do not accept their sexuality or gender identity during the lockdown and are unable to move out due to strains on their finances⁴⁶⁵. There is anecdotal evidence of such individuals experiencing isolation in their homes as a result or say they are “putting up with the abuse”. We do not have evidence of the scale of this issue, or the implications for mortality; however, there has been some suggestion that individuals who identify as LGBTQ+ may be at higher risk of mental health issues and suicidal thoughts^{466,467}. The Mental Health Foundation suggests the higher prevalence of mental ill health may be related to discrimination, isolation and homophobia.⁴⁶⁸

Regarding ‘shielded’⁴⁶⁹ groups, shielding and the lockdown in general could reduce anxiety due to reduced risk of catching the infection. However, this is at the cost of increased loneliness and isolation which can lead to anxiety, depression and poorer quality of life. Having serious health

conditions is in itself likely to be associated with mental health impacts, and the shielding and lockdown measures are likely to exacerbate these conditions. Other impacts may include potential for increased anger, stress, agitation or withdrawal, general boredom and frustration.

It is likely that the lockdown would particularly impact those with pre-existing mental health conditions, as possible disruptions to mental health services and general stress surrounding the pandemic would worsen their ability to cope with their conditions. For example, public health advice on hand washing could adversely impact those with compulsive tendencies⁴⁷⁰. For people who were already in contact with mental health services for a pre-existing mental health condition, treatment may have been disrupted during lockdown, which could exacerbate these conditions.

Health impacts

Studies looking into the psychological impacts of the lockdown at the initial stage of the COVID-19 outbreak in China found that over 50% of people rated the psychological impact of lockdown moderate or severe⁴⁷¹. In the regions where the outbreak had been worst, elevated levels of Post-Traumatic Stress Disorder (PTSD) had been found, especially among women⁴⁷². Lower levels of social capital⁴⁷³, younger age, lower levels of education⁴⁷⁴, pre-existing physical or mental health conditions⁴⁷⁵, and lack of opportunities to exercise⁴⁷⁶ were associated with greater levels of anxiety and stress in China – suggesting that different socio-economic groups may be differentially impacted. Higher levels of stress were also associated with poorer quality sleep potentially acting as catalyst for mental health problems⁴⁷⁷.

Research has noted a spike in depression and anxiety levels on 24th March, a day after the prime minister's announcement of a lockdown, with 39.0% of those surveyed showing clinical symptoms of depression, and 35.6% showing clinical symptoms of anxiety, using the GAD-7 and PHQ-9 clinical interview schedules, respectively. The corresponding rates were 16.7% and 17.4% a day before. Although decreased somewhat, the rates stayed at 22.4% for depression and 21.8% for anxiety over the 25th to 27th March period, still higher than the rates before the prime minister's announcement. The study showed that those aged under 35, living in a city, living alone, with lower incomes or whose incomes had been hit by the pandemic, and those with health conditions had higher rates of anxiety and depression. In contrast, those who felt that they belonged to their neighbourhood and who trusted their neighbours had lower levels of anxiety and depression.

A representative survey of the UK population found higher levels of depression and anxiety symptoms in late March 2020 compared with previous population estimates⁴⁷⁸. Other surveys also report higher levels of anxiety and stress and lower levels of wellbeing around the start of the lockdown (late March) than previous estimates. However, these levels appear to be improving through April⁴⁷⁹. Young adults, those living alone, those living with a lower household income and those with existing mental and physical health conditions tend to report higher levels of stress and anxiety than the overall population. At the same time, older people report lower levels of stress and anxiety and are less likely to report a negative impact on their well-being⁴⁸⁰. In the first week of the lockdown a survey of young people with a history of mental health problems found that a quarter reported no longer being able to access mental health support⁴⁸¹.

The COVID-Mind study⁴⁸² by the University College London has been tracking the mental health of 75,000 adults since 21st March (i.e. starting three days before the lockdown). The study gives the most comprehensive picture of how people's mental health has been changing since the lockdown. However, one of the downsides is that no pre-COVID-19 baseline is available. Since the pandemic was already quite advanced, and many of the social distancing measures were already in place, by

21st March, the starting values would already have been impacted by the disease outbreak and social distancing measures. In addition, most survey questions do not allow separating the impacts of the disease outbreak and the social distancing measures on people's mental health. The study found that:

- Depression levels have been relatively constant since the lockdown – at around 6.5 – 7.0 (out of 27) on the PHQ-9 instrument.
People aged 18-29 have been scoring around 10, those aged 30-59 have been scoring around 7.5, while people aged 60+ have been scoring around 4.5. Increased levels of depression are observed in people living alone (7.5 vs 6.5), on less than £30k annual incomes (8 vs 6), and with previous depression diagnosis (13 vs 5.5).
These values are considerably higher than the usual reported PHQ-9 averages of 2.7-3.7⁴⁸³ (measured in other countries – no UK reference value is available). Also, as a reference, patients who receive Cognitive Behavioural Therapy under the NHS Improving Access to Psychological Treatments (IAPT) programme score on average 14.7 pre-treatment and 9.3 at discharge on the PHQ-9⁴⁸⁴.
- Anxiety levels, which were at 6 at lockdown, have been decreasing and have stabilised at around 5 (out of 21) since around 14th April on the GAD-7 instrument.
People aged 18-29 have been scoring around 7.5, those aged 30-59 have been scoring around 5.5, while people aged 60+ have been scoring around 3.0. Increased levels of anxiety are observed in people on less than £30k annual incomes (5.5 vs 4.5), and previous depression diagnosis (10 vs 4.0).
These values are considerably higher than the usual reported GAD-7 averages of 2.7-3.2⁴⁸⁵ (measured in other countries – no UK reference value is available). Also, as a reference, patients who receive Cognitive Behavioural Therapy under the NHS Improving Access to Psychological Treatments (IAPT) programme score on average 13.6 pre-treatment and 8.4 at discharge on the GAD-7⁴⁸⁶.
- Stress relating to COVID-19 decreased from around 30% reporting COVID-19 to be constantly on their mind at the lockdown to around 20% by 19th April. Stress relating to COVID-19 was highest amongst those aged 30-59.
- Worries about money, employment and getting food slightly decreased since the start of the lockdown.
- Wellbeing (happiness) has slightly increased since the start of the lockdown.
Loneliness levels were relatively stable since lockdown started, even amongst high-risk groups. But they remained higher amongst younger adults, those living alone, with lower household income levels, and with a diagnosed mental health condition.

According to an ONS study⁴⁸⁷, there seem to be no meaningful differences in the proportion of people with and without underlying health conditions who reported being anxious or that their wellbeing has been affected by the pandemic. However, somewhat more people with underlying health conditions reported feeling lonely often or always than people without health conditions. The ONS study also reported that 89% of over-70s were 'somewhat' or 'very' worried due to COVID-19. The top 5 stressors were: 1) access to groceries, medication and essentials (66%), 2) being unable to make plans (62%), 3) availability of groceries, medication etc (58%), 4) own wellbeing impacted by boredom, anxiety, loneliness or stress (51%), and 5) personal travel plans impacted e.g. holidays

(49%). At the same time, other studies suggest that older people are more likely than younger people to report *not* feeling down, depressed or helpless during the COVID-19 outbreak³¹³².

A more recent ONS study⁴⁸⁸ shows that the proportion of adults who said their well-being was affected by the COVID-19 crisis continued to decrease reaching 45.8% compared with the previous week (49.9%). The proportion was higher for those with an underlying health condition (57.7%) and lower for those aged 70 years and over (38.2%). One in five (21.2%) of those whose well-being has been affected said it was making their mental health worse. Anxiety levels, though higher than before the COVID-19 pandemic, have fallen since last week for most adults.

To summarise, while there is overwhelming evidence of heightened levels of depression, stress, and anxiety during lockdown, based on the available evidence, it is not possible to gauge the extent to which the incidence of these mental health problems is above their pre-COVID-19 baseline. Evidence also points to a gradual decrease in the prevalence of these conditions since the lockdown was introduced, although their levels still appeared to be higher than before the lockdown was introduced. In addition, it is not possible to separate the mental health impacts of the disease outbreak from the impacts of the lockdown, and the lockdown may even *mitigate* the mental health impacts of the COVID-19 outbreak by reassuring people that the disease outbreak is being controlled.

It is important to note that the evidence around mental health impacts have been constantly evolving during the COVID-19 pandemic, with new research published very frequently³³. It has not been possible to include all new evidence in this paper and ensure it is kept up to date on a continuous basis. As such, the evidence base as a whole should be considered when reviewing the scale of the impacts.

We have used an illustrative 25% [range: 10% - 50%] increase in the incidence of anxiety, depression and self-harm (including suicides) among adults is assumed during lockdown. This rate is arbitrary and should only be considered as illustrative. The assumptions are applied on estimates of depression, anxiety and self-harm prevalence, incidence, deaths, Years Lived with Disability and Years of Life Lost among adults by the Global Burden of Disease Study⁴⁸⁹. The table below presents the estimated morbidity and mortality impacts per month of lockdown with pessimistic, central (in bold), and optimistic estimates, respectively.

Table 35. Anxiety, depressive disorders, self-harm QALYs

	Assumed change in incidence during lockdown	Change in incidence per month of lockdown	Change in morbidity (QALYs)	Change in deaths per month of lockdown	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Anxiety disorders (adults)	50%	10970	15,100	0	0	0	15,100
	25%	5490	7,600	0	0	0	7,600
	10%	2190	3,000	0	0	0	3,000
Depressive disorders (adults)	50%	106330	30,500	0	0	0	30,500
	25%	53170	15,300	0	0	0	15,300

³¹ Coronavirus and health survey LSHTM of approx. 6,350 people aged 13+ 07-14.04.2020

³² UK population and mental health survey (Ulster and Sheffield Universities) of 2,000 18+ year olds 23-28.03.2020

³³ For example, Understanding Society monthly COVID-19 surveys.

	10%	21270	6,100	0	0	0	6,100
	50%	2710	700	400	15,700	9,600	10,300
Self-harm (adults)	25%	1350	300	200	8,200	5,000	5,300
	10%	540	100	100	3,400	2,100	2,200

Children's Mental Health under social distancing measures

Concerns have been raised about the impact of COVID-19 and the social distancing measures that have been introduced on children's mental health.

Information about COVID-19 and exposure to anxiety

Like adults, children are exposed to a large amount of information about COVID-19, and the social distancing measures, which could cause worry and anxiety in some children⁴⁹⁰. Spending more time with the adults in their household may also mean children are exposed to their parents' higher levels of stress and anxiety.⁴⁹¹ Children may be well attuned to adults' stress and emotional states; being exposed to adults' unexplained and unpredictable behaviour may be perceived by children as a threat and lead them to feeling anxious⁴⁹².

There is also concern that anxiety might increase in adolescents as they try to understand the potential impact of COVID-19 on themselves as well as their friends and family.⁴⁹³ In the week ending 17th April, Childline said they had been contacted by concerned children whose parents had lost their jobs, as well as young carers who were looking after siblings as a result of parents falling ill with coronavirus symptoms⁴⁹⁴.

Social connections

Since the introduction of social distancing measures, children have been experiencing changes to their social connections:

- Contact with friends and family was lost as a result of school closures, social distancing measures and shielding of vulnerable people, meaning that typical sources of face-to-face support were no longer available^{495,496}.
- Younger children who attend childcare, either formally at nursery or informally (e.g. by family members), may have noticed this change and the absence of their regular caregivers.
- School age children will have seen their friends less frequently, and any contact is likely to be virtual.⁴⁹⁷
- Adolescents may also find themselves lose their newly gained independence as well as their valued connections with friends; this disruption, boredom from reduced social interactions and a lack of personal space at home may have an impact on their wellbeing.^{498,499}

It is possible that children and adolescents, having lost face-to-face connections to friends and family, may present externalising behaviours, such as arguing, or acting out⁵⁰⁰.

Separation from parents is also possible under social distancing measures. Government guidelines indicate that moving children between parental homes, where parents do not live in the same household, is permissible.⁵⁰¹ However, there has been some anecdotal evidence of instances where this is not possible due to one parent needing to be shielded due to a medical condition or one parent living abroad⁵⁰². This separation from parents could have impacts on children's mental health.⁵⁰³

For those young people with mental health issues, many have cited concerns about losing connection with friends, family and other trusted adults, particularly prevalent among those not confident or comfortable with the use of phones or with limited access to technology⁵⁰⁴. Indeed,

some have indicated they miss physical proximity with friends and feel that online communication was not a good substitute⁵⁰⁵. During the lockdown, Childline has been contacted by children who have had suicidal thoughts and talk about feeling trapped and isolated.⁵⁰⁶

Changes to daily routines

Children have experienced significant changes to their daily routine as a result of school closures; this may have a significant impact on mental health⁵⁰⁷ as daily routines usually foster resilience to difficult events⁵⁰⁸⁵⁰⁹. Daily and school routines are considered to be particularly important coping mechanisms for children with existing mental health issues; ⁵¹⁰ no longer being able to attend school is a significant disruption and could lead to re-emergence of symptoms.⁵¹¹ Indeed, the charity Young Minds have said this is a particularly difficult time for children and young people already struggling with their mental health.⁵¹² Respondents to a Young Minds survey of young people with a history of mental illness (carried out 20th to 25th March) said they frequently felt anxious about the impact of not being able to take part in regular activities, leaving them prone to overthinking and more likely to use negative coping strategies such as self-harm⁵¹³. They were also concerned about the loss of their 'safe' place away from difficult or dangerous home environments, the structure that school present and concerns about home learning, from a practical perspective and due to stress related to COVID-19.⁵¹⁴ At the same time, children who struggle with bullying and stress at school may experience improved mental health during the school closures.

Anecdotal evidence from Hong Kong, where schools were closed from 3rd February, suggests that losing school routines has been challenging for children with depression; following the closure of schools, some children with existing depression have refused to take showers, eat or leave their beds. There is also concern about the challenges for these children when returning to school and having to adjust to possibly new routines.⁵¹⁵

Lack of access to physical activity

Attending school not only provides a daily routine for many children, but also provides other opportunities to improve mental health and wellbeing which may be lost under lockdown measures. For example, concerns have been raised that children will struggle to achieve recommended physical activity levels under lockdown measures; this may be particularly challenging for children who live in households without access to outdoor space. As well as benefits for physical health, physical activity has been linked to mental health and wellbeing. Removing access to Physical Education as a result of school closures may lead to negative impacts on wellbeing, and increased engagement with detrimental behaviours such as increased screen time.⁵¹⁶ This was a particular concern for young people with Attention Deficit Hyperactivity Disorder (ADHD), who have cited concerns that they may not have been able to go outside as much as they want to⁵¹⁷.

Lack of access to school food

In addition, for many children from lower socio-economic backgrounds, attending school means free access to school lunch. Food insecurity, as well as school holidays, has been linked to increased risk of lower mental health and wellbeing; therefore, removing access to school lunches may be detrimental for mental health of children.⁵¹⁸ However, the government has pledged to ensure children eligible for free school meals have continued access to free school meals if they are no longer attending school during the lockdown measures.⁵¹⁹ Young people with a history of mental health issues, including those with eating disorders, have been feeling anxious about not being able to buy food and about no longer getting meals at school.⁵²⁰

Academic attainment

For some, missing out on schooling may cause anxiety with the view that they may fall academically behind their peers when they return to school. Some children may have access to school support virtually and have support from parents, but others, particularly children in deprived areas, may not and they may miss out on learning during this period. However, the government has pledged to provide disadvantaged children across England with laptops and tablets, as well as 4G routers, to facilitate remote learning.⁵²¹

As a result of school closures, SATs, GCSE, AS and A-Level examinations have been cancelled across the UK^{522,523}; for many students, results from these exams would have enabled their entrance into further education colleges, apprenticeships, university degree programmes or employment. Some students may experience relief from no longer having to complete exams, due to the stress associated with revision and taking exams⁵²⁴. Some have suggested that “adolescents may... be grieving for the rites of passage they were due to experience and feeling apprehensive about an uncertain future in the face of cancelled exams”^{525,526}. Others may feel disappointment from not being able to prove their abilities with examinations; they may have felt that they could do better than their predicted grades.⁵²⁷ Young people with a history of mental health issues have also cited concerns about how their grades would be assessed or about the impact on their university or career prospects.⁵²⁸

Lack of access to mental health support

Schools closures and social distancing measures may also mean reduced access to resources of support for children and young people with mental health needs.⁵²⁹ Indeed, a survey by the charity Young Minds of children and young people aged 25 or younger with a history of mental illness found that 26% said they had been unable to access mental health support, with the cancellation of GP appointments, peer support groups and face-to-face services^{530,531}. Some young people said they had not been told where to get support now they have lost their usual route to access support. Many young people said they received support via school or college; teaching staff and counsellors were mentioned frequently as trusted adults that young people are no longer able to talk to easily about how they are feeling as a result of lockdown measures. In the week ending 27th March 2020, Childline reported counselling young people about coronavirus and due to the removal of professional support from schools and the NHS⁵³².

Concerns about rising demand for mental health support during the lockdown have also been raised. Young people responding to Young Minds’ survey said they felt it took longer to access online or phone support due to an increase in people with mental health needs trying to access help during the pandemic⁵³³. Indeed, Childline said they had experienced unprecedented demand for their services during the pandemic; their support peaked on Wednesday 18th March, the day the Prime Minister confirmed UK schools would shut⁵³⁴. At the same time, they experienced a 30% decrease in volunteer hours as a result of staff self-isolating⁵³⁵. Respondents to Young Minds’ survey also felt that remote support by phone or online is less effective than face-to-face support; reasons for this included feeling anxious about talking on the phone or via video, a lack of privacy at home, with fears that household members would overhear conversations. Young Minds highlighted that in some cases, family relationships can be the focus of therapy which would be challenging to discuss in the family home. On occasion, families may not know that children and young people are receiving mental health support, and those receiving assistance may not want to disclose this.

Social media and cyberbullying

While staying at home, children may have more unsupervised time on social media, and may therefore have more exposure to cyberbullying, cyber-stalking, grooming, and unsuitable material

leading to longer term mental health impacts⁵³⁶. A stalking advocacy service has reported a 26% increase in referrals for cyber-stalking since the lockdown was introduced compared to the previous three months⁵³⁷. The effects of cyberbullying range from a reduction on mental wellbeing (low self-esteem, withdrawn from interactions with family and friend, losing weight, etc) to increases on risk factors for depressive symptoms⁵³⁸⁵³⁹ and attempts of suicide⁵⁴⁰. Cyberbullying victims are 2.35 more likely to self-harm and 2.57 times more likely to attempt suicide than the rest of the population⁵⁴¹.

Even before social distancing measures, online bullying seems to have overtaken traditional forms of harassment⁵⁴². The current lockdown situation, resulting on children spending more time online, points towards the increase in the risk of them being bullied online. This figure seems to have raised by 50% in the Australian case⁵⁴³. It is especially the case as parental limits on the use of internet are constraints by the fact of children being encouraged to use online platforms to keep with their learning schedule. The government has released new guidance to support parents keeping their children safe in this aspect during the lockdown⁵⁴⁴.

Concerns have also been raised about children with special education needs, such as autism spectrum disorder, and the impact of uncertainty and disruption of daily routines potentially leading to frustration for those children.⁵⁴⁵

Health impacts

The impact of social distancing measures on children and young people's mental health is likely to vary by the presence of existing mental health issues as well as individual circumstances. As noted above, for those with pre-existing mental health issues, the lockdown measures may exacerbate their needs or cause relapse, and this may be compounded by increased challenges associated with accessing mental health support remotely. For other children and young people who have not previously been diagnosed with mental health issues, the lockdown measures may lead to increased mental health needs. In some cases, they may cause mental health issues which cross a threshold to a diagnosable level. In others, mental health issues may heighten over the course of the pandemic but may not reach diagnosable levels. The evidence below sets out the potential impact on mental health for children and young people.

It is important to acknowledge that the introduction of the social distancing measures may mean an improvement in mental health for some children and young people. 7% of young people with a history of mental illness responding to the Young Minds survey said that their mental health had become a bit or much better during the crisis, and 9% said the pandemic had made no difference to their mental health. Reasons for improvements varied; some had a difficult relationship with school and they felt relief that they would no longer have to attend; others felt positive about the response to the pandemic, witnessing friends proactively contacting them and feeling reminded that they are valued; and others had found that their own anxiety had a clear focus which was now shared by other people.⁵⁴⁶

However, overwhelming concerns have been raised that the social distancing measures will have a detrimental impact on mental health of children and young people. There is relatively limited current evidence about the impact of the lockdown measures on children's mental health and it is possible that the impacts might be felt in the longer-term.

There is some evidence from parents' reports which suggests an impact of lockdown measures on children's behavioural and social needs. 36% of children aged between 5 and 18 have told their parents they are lonely since schools were closed in the UK.⁵⁴⁷ Almost a third (32%) of parents have

also noted a change in children’s behaviours since the lockdown, including tantrums, meltdowns, nightmares, stomach aches, fighting and crying. Over one in five (22%) children were concerned a family member or close friend could die from catching coronavirus. It is also thought that the impacts may differ with age, with younger children aged 5 to 11 being more likely to become clingy, cry and have tantrums as well as disturbed sleep, and children aged over 12 years being more likely to become withdrawn.

Of young people with a history of mental illness, 32% said the pandemic had made their mental health much worse and 51% said it had made their mental health a bit worse.⁵⁴⁸ Their concerns included being responsible for cross-infection and inadvertently spreading the virus, their family’s health, and having a fixation with hygiene and needing to remain clean, including for those with Obsessive Compulsive Disorder.⁵⁴⁹

The academic literature also points towards negative impacts from stressful events and lockdown measures. For example, research suggests that post-traumatic stress scores were four times higher in children who had been quarantined than in those who were not quarantined.⁵⁵⁰ Researchers have also linked early life stressful events with a range of health impacts, including disrupted neurodevelopment, social, emotional and cognitive impairment and adult medical and psychiatric disorders.⁵⁵¹

The potential impact on children’s mental health may also be observed in the use of support services. Over half of young people who spoke to Childline about coronavirus in the week ending 27th March were counselled for their mental and emotional health around issues like isolation, arguments at home and removal of professional support from schools and the NHS.⁵⁵² They also delivered over 50 counselling sessions with children who were having suicidal thoughts. Childline was also contacted by children whose parents have lost their jobs, and young carers struggling to look after their siblings while their parents were sick with coronavirus symptoms.⁵⁵³

In the absence of adequate data, an illustrative 25% [range: 10% - 50%] increase in the incidence of anxiety, depression and self-harm (including suicides) among children is assumed during lockdown. This rate is arbitrary and should only be considered as illustrative. The assumptions are applied on estimates of depression, anxiety and self-harm prevalence, incidence, deaths, Years Lived with Disability and Years of Life Lost among children by the Global Burden of Disease Study⁵⁵⁴. The table below presents the estimated morbidity and mortality impacts per month of lockdown with pessimistic, central (in bold), and optimistic estimates, respectively.

Table 36. Anxiety, depressive disorders, self-harm QALYs - children

	Assumed change in incidence during lockdown	Change in incidence per month of lockdown	Change in morbidity (QALYs)	Change in deaths per month of lockdown	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Anxiety disorders (children)	50%	4960	3,500	0	0	0	3,500
	25%	2480	1,700	0	0	0	1,700
	10%	990	700	0	0	0	700
Depressive disorders (children)	50%	10590	2,500	0	0	0	2,500
	25%	5290	1,300	0	0	0	1,300
	10%	2120	500	0	0	0	500
Self-harm (children)	50%	310	0	0	1,200	600	600
	25%	150	0	0	0	0	0
	10%	60	0	0	0	0	0

Musculoskeletal conditions

By radically increasing the number of people who are working from home, often without adequate workstation, the social distancing measures are expected to increase the incidence of musculoskeletal and eye health conditions.

As of 29th March, the government announced that anyone who can work from home must do so, as opposed to travelling to their place of work⁵⁵⁵. In 2019, 8.7 million out of 32.6 million in employment in the UK (26.7%) said that they worked from home at some point⁵⁵⁶, however the number of people who are able to work at home under the current circumstances may be greater. A poll by the British Chamber of Commerce, conducted from 25th to 27th March, found that 66% of the 600 businesses who responded were using remote working⁵⁵⁷.

It is assumed that most home workers will be using display screen equipment (DSE). Although employers have a legal obligation to assess the risks of those who use DSE, and, if risks are identified, put measures in place to reduce risks⁵⁵⁸, it is not expected that employers would provide office-grade equipment⁵⁵⁹. Therefore, it can be assumed that many home workers may not have access to adequate⁵⁶⁰ workstation equipment, such as adjustable chairs and monitors, during social distancing measures.

It has been shown that ergonomic workstations reduce musculoskeletal symptoms⁵⁶¹⁵⁶²⁵⁶³⁵⁶⁴ and that using laptops rather than desktops or external monitors can increase the risk of musculoskeletal (MSK) symptoms and computer vision syndrome (eye strain)⁵⁶⁵. A study⁵⁶⁶ found that laptop users are more likely than desktop users to suffer from eye tension (77% vs 27%), eye pain (43% vs 20%), headaches (43% vs 17%), eye irritation (50% vs 33%), dry eyes (50% vs 33%), blurred vision (57% vs 33%), pain in the neck (80% vs 50%) and pain in the back (70% vs 27%). The study suggested that musculoskeletal symptoms result from the low monitor position of laptops, causing workers to bend more often when working, whereas eye symptoms and headaches are the result of the smaller screens of laptops, causing workers to get closer to the monitor, which is associated with tension and headache.

According to the Global Burden of Disease (GBD) Study⁵⁶⁷, 18.8 million people in the UK suffer from MSK disorders, with around 5.5 million new cases each year, causing around 2.1 million Years Lived with Disability (YLD)³⁴. This suggests the average duration of the condition is 3.4 years, and its total disability weight (i.e. proxy for QALY loss) is 0.11. It is assumed that MSK conditions only result in morbidity and not mortality.

Health impacts

Given the typically inadequate workstation equipment at people's homes, and as up to 60% of employees are likely to work from home during the lockdown, it is assumed that new cases of MSK would increase by 25% [range: 10% - 50%] during lockdown. This rate is arbitrary and should only be considered as illustrative. The assumption is applied on estimates of musculoskeletal disorder prevalence, incidence, deaths, Years Lived with Disability and Years of Life Lost by the Global Burden of Disease Study⁵⁶⁸. The table below presents the estimated morbidity and mortality impacts per month of lockdown with pessimistic, central (in bold), and optimistic estimates, respectively.

³⁴ The YLD value refers to the equivalent number of years that are lived with full i.e. 100% disability.

Table 37. Musculoskeletal disorders QALYs

	Assumed change in incidence during lockdown	Change in incidence per month of lockdown	Change in morbidity (QALYs)	Change in deaths per month of lockdown	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Musculoskeletal disorders	50%	144,300	200	3,100	2,100	146,400	144,300
Musculoskeletal disorders	25%	72,100	120	1,600	1,100	73,200	72,100
Musculoskeletal disorders	10%	28,900	100	700	500	29,300	28,900

Occupational hazards and work accidents

By requiring that everyone who can work from home do so, the lockdown measures are expected to decrease occupational hazards and work accidents. In 2018/19, an estimated 1.4 million workers were suffering from an illness they believed was caused or made worse by their work, 581,000 workers sustained a non-fatal injury at work⁵⁶⁹, and 147 died from fatal injuries⁵⁷⁰. The highest rates of non-fatal injuries were observed in the agriculture/forestry/fishing sector, the construction sector, the accommodation/food services sector, the wholesale and retail trade, the public admin sector, and the manufacturing sector⁵⁷¹. However, considering the distribution of employees⁵⁷² across sectors, the highest numbers of work accidents were observed in the wholesale and retail trade, the human health and social work sector, the manufacturing sector, the accommodation and food sector, the education sector, and the administrative and support sector.

Health impacts

Assumptions were made on the proportion of employees who would no longer attend their usual place of work during the lockdown. These assumptions were informed by government messaging that only ‘key workers’⁵⁷³⁵⁷⁴ and those who are unable to work from home⁵⁷⁵⁵⁷⁶⁵⁷⁷⁵⁷⁸ should continue to go to work, that several sectors (e.g. accommodation providers and food service providers) were asked to close (except for food delivery)⁵⁷⁹⁵⁸⁰, as well as anecdotal evidence on job losses, furloughing, and industries (e.g. construction) stopping all non-essential work⁵⁸¹. The assumptions (shown in the table below) were evaluated with the number of employees per sector⁵⁸², and the work accident rate per sector⁵⁸³, to calculate the resulting indicative 55% reduction in work accidents.

Table 38. Accidents of employees broken down by sector (UK estimates)

Sector	% of all employees working in the sector	implied number of employees	work accident rate (per 100,000)	implied work accidents	Assumed reduction in employees going to work	resulting fall in work accidents
Wholesale and Retail Trade	15%	4636000	2220	102900	-80%	-82300
Human Health and Social Work	13%	4026000	1790	72100	-10%	-7200
Manufacturing	8%	2501000	2130	53300	-30%	-16000
Accommodation and Food	8%	2287500	2250	51500	-70%	-36100
Education	9%	2684000	1540	41300	-90%	-37200
Administrative and Support	9%	2745000	1390	38200	-70%	-26700
Construction	5%	1433500	2420	34700	-60%	-20800
Public Administration	4%	1311500	2170	28500	-20%	-5700
Transportation and Storage	5%	1464000	1860	27200	-30%	-8200
Information and Communication	4%	1281000	1710	21900	-80%	-17500
Professional Scientific Technical	9%	2592500	720	18700	-70%	-13100
Arts and Entertainment	3%	762500	1540	11700	-90%	-10500
Agriculture Forestry Fishing	1%	213500	4110	8800	-20%	-1800
				516600		-283100

The 55% [range: 30% - 55%] assumption is applied on estimates by the Global Burden of Disease Study⁵⁸⁴ of deaths, Years Lived with Disability and Years of Life Lost due to occupational injuries. The table below presents the estimated morbidity and mortality impacts per month of lockdown with pessimistic, central (in bold), and optimistic estimates, respectively.

Table 39. Occupational injuries QALYs

	Assumed change in morbidity and mortality during lockdown	Change in morbidity (QALYs)	Change in Deaths per month of lockdown	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Occupational injuries	-30%	-800	0	0	0	-800
Occupational injuries	-55%	-1,500	-20	-800	-500	-1,900
Occupational injuries	-70%	-1,900	0	-800	-500	-2,300

Other infectious diseases

By radically decreasing social contacts, the lockdown measures are expected to considerably decrease the transmission of other infectious illness that are air-borne, sexually transmitted, and transmitted via direct contact between people such as flu, childhood illnesses, and sexually transmitted infections (STIs).

Seasonal influenza usually occurs in the UK between December and March⁵⁸⁵. In the week commencing 23th March 2020, no new admissions for laboratory confirmed influenza were reported and influenza-related activity was below the baseline intensity threshold⁵⁸⁶. As the prevalence of influenza have already decreased to very low levels, social distancing measures are unlikely to have a meaningful impact on the transmission of the disease and the number of deaths.

Adults experience an average of 2-3 colds per year, whilst children experience an average of 5-6 colds per year⁵⁸⁷. Healthy younger children attending primary school or preschool may have up to 12 colds per year⁵⁸⁸. Whilst the common cold is more frequent in winter, cases caused by Rhinovirus, the most common cold virus, peak in late autumn and early spring⁵⁸⁹. Whilst social distancing measures are likely to reduce transmission of the common cold, the symptoms are mild⁵⁹⁰, so there will be limited impact on sufferers' quality of life.

The rate of transmission of other infectious diseases, including childhood infectious diseases, is likely to considerably decrease during lockdown and school closures. These include meningitis, hepatitis, encephalitis, tetanus, chicken pox, measles, varicella, diphtheria, mumps, slapped cheek disease, rubella, and whooping cough⁵⁹¹. Whilst most of these infectious result in mild symptoms, some, including measles and whooping cough, can have more severe symptoms⁵⁹². In 2019, there were 798 confirmed cases of measles England⁵⁹³, and from January-September 2019, there were 2755 laboratory confirmed cases of whooping cough in England⁵⁹⁴.

Health impacts

It is assumed that the lockdown would reduce the incidence of (and subsequently deaths caused by) STIs by 70% [range: 50% - 80%] due to the severely limited opportunities for people to meet new and/or casual sexual partners. Similarly, it is assumed that the lockdown and school closures would reduce the incidence of (and subsequently deaths caused by) other infectious diseases by 70% [range: 50% - 80%]. These rates are arbitrary and should only be considered as illustrative.

The assumptions are applied on estimates of STI and other infectious disease prevalence, incidence, deaths, Years Lived with Disability and Years of Life Lost by the Global Burden of Disease Study⁵⁹⁵.

The table below presents the estimated morbidity and mortality impacts per month of lockdown with pessimistic, central (in bold), and optimistic estimates, respectively.

Table 40. Infectious diseases QALYs

	Assumed change in incidence during lockdown	Change in incidence per month of lockdown	Change in morbidity (QALYs)	Change in deaths per month of lockdown	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
STIs	-50%	-204370	-1,100	0	-700	-400	-1,500
	-70%	-286120	-1,500	-30	-1,400	-800	-2,300
	-80%	-327000	-1,700	0	-1,400	-800	-2,500
Other infectious diseases	-50%	-69140	-1,100	-100	-2,500	-1,600	-2,700
	-70%	-96790	-1,500	-100	-3,100	-2,000	-3,400
	-80%	-110620	-1,700	-100	-3,600	-2,300	-4,000

Other public health programmes

Progress may slow on tackling other public health threats e.g. diet, smoking, alcohol consumption, other infectious diseases, air pollution, or health inequalities, during the COVID-19 outbreak and lockdown. There had been reports⁵⁹⁶ of child vaccination take-up falling during lockdown but some experts⁵⁹⁷ believe that vaccine hesitancy could decrease as an outcome of the COVID-19 pandemic. Some community services (such as weight management and obesity services) have also been stopped during the COVID-19 outbreak⁵⁹⁸. There is not enough information to estimate the health impacts of the lockdown via the effects on other public health programmes.

Physical exercise

It is believed that physical exercise levels have decreased during lockdown, especially among children. With many people working from home, or not at all, during lockdown, and with only essential shops remaining open, the exercise gained from commuting, running errands and leisure activities is likely to have been drastically reduced. It has been reported that pedestrian traffic in UK cities fell by around 80% during the first few days of lockdown⁵⁹⁹. In terms of health impacts, the lack of mobility and activities of daily living is likely to disproportionately impact the health of frailer and older people.

In addition, the social distancing measures and lockdown also led to the closure of gyms and sports clubs which shuts off the routes to exercise for many. However, in 2018, only 14.9% of the UK population had a gym membership⁶⁰⁰, and it is estimated that 44% of gym memberships are used less than once a week⁶⁰¹, so the impacts of gym closures are not likely to be substantial.

Children are believed to get most of their activity from games in PE, playground games during school break periods, and sport activities, none of which would be available during lockdown (except school-related activities for children able to attend school, e.g. key workers' children).

At the same time, it is possible that some people would have realised that daily exercise provides relief to the stresses of living in lockdown during a pandemic, and would have increased their exercise as part of a break from daily routine.⁶⁰² This may have led to a greater number of people taking up walking, or even running, and this change may persist even after the lockdown is lifted. Monitoring of Scottish cycling prevalence has reported significant increases in the number of people cycling in some parts of Scotland.⁶⁰³ Additionally, there have been reports of walking hotspots having many more visitors than usual⁶⁰⁴. Furthermore, during lockdown there has been a steep rise

in the popularity of digital fitness apps (such as Nike Run) and home workouts⁶⁰⁵. This suggests that many people may have shifted the type and location of exercise conducted.

Health impacts

A YouGov poll of 4,343 adults over 7th to 9th April reported that, since the outbreak of the pandemic, 27% of individuals were doing more exercise, while 36% of people were doing less exercise than before⁶⁰⁶. On this basis, and for simplicity (i.e. assuming that the proportion of people reporting to have reduced physical activity during lockdown equates to the corresponding health impacts), a 10% increase in the adverse health impacts of physical inactivity is assumed during lockdown. It is acknowledged that the relative risks of morbidity and mortality associated with physical inactivity may be proportionately greater for long-term than short-term changes in exercise, therefore the 10% assumption could overestimate the increase in adverse health impacts.

The assumed 10% is evaluated with estimates by the Global Burden of Disease Study⁶⁰⁷ of deaths, years of life lost, and years lived with disability due to physical inactivity. The table below presents the estimated morbidity and mortality impacts per month of lockdown with pessimistic, central (in bold), and optimistic estimates, respectively.

Table 41. Low physical activity QALYs

	Assumed change in morbidity and mortality during lockdown	Change in morbidity (QALYs)	Change in Deaths per month of lockdown	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Low physical activity	15%	1,400	500	6,400	4,400	5,800
	10%	600	220	2,700	1,800	2,400
	0%	0	0	0	0	0

Road traffic accidents

Due to lockdown measures restricting non-essential movement, it is expected that the number of road accidents and fatalities in the UK will fall while movement restrictions and the lockdown are in place. US reports suggest that motor vehicle accidents have fallen by 50% in California and Seattle since the lockdown was introduced⁶⁰⁸⁶⁰⁹⁶¹⁰⁶¹¹. In Europe, there were reports of around 70% reduction in road traffic accidents and fatalities in Portugal⁶¹²⁶¹³ and Spain⁶¹⁴ during the lockdown, compared to the same period last year.

Although UK accident or fatality figures for the lockdown have not yet been reported, estimates from the Department for Transport suggest that motor vehicle traffic has decreased by around 75% from its pre-COVID-19 level at the start of the lockdown and was staying at that level during lockdown⁶¹⁵. This would suggest considerable reductions in road traffic accidents and deaths. At the same time, these reductions may be somewhat counterbalanced by increased speeding⁶¹⁶⁶¹⁷⁶¹⁸.

Health impacts

It is not plausible to assume a one-to-one proportionate relationship between road traffic levels and road deaths, although it is likely that a fall in road activity leads to fewer road accidents and in turn fewer road fatalities. On this basis, and for simplicity, a 30% [range: 20% - 50%] decrease in the health and mortality impacts of road injuries is assumed during lockdown. The assumed reduction is evaluated with Department for Transport statistics⁶¹⁹ on the number of road deaths. To calculate morbidity impacts, estimates by the Global Burden of Disease Study⁶²⁰ on years of life lost and years lived with disability due to road injuries are used. The table below presents the estimated morbidity and mortality impacts per month of lockdown with pessimistic, central (in bold), and optimistic estimates, respectively.

Table 42. Road injuries QALYs

	Assumed change in incidence during lockdown	Change in incidence per month of lockdown	Change in morbidity (QALYs)	Change in deaths per month of lockdown	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Road injuries	-20%	-4540	-1,600	-100	-2,000	-1,200	-2,800
	-30%	-6810	-2,400	-70	-2,700	-1,700	-4,100
	-50%	-11350	-4,000	-100	-4,700	-2,900	-6,900

Rough sleeping

Rough sleeping is likely to fall during lockdown due to many rough sleepers being temporarily housed, potentially leading to better health outcomes for homeless people. Homeless people often have multiple chronic conditions, and live in groups, which make them vulnerable to COVID-19 infections and related complications⁶²¹. The Government has made available extra funding to temporarily house homeless people during the COVID-19 outbreak⁶²². There is not enough information to estimate the health impacts of these support measures.

Sexual and reproductive health

The social distancing measures could have implications for sexual and reproductive health and the number of pregnancies. The impact on infectious diseases, such as sexually transmitted infections, are discussed separately in the 'Other infectious diseases' section.

We may see a decrease in pregnancies, both those unplanned and planned. Unplanned pregnancies may decrease as a result of social distancing measures, lack of opportunity for social contact, and some couples not living together during the lockdown. It is also possible that financial concerns for couples planning to have children may delay their plans to try to have children; similarly, they may wish to delay engaging with health services to minimise potential exposure to COVID-19 at this time. Furthermore, there is evidence that IVF treatments have been cancelled or postponed as a result of the pandemic, however this is most likely due to pauses in NHS care, rather than as a result of social distancing measures.⁶²³

At the same time, we could see an increase in pregnancies. The British Pregnancy Advisory Service had said that maternity and abortion services are bracing for an increase in unplanned pregnancies due to the lockdown and potential difficulties obtaining contraceptives⁶²⁴, despite the Faculty of Sexual and Reproductive Health issuing guidance to make it easier to prescribe contraceptives⁶²⁵ and home abortions having been legalised in England⁶²⁶. One online pharmacy reported a 122% increase in sales of emergency contraceptive pills between February and March 2020.⁶²⁷ However it is possible that this may not reflect a change in demand, but a change from purchase in pharmacies to online, in line with social distancing measures. There have also been concerns regarding a worldwide shortage of condoms worldwide after the world's biggest supplier was forced to shut down production for more than week under lockdown rules; its factories have since been permitted to reopen with half the usual workforce^{628,629}.

Media sources have also drawn similarities to the baby boom following World War II and have suggested we may see a similar increase in births following the COVID-19 pandemic.⁶³⁰ In a recent survey of British adults, 8% said they were having more sex since the lockdown – 17% among 18 to 34-year-olds and 6% among 35 to 54-year-olds⁶³¹.

There is not enough information to estimate the net impacts of the lockdown on sexual health and (unwanted) pregnancies, and resulting health impacts.

Tobacco use

Smoking is one of the biggest causes of death and illness in the UK; it has been suggested that smoking increases the risk of developing more than 50 serious health conditions (including cancer, heart attack and stroke), some of which are fatal, and others can cause irreversible long-term damage to health.⁶³² Smoking during pregnancy has been linked to miscarriage, premature birth, low birth weight and stillbirth.⁶³³

Health issues can occur both directly from smoking and indirectly from inhaling second-hand smoke. Passive smoke increases the risk of developing the same health conditions as smokers; it has also been linked to increased risk of chest infections, meningitis and asthma in children, as well as cot death.^{634,635}

It has been suggested that smokers who stop smoking before their mid-30s have approximately the same life expectancy as people who have never smoked.^{636,637} It has also been suggested that stopping smoking reduces the excess risk of heart attack, decline in lung function, attacks of breathing difficulty in COPD patients and ‘freezes’ the risk of smoking-related cancers at the level experienced when ceasing smoking⁶³⁸.

In 2017/18, 489,300 hospital admissions were attributable to smoking, representing 4% of hospital admissions.⁶³⁹ In 2017, there were 77,800 deaths attributable to smoking, representing 16% of all deaths.⁶⁴⁰

Tobacco use in the UK

Smoking prevalence has been in decline in recent years.⁶⁴¹ In 2018, 14.4% of adults aged 16 and over are estimated to smoke.⁶⁴² Specifically in 2018/19, 10.6% of mothers were smokers at the time of delivery.⁶⁴³ 4.8% of adults aged 16 and over who smoked in the past year had stopped smoking in the past 12 months. 27.1% had tried to stop smoking the past year, of which 16.8% were successful.⁶⁴⁴ 6.3% of adults were current e-cigarettes users in 2018; the most common reason for e-cigarette use was to aid themselves in quitting smoking (51.5%).⁶⁴⁵

Tobacco use under lockdown measures

It is possible that smoking rates may decrease under lockdown measures. Indeed, Public Health England has encouraged smokers to stop smoking for their own and others’ health, citing concerns that smokers are more likely to develop severe symptoms if they contract COVID-19. Therefore, it is possible that some smokers may take this advice and stop smoking⁶⁴⁶.

In addition to this, it is possible that smoking prevalence may decrease as more people experience a decrease in income from losing their job, being furloughed or a decrease in business activity (e.g. shops operating online only). There is evidence that smoking reduces during economic downturns⁶⁴⁷, which is likely due to an income channel through which people buy fewer health-damaging goods when income falls. However, there is evidence that this effect has become less strong over time for some health behaviours. Some sources have suggested they expect a decrease in tobacco sales with increasing unemployment⁶⁴⁸; concerns about the cost of smoking is also thought to influence regular smokers to attempt to quit⁶⁴⁹ and a survey during the lockdown suggested that 32% of people who said they were worried about the effect of coronavirus on their life said their household finances were being affected.⁶⁵⁰

Furthermore, a reduction in socialising as a result of the closure of bars, pubs and restaurants as well as public gatherings may lead to a decrease in smoking. Having friends who smoke is thought to influence those who have never smoked to try smoking, and those who have tried smoking to smoke regularly⁶⁵¹. This, alongside general health messaging around COVID-19 and smoking, may be

particularly significant for younger people, with the absence of peer pressure from friends. Almost 1 in 10 smokers (8.3%) said they smoke because it helps them to socialise⁶⁵². Therefore, if people are unable to socialise with friends outside of their homes as much, this may reduce their likelihood of starting to or increasing the rate at which they smoke.

However, there is relatively limited evidence of people actively stopping smoking since the introduction of the social distancing measures. Action on Smoking and Health have reported an increase in calls to stop-smoking services⁶⁵³, which may suggest an increased willingness to stop smoking. Nielsen data also suggests that purchases of nicotine-replacement products increased by 5% year-on-year but rose by 54% in the third week of March (ending 21st March) compared with the same period last year⁶⁵⁴. This may suggest an increase in smokers wanting to quit, but it may also represent people, who were already trying to stop smoking, stockpiling these products. Indeed, Nielsen data showed supermarket sales in general rose by 43% in the week ending 21st March.⁶⁵⁵

However, it is also possible that smoking rates may increase as a result of social distancing measures, due to various reasons including unemployment, limits on socialising and stress. With all but essential workers working from home where possible during the initial lockdown, and many having been furloughed, the majority of the population were spending much more time in their own homes. The change to working from home, away from a smoke-free office environment for example, may increase the likelihood that workers will smoke and/or increase the frequency of their smoking. Some people may have previously cut down smoking and moved towards a healthier lifestyle before the introduction of the social distancing measures, either from being prevented from smoking at their workplace or by starting to go to the gym or a local sports club. Social distancing measures mean that these measures shifting people towards a healthier lifestyle are no longer available, and therefore they may be at increased risk of relapse.⁶⁵⁶

There is also a risk that individuals who are not working, either having been furloughed or having lost their jobs, may be at higher risk of smoking. Those who are unemployed (but looking for work) are more likely to smoke cigarettes (29.6%) than those who are employed (17.0%) and those who are economically inactive, not looking for work such as the retired or students (13.7%). About 20% of smokers in England said they smoke because it gives them something to do⁶⁵⁷; this issue may be exacerbated with people having to stay at home for longer periods of time during the lockdown.

A reduction in socialising may lead to increased stress and therefore also increased risk of smoking. Indeed, stress is considered to be a predisposing factor for increased frequency and quantity of smoking as well as relapse^{658,659}; almost half of smokers in England (47.2%) have said they smoke because it helps them cope with stress^{660,661} and the Centres for Disease Control and Prevention in the United States has suggested that stress during an infectious disease outbreak can mean increased use of tobacco⁶⁶². Mental health problems are also thought to be an influence for those who have never smoked to try smoking⁶⁶³.

Under government guidelines during the initial lockdown, vape shops selling e-cigarettes were not permitted to remain open, although users could still buy products online⁶⁶⁴. However, many newsagents and corner shops remain open and many sell e-cigarette kits and refills. Stakeholders have cited evidence from Italy, where vape shops remained open over concerns that e-cigarette users may return to smoking cigarettes to “maintain their nicotine needs”. 6.3% of adults in England were current e-cigarettes users in 2018. The most common reason for e-cigarette use was as an aid to stop smoking (51.5%).⁶⁶⁵

There is limited evidence of changes in rates of smoking under lockdown measures. Sales of tobacco products rose by 9% in the third week of March in the UK compared to last year, according to Nielsen data⁶⁶⁶. However, we do not know whether people are smoking more frequently and in higher quantities or stockpiled to avoid going to the shops as much and therefore were intending to smoke the same amount during the lockdown as before.

With schools closed to most children, children are spending more time at home with their parents and other adults in their household. This could mean that children (as well as other non-smoking household members) are at increased risk of inhaling second hand smoke from smokers in their home, particularly those without access to gardens. Moreover, stakeholders have suggested that smoking out of a window or in a room with a window open may not help reduce harm⁶⁶⁷. In 2012/13, 94% of owner-occupied dwellings had a private front and/or back garden compared with 67% of private rented, 61% of local authority and 63% of housing association dwellings.⁶⁶⁸ Whilst smoking in all enclosed public places and workplaces is legally prohibited in the UK, there are no such restrictions for private homes (apart from in cars where children are present); therefore, non-smoking adults and children in households without access to a garden may be at increased risk of inhaling second hand smoke, as a result of smokers spending more time at home. At the same time, in 2017, 28% of men and 24% of women reported at least some exposure to second hand smoke – most frequently in outdoor smoking areas of pubs, restaurants and cafes.⁶⁶⁹ Therefore, exposure of adults to second hand smoke may temporarily reduce during lockdown.

Health impacts

There is not enough evidence to establish the net impacts on smoking and smoking-related harm during lockdown. Whilst there is some evidence that tobacco sales have increased, potentially as a result of stockpiling, there is limited evidence of an observed increase, or decrease, in prevalence and frequency of smoking. Indeed, there is also evidence of an increase in purchases of nicotine replacement products to help people stop smoking. Therefore, a net zero impact of the lockdown is assumed under the central scenario [range: + / - 15%]. The assumption is applied on estimates by the Global Burden of Disease Study⁶⁷⁰ of deaths, years of life lost, and years lived with disability. The table below presents the estimated morbidity and mortality impacts per month of lockdown with pessimistic, central (in bold), and optimistic estimates, respectively

Table 43. Tobacco use QALYs

	Assumed change in morbidity and mortality during lockdown	Change in morbidity (QALYs)	Change in Deaths per month of lockdown	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Tobacco use	15%	11,700	2,000	32,900	22,200	34,000
	zero net impact	0	0	0	0	0
	-15%	-11,700	-2,000	-32,900	-22,200	-34,000

D2: Health impacts of the COVID-19 lockdown-induced recession

The consensus view is that the social distancing measures and the lockdown would induce a V-shaped economic recession, with a sharp fall in Q2 and a quick 'bounce back' in Q3 of 2020. Independent forecasters, on average, predict GDP to fall by 6.2% (range: -10.2%/-1.9%) in 2020, and increase by 5.3% (range: 1.5%/9.3%) in 2021. On average, they expect a 13.2% contraction in Q2 2020 and a 9.7% growth in Q3 2020. In contrast, the OBR coronavirus scenario assumes a 12.8% contraction in 2020, and a 17.9% increase in 2021. The scenario shows GDP to fall by 35% in Q2 2020 if social distancing lasts for three months, and increase by 27% in Q3 2020 – see chart below:

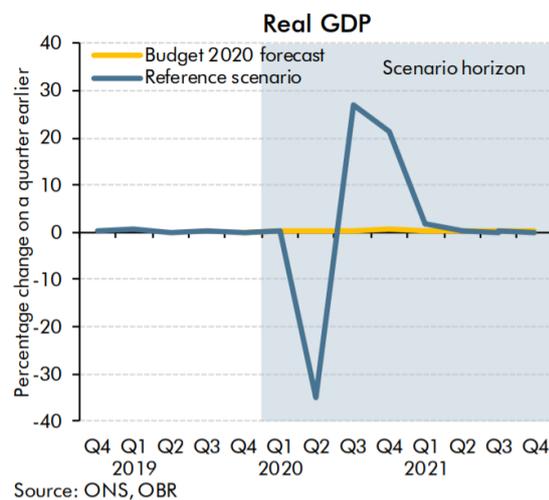


Figure 11 Real GDP coronavirus scenario (OBR)

It is important to note that the shape of the economic recession could impact the robustness of the estimates based on the academic literature. As most recessions are U or L-shaped, the literature evidence on the health consequences of economic recessions may be less applicable to a V-shaped recession and may overestimate the impacts.

OBR modelling also suggests unemployment to rise by more than 2m to 10% in Q2 2020, returning to below 6% by Q3 2021 (see chart below).

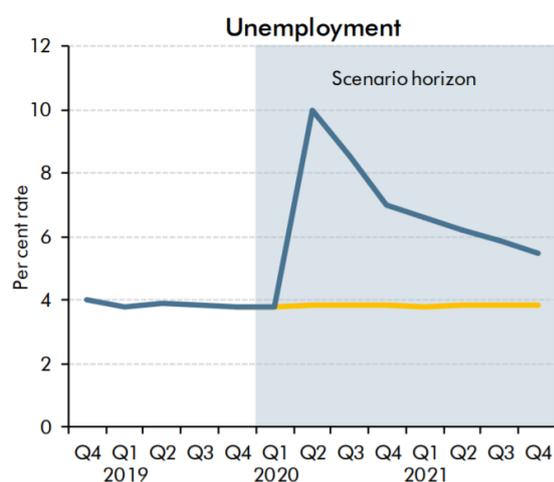


Figure 12 Unemployment coronavirus scenario (OBR)

A nowcast by the Financial Times⁶⁷¹ suggests a 1.3 percentage points increase in the unemployment rate by mid-April. Around 1.8 million people (not all of them are unemployed) have applied for Universal Credit since the start of the lockdown.

For simplicity, but largely in line with OBR and other forecasts, this paper assumes a 10% year-on-year GDP contraction and an 8% unemployment rate for 2020.

Short-term health impacts of the lockdown-induced recession

Most studies into the *short-term* health effects of economic cycles in developed countries documented mortality being procyclical – i.e. that a deteriorating economic situation is associated with short-term reductions in mortality rates³⁵. Studies have found higher mortality rates during economic booms and lower mortality rates during recessions, with the relationship holding true for economic downturns over 1870-1920⁶⁷², during the Great Depression⁶⁷³, during the 1970s, 1980s, and 1990s⁶⁷⁴⁶⁷⁵, and following the 2008 recession⁶⁷⁶.

For most, recessions tend to improve health via fewer job-related accidents⁶⁷⁷, fewer traffic accidents⁶⁷⁸, better air quality⁶⁷⁹, lower stress, lower alcohol consumption and smoking, weight loss, more exercise⁶⁸⁰⁶⁸¹⁶⁸², and more accessible health and care services⁶⁸³. At the same time, stress, mental health problems, chronic conditions (e.g. hypertension, arthritis, diabetes), alcohol abuse, and drugs misuse tend to increase among people who are impacted the most by job losses and economic hardship⁶⁸⁴⁶⁸⁵⁶⁸⁶⁶⁸⁷⁶⁸⁸.

The hypotheses put forward by earlier studies to explain mortality being procyclical mainly work through behavioural, environmental, and occupational risk factors, such as:

- Improved economic conditions predict longer working hours and less leisure time, thereby increasing the opportunity costs of undertaking health-producing activities such as exercise and eating a healthy diet and making it more ‘optimal’ for individuals to engage in health-risk behaviours such as drinking and smoking.
- Health is an input into the production of goods and services. Job-related stress, the physical exertion of employment, and hazardous working conditions predict worsening cardiovascular health and increasing injury rates when the economy is expanding
- Air pollution and traffic congestion, which tend to increase when the economy improves, can have particularly strong effects on the mortality of vulnerable segments of the population.
- Heightened intensity of employment may also make it harder for workers to care for their dependents.

A study⁶⁸⁹ of 50 US states between 1972 and 1991 found that a one percentage point increase in the unemployment rate, relative to its historical average, was associated with a 0.5%-0.6% short-term decrease in mortality, mainly in preventable causes of death (except for suicides). The largest impacts were observed in reduced motor vehicle fatalities, followed by reductions in cardiovascular disease, liver disease, and pneumonia. These latter impacts have been linked by the study to observed reductions in obesity and smoking, better diet, and more exercise during recessions. In line with these findings, a follow-up study⁶⁹⁰ found that a one percentage point rise in unemployment predicts the prevalence of smoking, severe obesity, and physical inactivity to fall by 0.6%, 1.4%, and 1.5%, respectively. Another US study⁶⁹¹ found that a one percentage point fall in unemployment over 1972–1981 predicted the prevalence of ischemic heart disease and intervertebral disk (i.e.

³⁵ Notable exceptions are studies of developing countries that tend to find mortality being countercyclical e.g. Jacinto Pde A, Tejada CA, Sousa TR (2010) Effects of macroeconomic conditions on health in Brazil. *Revista de Saude Publica*, 44 (2): 310–7; Cutler DM, Knaul F, Lozano R, Mendez O, Zurita B (2002) Financial crisis, health outcomes and ageing: Mexico in the 1980s and 1990s. *Journal of Public Economics*, 84: 279–303.

musculoskeletal) disorders to increase by 4.3% and 8.7%, respectively, pointing to increased stress and occupational hazards as mechanism.

Similar findings have been documented covering groups of OECD countries. A study⁶⁹² analysing 23 OECD countries over 1960-1997 found that a one percentage point decrease in the national unemployment rate is associated with a 0.4% rise in total mortality and 0.4%, 1.1%, 1.8%, and 2.1% increases in deaths from cardiovascular disease, influenza/pneumonia, liver disease, and motor vehicle fatalities, respectively.

The link between reduced economic activity and fewer road traffic accidents is shown in other studies, too. A US study finds a significant 2.9% decrease in motor vehicle fatality rate for each percentage point increase in unemployment rate during the 2008 recession⁶⁹³. Interestingly, another study links reduced traffic to slower spread of viral diseases such as flu⁶⁹⁴.

In Europe, a recent study⁶⁹⁵ has also suggested mortality being procyclical over the 2000-2010 period in each of the sampled countries including Austria, Belgium, Croatia, the Czech Republic, Denmark, France, Germany, Italy, Luxembourg, the Netherlands, Poland, Portugal, Slovenia, Spain, and the UK. Similar findings have been reported for Sweden over 1993-2007⁶⁹⁶, for Spain over 1980-1997⁶⁹⁷, and for France over 1982-2002⁶⁹⁸.

A recent working paper⁶⁹⁹ by Harvard academics using mortality data covering 100 birth cohorts over 200 years in 32 countries (including the UK) also suggests mortality being procyclical except in the case of 'big booms' (defined as GDP rising by more than 10%) which predicts 4% *lower* mortality and 'big busts' (defined as GDP falling by more than 10%) which predicts 5% *higher* mortality. The paper also finds that around two-thirds of the mortality impact of (ordinary) booms are a result of increased pollution.

Some more recent studies have observed that a considerable part of the increased mortality in boom times works through changes in older people's mortality, calling into question behavioural, environmental and occupational risk factors as the only mechanisms, and increasingly pointing towards changes in access and quality of health and care services during times of economic growth. In particular, while falls in the GDP, and 'austerity' measures, may reduce countries' ability to pay for good quality care, a recession could make it easier to staff health and long-term care services as pay becomes more competitive with the rest of the economy. At the same time, these studies also noted strong procyclical mortality impacts via road traffic accidents and air pollution, confirming some of the mechanisms via general employment levels, too.

A study⁷⁰⁰ of 50 US states between 1979 and 1998 found that a one percentage point rise in employment was associated with a 0.75% increase in deaths from coronary heart disease (CHD) and related heart attacks (equally among working age individuals and people over the age of 65), linking these changes to the reduced availability of CHD treatments such as coronary artery bypass graft and percutaneous transluminal coronary angioplasty in boom times.

Another US study⁷⁰¹ found that a one percentage point increase in the unemployment rate led to a 0.43 decrease in the mortality rate over 1972-2004. The study confirmed that the changes in mortality among working-age individuals came mostly from fewer motor vehicle accidents, but identified stronger impacts among older people's mortality, mainly due to cardiovascular and respiratory diseases, suggesting that air pollution and changes in the quality, quantity and nature of health care inputs over the business cycle could be driving the effects.

A more recent US study⁷⁰² found that a one percentage point increase in unemployment over the 1978-2006 period predicted a 0.33% short-term fall in all-cause mortality. The study, again, confirmed that changes in mortality among working age individuals were mostly driven by motor vehicle accidents, but pointed out even larger changes in mortality among older people in nursing homes (mainly due to cardiovascular and respiratory conditions) linking these to lower employment levels in nursing homes during periods of economic boom. A UK study has also made a similar observation linking NHS pay rates to mortality rates³⁶.

Evidence⁷⁰³ also shows that excess weight tends to decline during economic downturns, as the reduction in employment and/or work hours decreases the relative cost of free time making it more optimal to home cook, which tends to be less calorie rich than prepared meals⁷⁰⁴. At the same time, net physical activity tends to decline in economic recessions. Although recreational exercise often increases as employment falls, this would not compensate for the decrease in work-related exertion, and this impact is especially strong amongst individuals with lower education⁷⁰⁵.

Evidence also suggests that drinking tends to fall, at the population level, in economic downturns⁷⁰⁶⁷⁰⁷. At the same time severe individual outcomes (e.g. job and/or housing loss) were associated with more drinking or more heavy episodic (binge) drinking⁷⁰⁸⁷⁰⁹⁷¹⁰⁷¹¹. One study⁷¹² suggests *increased* alcohol-related deaths during periods of prolonged, mass unemployment (over 3 percentage points increase).

Similarly, smoking tends to fall, at the population level, during recessions⁷¹³⁷¹⁴⁷¹⁵⁷¹⁶, while at the same time, adverse individual outcomes are associated with increased smoking⁷¹⁷⁷¹⁸, especially among less educated groups⁷¹⁹.

While all-cause mortality tends to be procyclical, recessions tend to severely impact mental health and wellbeing⁷²⁰⁷²¹⁷²²⁷²³. Economic crises increase the risk factors for poor mental health, such as low household income, debt and financial difficulties, housing payment problems, poverty, unemployment and job insecurity⁷²⁴⁷²⁵⁷²⁶⁷²⁷⁷²⁸⁷²⁹⁷³⁰. A review of evidence⁷³¹ of the health outcomes during the 2008 crisis in Europe found that most studies reported significant increase in suicide during the financial crisis. A study⁷³² looking at data from 26 EU countries over 1970–2007 found that a one percentage point increase in unemployment was associated with a 0.79% rise in suicides among people aged under 65, with proportionately larger increases upon more than 3 percentage points rises in unemployment. An Australian study⁷³³ shows that unemployment can adversely affect individual wellbeing and mental health both through lower income and directly. A review of evidence⁷³⁴ of well-being and unemployment suggests that unemployment is associated with long-term earnings losses, lower job quality; declines in psychological and physical well-being; loss of psychosocial assets; social withdrawal; family disruption; and lower levels of children's attainment and well-being. Although reemployment mitigates some of the negative effects of job loss, it does not eliminate them. At the same time, widespread unemployment tends to *lessen* the social-psychological impact of job losses, all other things equal. Further evidence⁷³⁵ shows increases in stress-related conditions in people who become unemployed including cardiovascular conditions, hypertension and heart disease.

³⁶ They found that where nationally-set wage rates were high compared with the local market, higher quality staffing reduced mortality rates, and conversely, where nationally-set wage rates were low compared with the local market staffing was more problematic and mortality was higher: "A 10% increase in the outside wage is associated with a 4% to 8% increase in AMI death rates. An important part of this effect operates through hospitals in high outside wage areas having to rely more on temporary agency staff". <http://eprints.lse.ac.uk/3282/1/canpayregulationkill.pdf>

A systematic literature review⁷³⁶ also found evidence of worsening infectious disease outcomes in developed countries following periods of economic crisis, attributable to higher rates of infectious contacts in poorer living circumstances and worse access to treatments. Violence might also increase during recessions⁷³⁷⁷³⁸, although some studies report the opposite impact⁷³⁹.

Evidence suggests that health inequalities across socioeconomic groups and regions are likely to widen following an economic crisis and that previous recessions (even though they were very different to the one we may face soon) have disproportionately affected lower income groups, and ex-industrial areas. Research into mortality in the United States in the 1980s and 90s found that the health of those with a high school degree or higher level of education, tended to improve during economic recessions, while those with very low education were at greater risk of worsening health during these times⁷⁴⁰. Different age groups are likely to be affected in different ways. For example, in Canada, mortality patterns in times of recession were found to be more significant for adults in their thirties than for infants and older people⁷⁴¹. Men have been shown to be at increased risk of mental health problems and death due to suicide or alcohol use during times of economic difficulty⁷⁴².

To summarise, the literature consistently shows all-cause mortality to decline during recessions with a one percentage point increase in the unemployment rate predicting between 0.3%-0.5% short-term reduction in mortality (with most impacts realised within a year). And while the exact mechanisms are still debated, studies tend to report large reductions in deaths due to traffic and other accidents, as well as deaths due to cardiovascular and respiratory diseases – most likely attributable to reduced pollution, reduced behavioural risk factors, and better availability of health and care services. At the same time, studies consistently report an increase in suicides, a deterioration of mental health, and worsening health inequalities – with many of the adverse impacts concentrating among people from lower socio-economic backgrounds.

At the same time, it is not known whether the lockdown-induced recession would impact health differently than other recessions, on which the literature is based. Also, the impacts of the lockdown-induced recession could be different from the impacts of other recessions given there is a variety of fiscal measures in place, but perhaps these measures would only delay some of the short-term impacts. The health impacts of the recession may also depend on the subsequent measures by the government. Since 2011, many countries have been witnessing a slowing improvement in life expectancy and avoidable mortality – cardiovascular and chronic lower respiratory mortality in particular. Some academics⁷⁴³⁷⁴⁴⁷⁴⁵⁷⁴⁶⁷⁴⁷⁷⁴⁸ have attributed part of this to austerity measures. Correspondingly, expansionary government policies, and extra healthcare funding, during and post-recession may be able to counteract some of these adverse health impacts.

To calculate the impacts of the lock-down induced recession, this paper uses elasticities calculated by Stevens et al (2011)⁷⁴⁹ as the study covers a relatively long and recent period 1978-2006 period, its headline result (i.e. -0.33 mortality elasticity with respect to unemployment) is consistent with many other studies (albeit somewhat lower), and it provides detailed estimates of mortality impacts across a range of conditions and causes. The study uses US data, which is a limitation of this paper, however, no adequate UK, or similarly detailed EU-based, study has been identified.

The table below presents the estimates of the short-term mortality and morbidity impacts of the assumed recession (with 4 percentage points average increase in unemployment). These estimates are based on the cause- and disease-specific elasticities as reported by Stevens et al (2011), and estimates of the prevalence, incidence, deaths, Years Lived with Disability and Years of Life Lost of the corresponding conditions in the UK as reported by the Global Burden of Disease Study⁷⁵⁰. As Stevens et al (2011) only calculates mortality impacts, proportional changes are assumed for

morbidity, too. As suicides do not have morbidity impacts, the estimated impacts on suicides are applied to depressive and anxiety disorders.

Table 44. Central scenario

	Implied change in Incidence	Implied change in Deaths	Change in morbidity (QALYs)	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Cardiovascular diseases	-21570	-2,100	-4,900	-27,300	-18,600	-23,500
Neoplasms	5930	1,500	1,900	26,400	17,800	19,600
Chronic respiratory diseases	-19800	-1,400	-15,000	-18,400	-12,500	-27,500
HIV/AIDS and STIs	-184430	0	-500	-300	-200	-700
Alzheimer's disease and other dementias	-5120	-2,000	-3,700	-16,200	-11,000	-14,700
Chronic kidney disease	-9120	-200	-1,700	-2,400	-1,600	-3,300
Transport injuries	-45620	-200	-8,700	-9,800	-6,000	-14,800
Unintentional injuries	-205900	-400	-17,500	-6,000	-4,100	-21,600
Self-harm	3990	300	500	11,100	6,800	7,200
Interpersonal violence	-4240	0	-700	-400	-200	-900
Nutritional deficiencies	-12830	0	-400	0	0	-400
Depressive disorders	154900	0	21,900	0	0	21,900
Anxiety disorders	21110	0	12,300	0	0	12,300
Total	-322700	-4,500	-16,500	-43,300	-29,600	-46,400

The optimistic scenario uses elasticities calculated by Miller et al (2009)⁷⁵¹, which tend to be larger than those estimated by Stevens et al (2011). In contrast, the pessimistic scenario uses coefficients calculated by subtracting the difference between the coefficients of Stevens et al (2011) and Miller et al (2009) from the coefficients Stevens et al (2011). The tables below present the estimated morbidity and mortality impacts under the pessimistic and optimistic scenario, respectively.

Table 45. Pessimistic scenario

	Implied change in Incidence	Implied change in Deaths	Change in morbidity (QALYs)	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Cardiovascular diseases	-14980	-1,500	-3,400	-19,000	-12,900	-16,400
Neoplasms	7360	1,900	2,300	32,700	22,000	24,300
Chronic respiratory diseases	-12740	-900	-9,600	-11,800	-8,000	-17,700
HIV/AIDS and STIs	23540	0	+100	0	0	+100
Alzheimer's disease and other dementias	-1200	-500	-900	-3,800	-2,600	-3,400
Chronic kidney disease	-3230	-100	-600	-900	-600	-1,200
Transport injuries	-38440	-200	-7,400	-8,500	-5,200	-12,600
Unintentional injuries	-173510	-300	-14,800	-5,000	-3,400	-18,100
Self-harm	3120	200	400	8,700	5,300	5,700
Interpersonal violence	-1170	0	-200	0	0	-200
Nutritional deficiencies	19740	0	+600	0	0	+600
Depressive disorders	121220	0	17,100	0	0	17,100
Anxiety disorders	16520	0	9,700	0	0	9,700
Total	-53770	-1,400	-6,700	-7,600	-5,400	-12,100

Table 46. Optimistic scenario

	Implied change in Incidence	Implied change in Deaths	Change in morbidity (QALYs)	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Cardiovascular diseases	-28160	-2,800	-6,400	-35,700	-24,300	-30,700
Neoplasms	4510	1,200	1,400	20,100	13,500	14,900
Chronic respiratory diseases	-26850	-1,900	-20,300	-24,800	-16,900	-37,200
HIV/AIDS and STIs	-392400	0	-1,000	-1,000	-600	-1,700
Alzheimer's disease and other dementias	-9050	-3,600	-6,600	-28,700	-19,400	-26,000
Chronic kidney disease	-15000	-300	-2,800	-3,900	-2,700	-5,500
Transport injuries	-52800	-300	-10,100	-11,500	-7,100	-17,200
Unintentional injuries	-238290	-400	-20,300	-6,800	-4,600	-24,900
Self-harm	4860	300	600	13,500	8,300	8,800
Interpersonal violence	-7320	0	-1,100	-800	-500	-1,600
Nutritional deficiencies	-45410	0	-1,400	0	0	-1,400
Depressive disorders	188570	0	26,700	0	0	26,700
Anxiety disorders	25700	0	15,000	0	0	15,000
Total	-591640	-7,800	-26,300	-79,600	-54,300	-80,800

Reconciling procyclical mortality with positive correlation between GDP and Life expectancy

Despite mortality having been found procyclical, studies documented a positive relationship between life expectancy and the *long run* (i.e. steady state level) GDP and health expenditure.

An OECD study⁷⁵² found that every 1% difference in (steady state) per capita GDP predicts a 0.045% difference in life expectancy at birth, other things being equal. This relationship is also borne out in UK data over the past decades. At the same time, short-term fluctuations (i.e. annual changes) in the GDP and Life Expectancy do show a negative relationship with -0.2 correlation coefficient – providing tentative support to mortality being procyclical in the short run.

The OECD study also estimated that every 1% difference in (steady state) per capita health spending predicts a 0.041% difference in life expectancy at birth, other things being equal. The study also found a 0.81 elasticity between per capita GDP and health spending – implying that countries that become richer tend to increase health spending almost proportionally.

However, as the GDP is expected return to its pre-crisis level in 2021, no (long-term) impacts via the GDP are assumed. Also, as the steady state level of health spending is not expected to fall in England, and is not expected to be adversely impacted by the lockdown-induced recession⁷⁵³, no (long-term) impacts via health spending are assumed either.

Medium-term health impacts of the recession

There is comparatively little research into the medium-term health impacts of economic crises. Janke et al (2020)⁷⁵⁴ finds that a one percentage point increase in the unemployment rate is associated with a 1.7% increase in the long-term prevalence of chronic health conditions, especially mental health, musculoskeletal, cardiovascular, and respiratory conditions with corresponding elasticities of 4.2, 2.7, 2.4, and 2.1, respectively. In a follow-up article⁷⁵⁵, the authors add that a recession similar to the 2008 financial crisis would lead to around 900,000 more people suffering from at least one chronic condition. The paper emphasises that the estimated impacts would start to be observed after 2 years of the recession, and it would take around 5 years for the full health impacts to accrue, therefore using these estimates would not lead to double-counting either with

the short-term health impacts or the long-term mortality impacts as discussed in the next sub-section.

To calculate the medium-term impacts on chronic disease prevalence, the elasticity estimates by Janke et al (2020), evaluated with the assumed 4 percentage point increase in unemployment, are applied on estimates of the prevalence, incidence, deaths, Years Lived with Disability and Years of Life Lost of the corresponding chronic conditions in the UK as reported by the Global Burden of Disease Study⁷⁵⁶.

Table 47. Central scenario

	Change in Incidence	Change in morbidity (QALYs)	Change in Deaths	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Mental disorders	583070	182,100	0	0	0	182,100
Musculoskeletal disorders	592830	187,000	300	3,900	2,600	189,600
Cardiovascular diseases	143810	32,800	14,300	182,200	123,900	156,700
Chronic respiratory diseases	47790	36,200	3,300	44,200	30,000	66,200
Total	1367500	438,100	17,900	230,300	156,500	594,600

The pessimistic scenario uses 25% higher coefficients as in Janke et al (2020), whereas the optimistic scenario uses 50% lower coefficients as in Janke et al (2020). The tables below present the estimated morbidity and mortality impacts under the pessimistic and optimistic scenario, respectively.

Table 48. Pessimistic scenario

	Change in Incidence	Change in morbidity (QALYs)	Change in Deaths	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Mental disorders	728840	227,600	0	0	0	227,600
Musculoskeletal disorders	741040	233,700	400	4,900	3,300	237,000
Cardiovascular diseases	179770	41,000	17,800	227,700	154,800	195,900
Chronic respiratory diseases	59740	45,200	4,200	55,300	37,600	82,800
Total	1709390	547,500	22,400	287,900	195,700	743,300

Table 49. Optimistic scenario

	Change in Incidence	Change in morbidity (QALYs)	Change in Deaths	Change in years of Life Lost	Change in mortality (QALYs)	Change in morbidity and mortality (QALYs) [positive: QALY loss; negative: QALY gain]
Mental disorders	291530	91,000	0	0	0	91,000
Musculoskeletal disorders	296420	93,500	200	2,000	1,400	94,800
Cardiovascular diseases	71910	16,400	7,100	91,100	61,900	78,300
Chronic respiratory diseases	23900	18,100	1,700	22,100	15,000	33,100
Total	683760	219,000	9,000	115,200	78,300	297,200

D3: Long-term health impacts of the recession

There is comparatively little research into the longer-term health impacts of economic crises. However, it is observed that structural changes and/or deep economic downturns tend to have strong impacts on health, mainly through deprivation, which can be long lasting⁷⁵⁷. One of the mechanisms is termed ‘deaths of despair’⁷⁵⁸ which have been linked to recent falls in life expectancy in the US.

The few studies that analyse **long-term** impacts tend to find strong, enduring, negative health and mortality impacts on people who were young (or even in the womb) during recessions. A study⁷⁵⁹ of people born in the Netherlands over 1812-1912, followed up to 2000, reports that those who were born in a recession had a reduced life span by 5 years, with most of the impacts concentrating among people in lower socio-economic groups. Although the study controlled for infant mortality, which had been much higher in the 1800s, due to the range of other differences between birth cohorts up to 200 years ago and now, it is not clear to what extent these results could be applied to people born in 2020.

A literature review⁷⁶⁰ suggests negative impacts of a recession on birth outcomes and child health. One study of birth outcomes found that the announcement of mass layoffs (an indicator of fear or stress related to the economy) was associated with declines in birthweight even prior to actual layoffs⁷⁶¹. This study is notable because of the author's attempt to isolate the effects of fear and/or stress associated with the announcement of mass layoffs from the material effects of job loss itself. In addition, this study includes both aggregate- and individual-level analyses, the findings of which generally converge. In counties with large layoffs, average birth weight declined approximately 1–4 months prior to the layoff.

A US study⁷⁶² demonstrated that even temporary adverse labour market conditions during young adulthood can have lasting impacts affecting health and mortality well into middle ages. The study found that cohorts graduating shortly before, during and after the 1982 recession (when unemployment reached 11%, 3.9 percentage points higher than before the recession) suffered higher mortality rates from their late 30s onwards, and especially towards the age of 50, leading to 6-9 months total reduction in their life expectancy, all other things equal. The paper showed that these mortality impacts were primarily driven by heart disease, lung cancer, and liver disease, as well as drug overdoses, with no recorded impacts on causes that are not linked to behavioural risk factors (e.g. accidents or other cancers).

A recent working paper by Harvard academics (Cutler et al, 2016⁷⁶³), covering over 100 birth cohorts in 32 countries (including the UK), found that poor economic conditions while growing up (i.e. from birth to age 25) significantly raised adult mortality. The paper reports that a one percentage point increase in GDP (above its long run level) around ages 16 to 25 lowers middle and later life mortality by 0.3% - 0.6%.

To calculate the recession's long-term mortality impacts on those who were aged 15-24 during the lockdown-induced recession, the elasticity estimate by Cutler et al (2016) is applied on the age-specific mortality rates from ONS Life Tables⁷⁶⁴ and evaluated with ONS population estimates⁷⁶⁵ of people aged 15-24 in 2020 (7.8 million). The central scenario uses the 0.3 elasticity estimate whereas the pessimistic scenario uses the 0.6 elasticity estimate from Cutler et al (2016). The optimistic scenario assumes 0.1 elasticity.

It is important to note that there is considerable uncertainty regarding the long-term impacts of the recession. The estimated impacts are based on previous recessions and it is not known whether the current recession, and especially its long-term impacts, would be different from those of past recessions. The table below presents the estimates of extra deaths, years or life lost and QALYs lost by increasing the annual mortality rates of the cohort currently aged 15-24 by 3% [range: 1% - 6%]³⁷ between ages of 30 and 60.

³⁷ The assumed 10% GDP fall is multiplied by the 0.3 [range: 0.1 - 0.6] elasticity.

Table 50. Central, pessimistic and optimistic scenarios

Age	Central scenario				Pessimistic scenario				Optimistic scenario			
	Additio nal probab ility of dying	Prematu re death s by age among the cohort	Total years of life lost	Change in QALYs [positive : QALY loss]	Additio nal probab ility of dying	Prematu re death s by age among the cohort	Total years of life lost	Change in QALYs [positive : QALY loss]	Additio nal probab ility of dying	Prematu re death s by age among the cohort	Total years of life lost	Change in QALYs [positive : QALY loss]
30	0.002%	130	6790	3960	0.004%	270	13580	7910	0.001%	40	2260	1320
31	0.002%	140	7250	4240	0.004%	290	14500	8490	0.001%	50	2420	1410
32	0.002%	160	7790	4580	0.004%	320	15590	9160	0.001%	50	2600	1530
33	0.002%	170	8060	4760	0.005%	330	16120	9520	0.001%	60	2690	1590
34	0.002%	180	8530	5060	0.005%	360	17070	10120	0.001%	60	2840	1690
35	0.003%	190	8920	5310	0.005%	380	17840	10630	0.001%	60	2970	1770
36	0.003%	210	9740	5830	0.006%	430	19490	11660	0.001%	70	3250	1940
37	0.003%	230	10420	6270	0.006%	470	20840	12530	0.001%	80	3470	2090
38	0.003%	230	10020	6050	0.006%	460	20050	12110	0.001%	80	3340	2020
39	0.004%	260	11260	6830	0.007%	530	22520	13660	0.001%	90	3750	2280
40	0.004%	280	11840	7210	0.008%	570	23680	14430	0.001%	90	3950	2400
41	0.004%	320	13080	8010	0.009%	640	26170	16020	0.001%	110	4360	2670
42	0.005%	340	13570	8340	0.009%	680	27150	16690	0.002%	110	4520	2780
43	0.005%	380	14890	9190	0.010%	770	29780	18380	0.002%	130	4960	3060
44	0.005%	410	15470	9590	0.011%	810	30940	19180	0.002%	140	5160	3200
45	0.006%	440	16270	10130	0.012%	880	32550	20260	0.002%	150	5420	3380
46	0.006%	470	16980	10610	0.013%	940	33960	21230	0.002%	160	5660	3540
47	0.007%	520	18350	11520	0.014%	1040	36700	23040	0.002%	170	6120	3840
48	0.007%	550	18940	11940	0.015%	1100	37890	23880	0.002%	180	6310	3980
49	0.008%	600	19990	12650	0.016%	1200	39980	25300	0.003%	200	6660	4220
50	0.009%	650	21070	13380	0.017%	1300	42130	26760	0.003%	220	7020	4460
51	0.009%	690	21950	14000	0.018%	1390	43910	28000	0.003%	230	7320	4670
52	0.010%	760	23460	15020	0.020%	1530	46920	30040	0.003%	250	7820	5010
53	0.011%	800	23950	15390	0.021%	1610	47890	30780	0.004%	270	7980	5130
54	0.012%	870	25090	16190	0.023%	1740	50190	32370	0.004%	290	8360	5400
55	0.013%	960	26850	17390	0.025%	1920	53710	34770	0.004%	320	8950	5800
56	0.014%	1060	28720	18660	0.028%	2120	57450	37330	0.005%	350	9570	6220
57	0.015%	1150	30160	19660	0.030%	2300	60310	39330	0.005%	380	10050	6550
58	0.017%	1260	32100	21010	0.033%	2530	64210	42020	0.006%	420	10700	7000
59	0.018%	1380	33940	22280	0.037%	2770	67870	44560	0.006%	460	11310	7430

60	0.020%	1510	35770	23570	0.040%	3020	71540	47130	0.007%	500	11920	7860
UK Total		17300	551220	348630		34700	1102530	697290		5770	183710	116240
England Total		14,600	464,500	293,800		29,200	929,100	587,600		4,900	154,800	98,000

D4: Estimating excess deaths due to increased deprivation using an Index of Multiple Deprivation approach

This annex explores what the impact on mortality may be of a longer-term downturn in the economy, estimating this using the Index of Multiple Deprivation for England (IMD). There is debate between economists on the shape this recession will take. Some argue that growth will recover quickly, whereas others argue that the economy will take time – potentially quite some time – to bounce back⁷⁶⁶. To understand the mortality impact of a challenging economic scenario, here we estimate what the result of increased deprivation on mortality would be, were this recession to become L-shaped.

The IMD splits the population by levels of deprivation, from the most deprived lower layer super output areas (LSOAs) to the least deprived. Looking geographically at the IMD results⁷⁶⁷, we see correlations between the areas with lower economic scores (e.g. lower income and higher unemployment), and poorer health outcomes (life expectancy, self-reported health, and mortality). Given recessions are linked to increased unemployment and reduced income, this suggests the effects and characteristics of a recession are linked to increased deprivation and, in turn, lower health and increased mortality. As such, published ONS data on all-cause mortality stratified by IMD⁷⁶⁸ can inform how numbers of deaths could increase if an economic downturn from COVID-19 or government's NPIs is prolonged enough to increase levels of deprivation.

To estimate this effect, we have used a model in which every LSOA has its IMD score increased (becomes more deprived) as a result of contractions to GDP. Before any adjustment, there is a clear correlation between increased deprivation and increased all-cause mortality (see published ONS data on IMD deciles mentioned above). If, following an adjustment to IMD score, an LSOA's IMD score changes sufficiently to move from one decile group's score range into a more deprived group, the new (higher) mortality rate for that decile group is applied to their population. In this way we can estimate an increase in mortality associated with a reduction in GDP. This methodology does not allow LSOAs in the most deprived decile group to experience an increase in their mortality rate; the possible impact of changing this assumption is explored in notes below.

- The **central GDP contraction estimate used is 12.8%**, consistent with OBR's reference scenario for the GDP level by the end of 2020⁷⁶⁹. Unlike the OBR scenario, this analysis assumes GDP does not further recover once reaching this level, to present a longer-term negative economic scenario. To achieve a range of estimates, we have also tested scenarios with 10% and 15% contractions either side of this central estimate.
- The **central estimate of elasticity between GDP and IMD score is -1.0**: a 1% contraction in GDP corresponds with a 1% increase in IMD score. To provide a range of estimates here, alternative elasticities of -0.5 and -2.0 have been tested, where change in GDP has half and double the effect on IMD score respectively. These elasticity values are fundamentally arbitrary. Research informing the long-term mortality impacts, estimated using the ONS life

tables in [Annex D3](#), provides an elasticity estimate of -0.3 to -0.6 for the relationship between GDP and mortality⁷⁷⁰; but given this IMD-based approach is assuming a relationship between GDP and deprivation score rather than GDP and mortality, it would not necessarily be suitable to use the same level. The -0.5 elasticity presented here falls within the range observed in that analysis.

Applying age-standardised mortality rates in 2018 to the corresponding mid-year population estimates⁷⁷¹, stratified by 2019-based IMD decile group estimates and for males and females separately, the table below shows the number of additional deaths expected for different values of GDP contraction and GDP-IMD score elasticity. This produces an increase in deaths of between 1.2% and 6.8% in England as a result of the negative economic impact from COVID-19 and associated NPIs, with a central estimate of 3.1%. This is between 6,800 and 38,300 additional deaths per year, with a central estimate of 17,400 per year. Following this methodology's assumptions, this proportion of additional deaths would persist until GDP recovered.

Table 51. Estimates of the number of additional deaths per year¹ in England, using 2019-based IMD and 2019 mid-year population data

	GDP contraction		
	10%	12.8%	15%
-0.5 elasticity GDP-IMD score	6,800 (1.2%)	8,800 (1.6%)	10,300 (1.8%)
-1.0 elasticity GDP-IMD score	13,700 (2.4%)	17,400 (3.1%)	20,200 (3.6%)
-2.0 elasticity GDP-IMD score	26,500 (4.7%)	33,200 (5.9%)	38,300 (6.8%)

¹ This number of additional deaths per year would continue for as long as GDP contractions continue, per this methodology's assumptions.

There are several important points to consider when interpreting these estimates, which are explored in more detail below:

1. These results are deaths *per year* in the long-term, for as long as GDP remains contracted.
2. We have assumed a contemporaneous and simultaneous relationship between GDP and deprivation, such that changes in GDP and IMD scores coincide in terms of their timing.
3. This approach is measuring a different effect to that of the life tables approach in [Annex D3](#).
4. This approach does not increase the mortality rate for the most deprived decile group.
5. It could be expected that less deprived areas are less affected by the economic impacts of COVID-19.
6. These results are produced by adjusting final IMD score post-standardisation.
7. These estimates are based on age-standardised mortality rates.

1. These results are deaths *per year* in the long-term, for as long as GDP remains contracted.

With this methodology mortality is linked to GDP such that deaths occur per year for as long as GDP remains at that low level. Using the numbers in Table 51 for the 1.0 elasticity scenario, if we experience five years with GDP contracted by 15%, and then five years with an improved contraction

of 10%, we would observe 20,200 additional deaths per year due to deprivation for five years, then 13,700 per year for the remaining five years. So as GDP recovers, the excess mortality rate reduces towards 0.

This is both a function and a limitation of this simpler approach to increasing levels of deprivation. In reality, a short-term drop in GDP will not likely increase deprivation to a great extent, so we would not expect additional deaths due to deprivation on this scale – especially if GDP recovers fully as quickly as within the current calendar year, as many predict. This does not mean there are no negative effects of short-term economic shocks on health and mortality.

2. We have assumed a contemporaneous and simultaneous relationship between GDP and deprivation, such that changes in GDP and IMD scores coincide in terms of their timing.

In reality there are reasons to expect the impact of deprivation not to emerge immediately when GDP reduces, and not to disappear as soon as GDP recovers. The most deprived areas of the country also experience low social mobility, and therefore people in these areas ‘accrue’ poor health over their lifetime. People in areas which move into a worse-off economic group from a less deprived one will not necessarily have the same health characteristics as others who have experienced that level of deprivation for longer. As mentioned above, this does not mean there is not a great burden of poverty on affected individuals. Also, in reality a long-term drop in GDP could increase levels of deprivation which persist even once GDP recovers.

This calculation does not account for either of those effects. As a result, it likely overestimates increases in mortality in the early years of a longer-term recession but underestimates the residual impact once GDP recovers (by estimating the latter as zero).

3. This approach is measuring a different effect to that of the life tables approach in [Annex D3](#).

This result differs from the estimate produced using ONS life tables in several ways. The life tables estimate (approx. 14,600 additional deaths) is the total impact of a short-term recession on one age cohort of the population, where the total death estimate would occur over several years. The IMD-based estimate provides an illustration of what the longer-term impacts could be per year in the event of a much longer recession.

The IMD-based results (central estimate here of 17,400 additional deaths per year) are of a similar scale to the life table results *if* a GDP contraction only persists for one year, because the total mortality impact would be the per-year expected additional deaths multiplied by 1 year. The life table approach focuses on a single cohort rather than the whole population, but that cohort is expected to experience the greatest change in mortality due to economic shift during their developmental years, which could explain why the life table estimate is only below the IMD estimate by a small amount.

When compared outside of the one-year scenario, we do not anticipate the numbers would be consistent. This is because the IMD estimate is investigating the illustrative scenario of a prolonged recession.

4. This approach does not increase the mortality rate for the most deprived decile group.

We would expect to see increased mortality in the group already experiencing greatest deprivation in this longer-term scenario. To investigate the impact of this decile group’s mortality also increasing, an alternative calculation identified any LSOA whose IMD score increased beyond the current maximum (the upper bound of decile group 1) to become part of a new 11th group. The age-standardised mortality rate for this new group is estimated by extrapolating the change in the rate

between decile groups 1 and 2. In the base case, this leads to little over 200 additional deaths, and no change at 1 decimal place to the corresponding percentage increase of 3.1%. Very few LSOAs move into this new high-deprivation group because the IMD score distribution is positively skewed with a long upper tail, such that only 27 of the 32,844 LSOAs in England move beyond the current maximum IMD score. As such this adjustment has not been added to the base case methodology.

Further analysis could expand upon how the mortality rate for the most deprived LSOAs could be increased with this methodology; but given the small effects for this sensitivity analysis, and lack of evidenced mortality rate for the new high-deprivation group, this has not been explored further in this analysis.

5. It could be expected that less deprived populations are less affected by the economic impacts of COVID-19.

With this method, a proportional increase in IMD score was uniformly applied to all LSOAs, irrespective of their starting decile group. In the base case, we observe that additional deaths occur in the four most deprived decile groups, with the number of deaths falling in decile groups 5 to 10 due to a net decrease in population size in these groups as IMD scores are inflated.

6. These results are produced by adjusting final IMD score post-standardisation.

Summary IMD scores are comprised of various individual indicator scores which have been transformed and standardised. The combined scores are intended to be used to measure relative deprivation rather than adjusted in this way. By basing this analysis on the overall IMD score, this approach adds additional uncertainty to estimating the magnitude of change in mortality that might be expected from increasing the magnitude of these scores. However, the relationship between all-cause mortality rates and IMD score is an accepted comparison with results published by ONS in this format; and the impacts of recession on deprivation will occur in multiple of the IMD's seven domains⁷⁷², such that using combined score to estimate changes to mortality rates should produce an acceptable measure. A more detailed consideration of which indicators within IMD are expected to change in tandem with a recession, and the impact this has on overall IMD score, could be more valid; but would rely on a greater number of specific assumptions about the recession expected to occur.

7. These estimates are based on age-standardised mortality rates.

It could be that different age groups are affected differently by an economic downturn, which is not accounted for in this analysis. For example, the working age population will be most impacted by increases in unemployment; and the older population will be most impacted by austerity measures which impact healthcare and social security. Further analysis could improve the estimates so specific domains of the IMD are impacted, to simulate these age effects.

D5: Global Burden of Disease Methodology

Most estimates in this paper are building on disease- and risk factor-specific incidence (I), prevalence (P), deaths (D), years of life lost (YLL), and years lived with disability (YLD) estimates by the Global Burden of Disease Study (GBD)⁷⁷³⁷⁷⁴. The general methodology is as follows:

Risk factors

1. An illustrative assumption is made on the percentage change in the risk factor-specific morbidity and mortality during lockdown on the basis of the available evidence.
2. Assuming uniform distribution of D, YLL and YLD over the course of the year, the assumption is applied on 1/12 of the GBD estimate of the annual D, YLL, and YLD to express the marginal change in D, YLL, and morbidity QALYs, respectively, per month of lockdown. For simplicity, equivalence is assumed between YLD and morbidity QALYs. As YLD is calculated as $YLD = I * DW * L$ ⁷⁷⁵ (where DW = disability weight, L = average duration of the resulting condition(s)), in effect YLD expresses the number of years lived with full (i.e. 100%) disability by all new cases within a year. Assuming that 100% disability equals 0 Quality of Life, the marginal change in YLD is an appropriate proxy for the marginal change in morbidity QALYs. The crucial difference is that no discounting is applied in YLD in the GBD from 2010 onwards⁷⁷⁶. As L is not published by the GBD for risk factors, it is not possible to apply time-discounting on the morbidity QALY estimates, which are therefore likely to overestimate the true morbidity QALYs. However, given most conditions have limited (e.g. a few years) duration, this is not likely to materially change the estimates.
3. To estimate the change in mortality QALYs, first, the remaining life expectancy (LE) of the average fatality is calculated as: D/YLL ⁷⁷⁷. Then, the mortality QALYs for the average fatality is calculated by taking the present discounted value (with 1.5% discount rate) of the corresponding age-specific Health-Related Quality of Life (QoL) scores based on age-specific average EQ-5D scores from the Health Survey for England (HSE 2017)⁷⁷⁸, evaluated with Euroqol's value set⁷⁷⁹, and ONS Life Tables⁷⁸⁰. An example calculation is given in the footnote³⁸. The mortality QALYs for the average fatality is then multiplied by the marginal change in deaths per month of lockdown to get the change in mortality (QALYs) at the population level.
4. Total QALYs are the sum of morbidity and mortality QALYs.

Diseases and injuries

The applied methodology is similar as for risk factors, except that morbidity QALYs can now be adjusted for discounting. This is because L can be calculated for diseases and injuries as: $L = P/I$. Then, the morbidity QALY for the average sufferer can be calculated as the present discounted value (with 1.5% discount rate) of the future DW stream for L time periods using the annuity due formula: $DW * ((1 - (1.015^{-L})) / 0.015) * 1.015$.

³⁸ For example, if $LE = 20$, then, using ONS Life Tables, it is established that the average age of death is around 65. The HSE suggests that the average QoL values from age 65 onwards are: 0.814, 0.811, 0.808, and so on... These QoL values for 20 years, starting from age 65, are discounted (using 1.5% rate) and summed to get 13.3 mortality QALY.

Annex E: Evidence review methodology

This paper has been significantly informed by reviewing the evidence available in different forms. It should be noted however that the evidence shown in the following annexes does not represent an exhaustive or comprehensive literature. The following section details our approach to monitoring the evidence base around morbidity and mortality impacts of COVID-19.

To develop our understanding of the potential areas of indirect morbidity and mortality that may arise as a result of COVID-19, we initially reviewed DHSC's single departmental plan⁷⁸¹ to assess where health impacts might occur. Following this, we have regularly monitored the academic literature, media coverage of the pandemic as well as stakeholder views, in a number of ways:

Academic literature

- Daily monitoring of PHE COVID-19 email alerts⁷⁸², which identify COVID-19 related publications in PubMed.
- Regularly monitoring email updates from specific journals of their latest publications, including The Lancet, the British Medical Journal (BMJ) and Thorax.
- Monitoring regular Google Scholar alerts for coronavirus or COVID-19 publications.
- Checking regular publications from public opinion and social research consultancies, such as YouGov and Ipsos MORI, as well as updates from ongoing survey studies during the pandemic, such as the COVID-19 Social Study conducted by UCL.
- For specific topics, we have also used the Centers for Disease Control Downloadable Database⁷⁸³ of articles published on COVID-19, such as the impact on COVID-19 survivors (e.g. survive*) and the social care (e.g. social care, carer*) workforce, to identify recent research on targeted areas of interest.

Media

- Monitoring every news outlet on a regular basis is not possible with the time and resources available; on some days, it is estimated that DHSC's media database returns 100 to 200 articles on coronavirus and there is likely to be some repetition of topics between publications.
- We have regularly monitored the outputs of a range of publications to incorporate a diversity of perspectives; amongst others, this has included the BBC, the Telegraph, the Guardian, the i newspaper, the Financial Times as well as opinion pieces from the BMJ and the Health Service Journal.
- We have also intermittently monitored publications from think tanks and NGOs, such as the Health Foundation, IPPR and the King's Fund.
- Monitoring media publications has also uncovered research and briefings produced by charities and third sector organisations. In addition to this, we have conducted specific web searches on certain topics to identify reports published by charities in relevant sectors (e.g. Carers UK publication detailing a survey of carers during the pandemic).

Whilst we have attempted to monitor and factor in a range of views and resources, this approach is by no means exhaustive and does not replicate a full, comprehensive literature review.

Annex F: UK estimates

As noted in Section 3, this paper provided estimates of mortality and morbidity impacts for England only. This annex presents estimates at a UK level for future excess deaths (excluding those estimated to have already occurred). For all estimates we have scaled up England estimates, assuming England represents 84% of the UK population. The only exceptions to this are Category D estimates for social distancing measures, for which the original estimates were UK level and scaled down to England for the purposes of the main paper; and Category C4 estimates, where estimates have been scaled up by 25%, based on estimates of the distribution of cancer patients in the DAs. The figures below represent central estimates. The table covers estimates from March 2020 onwards, including excess deaths to date.

Table 52. Comparison of England and UK estimates of mortality and morbidity impacts

Category of Harm		Time period	Mortality				Morbidity		
			Excess deaths		QALYs lost		QALYs lost		
			England	UK	England	UK	England	UK	
A	Directly from COVID-19	1 year	67,000	82,000	530,000	641,000	40,000	47,000	
B	From COVID-19 as a result of lack of NHS critical care capacity	It is judged that there have been no cases of NHS critical care capacity being breached to date, and none are anticipated within the CSS.							
C1	From changes to emergency care, to respond to COVID-19	Impact on patients	1 year	15,000	18,000	41,000	48,000	140,000	160,000
			Impact on healthcare staff	Not quantified	Not quantified	Not quantified	Not quantified	17,000	22,000
C2	From changes to adult social care, to respond to COVID-19	Impact on service users	1 year	26,000	31,000	73,000	86,000	Not quantified	Not quantified
			Impact on social care staff	Not quantified	Not quantified	Not quantified	Not quantified	21,000	27,000
C3	From changes to elective care, to respond to COVID-19	1 years	12,500	15,000	185,000	221,000	Not quantified	Not quantified	
C4	From changes to primary and community care, to respond to COVID-19	5 years	1,420	1,770	3,500	4,000	260	325	
D1	Social distancing measures	1 year	7,230 fewer deaths	8,740 fewer deaths	60,000 QALYs saved	71,300 QALYs saved	117,000	129,000	
D2	Economic impacts increasing deprivation	Medium-term	17,900	21,400	156,500	185,700	438,000	520,000	
		Long-term	14,600	17,300	293,800	348,600	Not quantified	Not quantified	

Annex G: Comparison to unmitigated scenario

In this section we show the results of comparing the total deaths expected over 12 months with the CSS as compared to the “unmitigated Reasonable Worst Case (RWC) Scenario 31st March”. This is a scenario provided to SAGE to represent what might feasibly have occurred if no changes occurred to reduce the spread of the virus, such as through social distancing measures and other non-pharmaceutical interventions. The results are shown in the table below.

Table 53 Comparison with “unmitigated RWC scenario 31st March”

Comparison with unmitigated RWC scenario			
Health impact category	CSS (covers 12 months from Mar '20 to Mar '21)	Unmitigated RWC Scenario 31 st March	
A. Direct impact from COVID-19	85,000 COVID-19 deaths (12 months from March 2020 to end March 2021) We estimate that around 67,000 of those are excess deaths. 700,000 years of life lost. 530,000 QALYs lost	504,000 COVID-19 deaths. 439,000 (410,000 to 454,000) excess deaths 4,000,000 (2,700,000 to 5,100,000) years of life lost. 3,000,000 (2,800,000 to 3,500,000) QALYs lost	Comparing this to the mitigated scenario suggests 420,000 COVID-19 deaths would have occurred if mitigations were not put in place. Of this, we estimate that around 380,000 would be excess deaths , equivalent to 2,500,000 QALYs .
B. Health outcomes for COVID-19 worsened because of lack of NHS critical care capacity	No impact	1,100,000 COVID-19 deaths Up to 1,000,000 (900,000 to 1,010,000) excess deaths 11,000,000 (8,600,000 to 15,000,000) years of life lost 7,400,000 (5,400,000 to 9,600,000) QALYs lost	These are the indirect deaths from COVID-19 due to insufficient critical care beds. We estimate up to 1.1M additional deaths, or up to 1M excess deaths This takes into account the additional beds that were made available through Nightingale hospitals and cancelling non-urgent care. These excess deaths represent up to 9M to 15M years of life lost and 6M to 10M QALYs lost

Discussion:

It is important to note that the estimates for health impacts in Category C and D have not been developed for the unmitigated RWC. It is reasonable to assume a very significant impact Category C, as hospitals would be over-run with COVID-19 patients. The economic impacts are unclear.

Comparing the total impact across Categories A and B suggests that lives saved due to mitigations could total up to 1.5m. This estimate does not include Category C and D deaths, which without mitigation would also be higher in the short-term.

However, this is a very limited comparison and many other factors have not been considered; it is difficult to know whether mitigating the pandemic may lead to impacts over a longer term and therefore greater impacts on the economy and the healthcare system.

For further information on the methodology to estimate the excess deaths in the unmitigated scenario in categories A and B, see annexes A and B.

Annex H: Results for all SAGE planning scenarios

SAGE signed off five planning scenarios on 21st May 2020. So far in this paper we have based all the analysis on one of these scenarios (Scenario 2, or the CSS). In this section we show the results if we apply the same methodology to the remaining four scenarios

Description of SAGE planning scenarios

The scenarios are illustrated in the graph below. These were developed with the expertise of SPI-M to provide a helpful range of plausible futures. These scenarios were generated by SPI-M based on the information available at the time. They are not forecasts and they do not attempt to reflect specific combinations of policies, or conclude what might happen as the result of specific actions. They are not official Government planning scenarios. Behind each scenario is a set of detailed data generated by SPI-M which we have been able to source for this work.

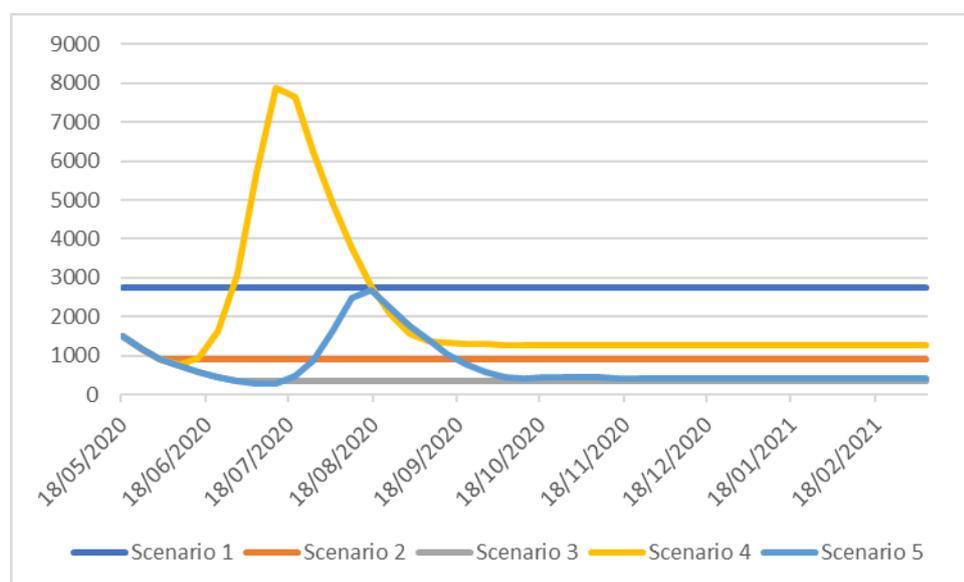


Figure 13 Weekly COVID-19 deaths in England (all settings) in scenarios 1-5

The height and shape of the scenarios are determined by how R^{39} changes over time. The first three flat-line scenarios (Scenarios 1, 2 and 3) show $R=1$ on 18th May, 1st June and 1st July respectively (based on the short-term forecasts generated by SPI-M at the time), and remains at that level for the rest of the year.

The other two scenarios model a second wave, with Scenario 4 showing $R=1.7$ in June before being reduced to 0.7 in July and August and returning to 1 in September and remaining constant for the rest of the year. This scenario is the most pessimistic scenario signed off by SAGE, and features a second peak roughly the same size as the first. This is similar to Scenario 5, however a smaller second wave is modelled, a month later than Scenario 4. The scenario is showing $R= 1.7$ in July before being reduced to 0.7 in August and September and then returning to 1 in October and remaining constant for the rest of the year. All scenarios signed off by SAGE only cover up to

³⁹The reproduction number is a way of rating a disease's ability to spread. It's the number of people that one infected person will pass the virus on to, on average.

December 2020 and therefore for all scenarios we assume R remains at 1 from then until March 2021.

These scenarios provide the key inputs to estimating Category A – direct COVID-19 deaths, and the morbidity impact for survivors. They also affect Category C (i) and (ii) – deaths from a lack of access to emergency hospital care and deaths in care homes. These are assumed to scale linearly with the direct COVID-19 deaths. Other categories of harm (Category C (iii), (iv) and Category D) do not account for these scenarios and therefore have not been adjusted in this annex.

Table 54 Excess deaths for scenario 1 to 5

Health impact category	Scenario 1	Scenario 3	Scenario 4	Scenario 5	Scenario 2 (COVID-19 Static Scenario, CSS)
A. Direct impact from COVID-19	134,000	50,000	109,000	61,000	67,000
C (i) From changes to emergency care, to respond to COVID-19	30,000	11,000	25,000	14,000	15,000
C (ii) From changes to adult social care, to respond to COVID-19	51,000	19,000	42,000	24,000	26,000
Categories C(iii), C(iv) and D combined	Not estimated	Not estimated	Not estimated	Not estimated	[excluded to aid comparison]
TOTAL of A, Ci, and Cii	215,000	80,000	176,000	99,000	108,000

Table 55 Lost QALYs for scenario 1 to 5

Health impact category	Scenario 1	Scenario 3	Scenario 4	Scenario 5	Scenario 2 (COVID-19 Static Scenario, CSS)
A. Direct impact from COVID-19	1,010,000	372,000	677,000	402,000	530,000
C (i) From changes to emergency care, to respond to COVID-19	77,000	29,000	58,000	33,000	41,000
C (ii) From changes to adult social care, to respond to COVID-19	141,000	53,000	118,000	66,000	73,000

Categories C(iii), C(iv) and D combined	Not estimated	Not estimated	Not estimated	Not estimated	[excluded to aid comparison]
TOTAL of A, Ci, and Cii	1,230,000	454,000	853,000	501,000	644,000

- The range of estimates for total excess deaths range from an additional 78,000 (Scenario 1) to 28,000 fewer excess deaths (Scenario 3) as compared to the COVID-19 Static Scenario.
- The range of estimates for total QALY impact range from an additional 586,000 (Scenario 1) to 190,000 fewer QALY impact (Scenario 3) as compared to the COVID-19 Static Scenario. The difference between Scenario 1 and Scenario 3 is 135,000 excess deaths and 776,000 QALYs.

Discussion

This analysis illustrates some of the potential health impacts of a significant second peak as compared to bringing incidence down to a lower level before maintaining R at 1 for the rest of the year. It is important to note that these calculations are incomplete and hence are inappropriate for use in quantifying the health impacts of different courses of Government action.

In particular, this analysis does not attempt to estimate the differential impact from Category D for each scenario (i.e. the direct impact of social distancing measures, and the indirect impact from a recession), which would counteract some of this difference; and as such it is limited in terms of what conclusions can be drawn from this. For example, tighter social distancing measures would make Scenario 3 more likely but would increase Category D health impacts, and relaxing social distancing measures would make Scenario 1 more likely but would decrease Category D impacts. Estimating the corresponding Category D impacts for each scenario would require significant additional assumptions to be made and would be extremely uncertain and sensitive to many additional factors, such as the effectiveness of Test & Trace, and other measures such as face coverings. We have therefore decided not to attempt this within the scope of this paper.

The range of outcomes presented in Table 54 and Table 55 present a picture of the health impacts of COVID-19 and illustrates some of the uncertainty in the period to March 2021. Applying these alternative estimates to Category A, C(i) and C(ii) represents a range in total QALY impact from +91% to -30% impact. This is clearly a very significant aspect of uncertainty, but it is still just one of many uncertainties in the QALY estimates within this paper.

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- ²⁸⁰ This is from a bespoke dataset provided by PHE for this analysis and is not in the public domain.
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