Reasonable worst-case planning scenario – 30 July 2020

Purpose: To help government departments plan for the impact of COVID-19, this document sets out the reasonable worst-case planning scenario as agreed by SAGE (Scientific Advisory Group for Emergencies) on 30 July 2020. This reasonable worst-case scenario (RWCS) is available for the whole of the UK, for devolved nations, and the seven NHS regions of England. The differences between the scenarios lie in the assumptions made about rate of epidemic growth as a result of relaxing and re-implementing behavioural and social interventions (BSIs).

It should be noted that **this is a scenario, not a prediction**. The precise timings of peaks in infection and, in particular, demand on healthcare are subject to **significant uncertainty**. The scenarios are sensitive to initial conditions and any increase in the starting estimates of numbers of infections, hospitalisations, or deaths could lead to a larger peak.

These assumptions will be kept under review and amended as the scientific and medical advice develops, and implications of the current measures are further understood.

For the RWCS, deaths, ICU occupancy, hospital admissions and new infections are modelled from July 2020 until March 2021. The scenario models incidence continuing as per current trends until the end of July 2020, with all non-household contacts assumed to be constant with current levels. Incidence is then assumed to double once by the end of August 2020, and double again during the first two weeks of September. At this point, policy measures are implemented that reduce R to approximately 1, keeping infection levels steady until the end of October. Two-week doubling times return throughout November (i.e. incidence quadruples through November), after which policy measures are put in place to reduce non-household contacts to half of their normal pre-March 2020 lockdown levels, while all schools contacts are assumed to be maintained. These measures are sustained until the end of March 2021.

This is only one of several possible scenarios that could lead to a reasonable worst case, all of which could be different and challenging in their own ways; this RWCS has a difficult autumn followed by a large winter peak. It is a reasonable scenario to plan for, however, planners will need to be flexible and be conscious of the limitations of relying on a single scenario.

SAGE provides scientific advice to government. It does not make decisions on what scenario government should be planning for. The Cabinet Office Civil Contingencies Secretariat and COVID-19 Taskforce currently advises that HMG should plan based on the RWC scenario below.

RWCS Assumptions

The RWCS is based on a mitigated second wave of the epidemic, however the changes in the rate of growth of the disease from July to November have been modelled based on incidence doubling times, following which, policy-neutral measures are implemented that lead to a reduction in non-household contacts. This profile of increasing incidence to the end of November 2020, was agreed by SPI-M-O co-chair in collaboration with SAGE and Cabinet Office Civil Contingencies Secretariat and COVID-19 Taskforce. No specific assumptions as to what these measures may be were made.

The model makes a variety of assumptions including:

- Mortality in hospitalised COVID-19 patients treated with dexamethasone is reduced by 17%, based on data from the [RECOVERY study](#).
- Case isolation, household quarantine and contact tracing were assumed to reduce transmission outside of the households by 40%.
- Immunity acquired at any point is maintained over the course of the scenario.

The RWCS model explicitly estimates incidence and subsequent metrics based on the community and hospital transmission. From the first wave of the epidemic, it is known that care homes accounted for a significant proportion of deaths, and their effect needs to be considered in this revised reasonable worst-case scenario as far as practicable. A different model suggests that the division between deaths in care homes and hospitals accounted for approximately a one third to two thirds split respectively during the first wave of the UK epidemic; this model now estimates that, in a second wave, the split would likely be one fifth to four fifths. This means a 25% uplift in incidence has been applied to the RWCS output, in order to represent care homes as far as possible. 25% has been chosen as lower incidence in care homes is anticipated than that seen in the first wave due to a smaller susceptible population and improved mitigations but more pessimistic than those estimated in this other model.

NOTE: This modelling has been performed at the UK, nation and NHS England region level and does not necessarily reflect the variability that might be observed at a more local level. Care must be taken when applying this scenario and its data to smaller geographies as **there will be significantly more variability at more local scales**.

SAGE RWCS planning assumptions – 30 July 2020

The data in tables 1, 2, and 3 provided information that underpins the model that has been chosen by SPI-M and SAGE to provide the RWCS. This model makes various assumptions based on the data available about the how long it takes to progress from one stage of time in hospital e.g. ICU admission to another e.g. discharge, including how this differs by age groups. Table 4 provides headline data for the key metrics (deaths, hospital admissions, peak ICU bed occupancy) across the time frame of the RWCS.

Table 1: Severity estimates for stages of COVID-19[1]

Risk	Proportion (range)
Proportion of infections which have symptoms	66%
Infected people hospitalised	2.4% (0.0% – 8.9%)
Hospitalised (non-ICU) patients transferring to ICU (HDU/ITU)	20.5% (1.5% – 35.2%)
All hospitalised patients dying	23.3% (1.2% – 43.3%)
Overall infection fatality rate	0.7% (0.0% – 9.7%)

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[1] <u>Footnote added for release</u>: Following discussion of these papers at SAGE 49, a technical error was identified, affecting a small number of values in the summary tables. The correct values are given below. Please note that this error only affected these summary tables, and not the underlying model outputs used by the Cabinet Office Civil Contingencies Secretariat and circulated to central and local planners.

<u>Table 1: Corrected values (changes shown in italics)</u>
Hospitalised (non-ICU) patients transferring to ICU (HDU/ITU): *20.6%* (1.5% – 35.2%)
All hospitalised patients dying: *22.9%* (1.2% – 43.3%)
Overall infection fatality rate: *0.8%* (0.0% – *9.6%*)

Table 2: Average length of stay for COVID-19 hospitalisation phases[2]

Period	Mean length of stay in days (range)
Hospital (non-ICU) admission to transfer to ICU (HDU/ITU)	2.0
Hospital (non-ICU) admission to death or discharge *without* an ICU (HDU/ITU) admission	8.7 (7.9 – 9.2)
ICU (HDU/ITU) stay	10.6 (8.9 – 12.1)
Hospital (non-ICU) admission to death or discharge *with* an ICU (HDU/ITU) admission[†]	19.0 (17.3 – 20.5)

[†] Includes step-down care in hospital (non-ICU) following ICU stay but prior to discharge of 6.4 days.

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Table 2: Corrected values (changes shown in italics)
ICU (HDU/ITU) stay: *10.7* (8.9 – 12.1)
Hospital (non-ICU) admission to death or discharge with an ICU (HDU/ITU) admission[2] *19.1* (17.3 – 20.5)

Table 3: Severity parameters by five-year age group for the RWCS model[3]

Age band	Proportion of infected people who are hospitalised	Proportion of hospitalised cases in need of ICU	Proportion of infected people who die	Proportion of hospitalised cases who die
0 to 4	0.1%	6.0%	0.0%	1.2%
5 to 9	0.0%	5.5%	0.0%	1.3%
10 to 14	0.1%	5.2%	0.0%	1.3%
15 to 19	0.2%	5.3%	0.0%	1.4%
20 to 24	0.4%	5.9%	0.0%	1.6%
25 to 29	0.8%	7.3%	0.0%	2.0%
30 to 34	1.3%	10.1%	0.0%	2.7%
35 to 39	1.8%	15.3%	0.1%	4.1%
40 to 44	2.2%	22.4%	0.1%	6.5%
45 to 49	2.9%	29.2%	0.3%	10.0%
50 to 54	4.2%	33.9%	0.7%	14.5%
55 to 59	5.0%	35.2%	1.1%	20.1%
60 to 64	6.6%	32.1%	2.1%	26.0%
65 to 69	7.1%	24.4%	2.9%	31.3%
70 to 74	8.0%	14.2%	4.0%	35.6%
75 to 79	8.9%	6.6%	5.3%	39.2%
80+	8.2%	1.5%	6.0%	43.3%
CH worker	3.1%	22.1%	0.3%	8.3%
CH resident	8.5%	1.5%	9.7%	43.3%
Average	**2.4%**	**20.5%**	**0.7%**	**23.3%**

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Table 3: Corrected values (changes shown in italics)

Age band	Proportion of infected people who are hospitalised	Proportion of hospitalised cases in need of ICU	Proportion of infected people who die	Proportion of hospitalised cases who die
CH resident	*8.4%*	1.5%	*9.6%*	43.3%
Average	2.4%	*20.6%*	*0.8%*	*22.9%*

Table 4: Key RWCS headline data based on epidemiological modelling, to support HMG planning decisions.

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Number of direct COVID-19 deaths This is the number of **confirmed** COVID-19 deaths for hospitals and the community, with a 25% uplift to reflect care home deaths. It does not include deaths which are not captured in headline data, additional COVID-19 deaths that could occur due to lack of NHS capacity, or other excess deaths	**85,000** (to the nearest 1,000, 1st July 2020 to 31st March 2021) **Daily direct covid-19 deaths over 500** for at least 90 days (**Peak 800** – nearest 100, late February 2021) **The peak weeks are from early-January 2021 and continues past the end of the scenario on 31 March 2021**
Number of cases requiring hospitalisation	**356,000** (nearest 1,000, 1st July 2020 to 31st March 2021)
Peak daily hospital (non-ICU) occupancy	**25,000** (nearest 1,000, late February 2021)
Peak daily ICU occupancy	**6,000** (nearest 1,000, early March 2021)

RWCS data for the nations and regions

Regional and devolved nation breakdowns are available for the RWCS. This scenario, however, was designed to consider the whole UK. As policy responses to the epidemic are likely to differ between the devolved nations, it would be expected that each of Scotland, Wales, and Northern Ireland would have different trajectories over time; devolved administrations will want to take this into account when considering this paper.

When case numbers are low, due to small populations and/or low incidence as is the case in the devolved nations, uncertainty increases and fluctuations in the data can have a significant impact on estimates. Significant variability across a region, for example due to a local outbreak, can also add to uncertainty. Care must therefore be taken when applying this scenario and its data to these smaller geographies.

Table 5: Key RWCS headline data based on epidemiological modelling for each devolved nation, to support planning decisions from 1st July 2020 to 31st March 2021.

|	England	Scotland	Wales	Northern Ireland
Number of direct COVID-19 deaths This is the number of **confirmed** COVID-19 deaths for hospitals and the community, with a 25% uplift to reflect care home deaths. It does not include deaths which are not captured in headline data, additional COVID-19 deaths that could occur due to lack of NHS capacity, or other excess deaths	77,000	2,600	4,400	1,900
Number of cases requiring hospitalisation	323,000	11,000	18,000	7,000
Peak daily ICU occupancy	5,000	300	400	100

Figure 1: RWCS daily direct COVID-19 deaths for Scotland, Wales and Northern Ireland, actual data to end of June, RWCS estimation from 1st July 2020 to 31st March 2021.

Devolved nations: Daily direct COVID-19 deaths
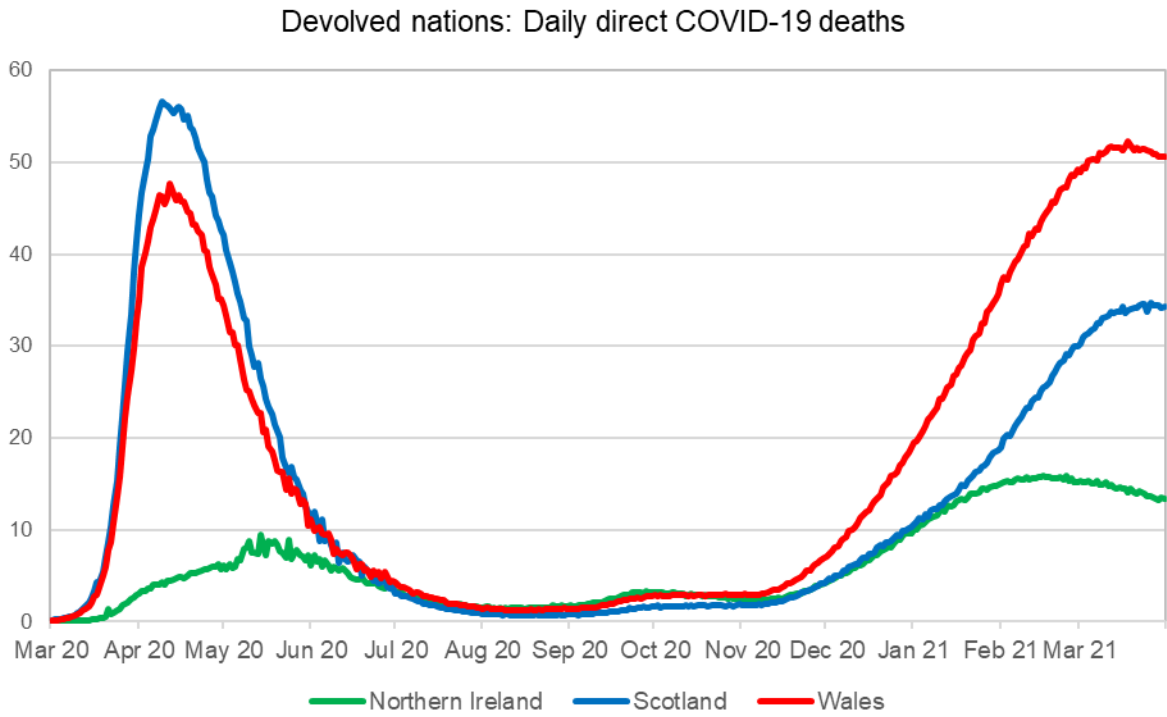
Annex A: RWC Scenario Graphs UK

Figure 1: Number of deaths directly from COVID-19 under RWC planning scenario

Direct COVID-19 deaths per day
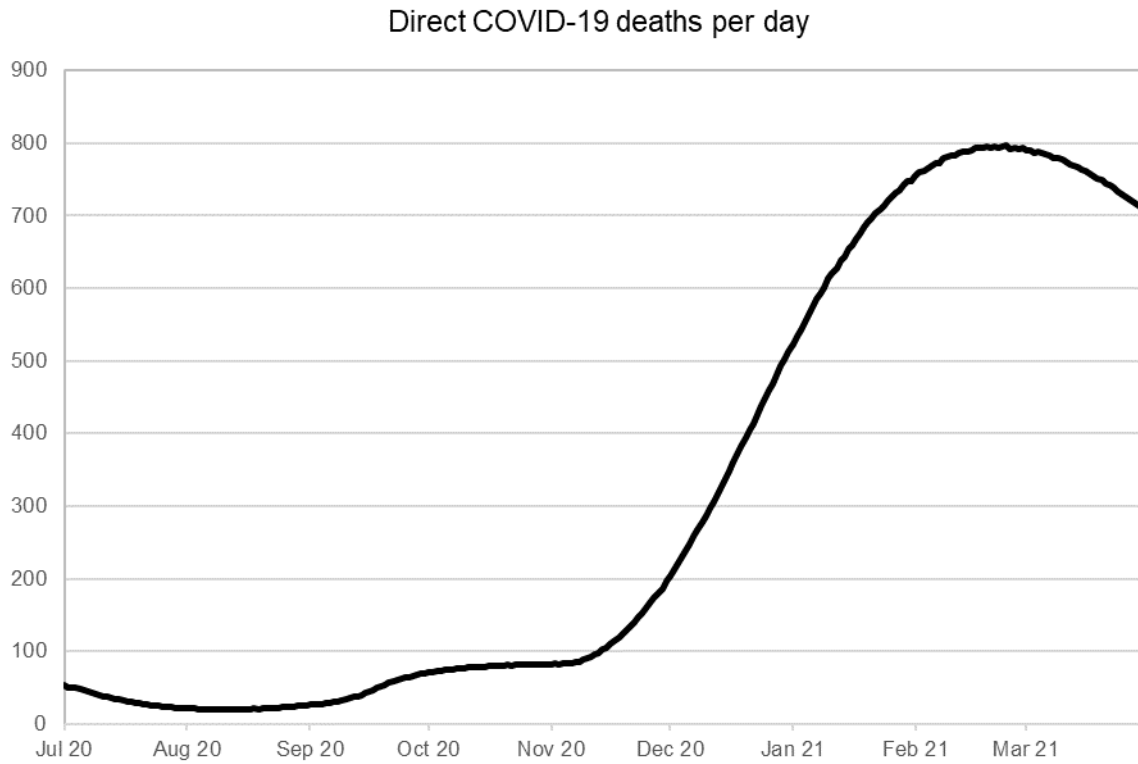
Figure 2: ICU occupancy under RWC planning scenario

ICU beds occupancy per day
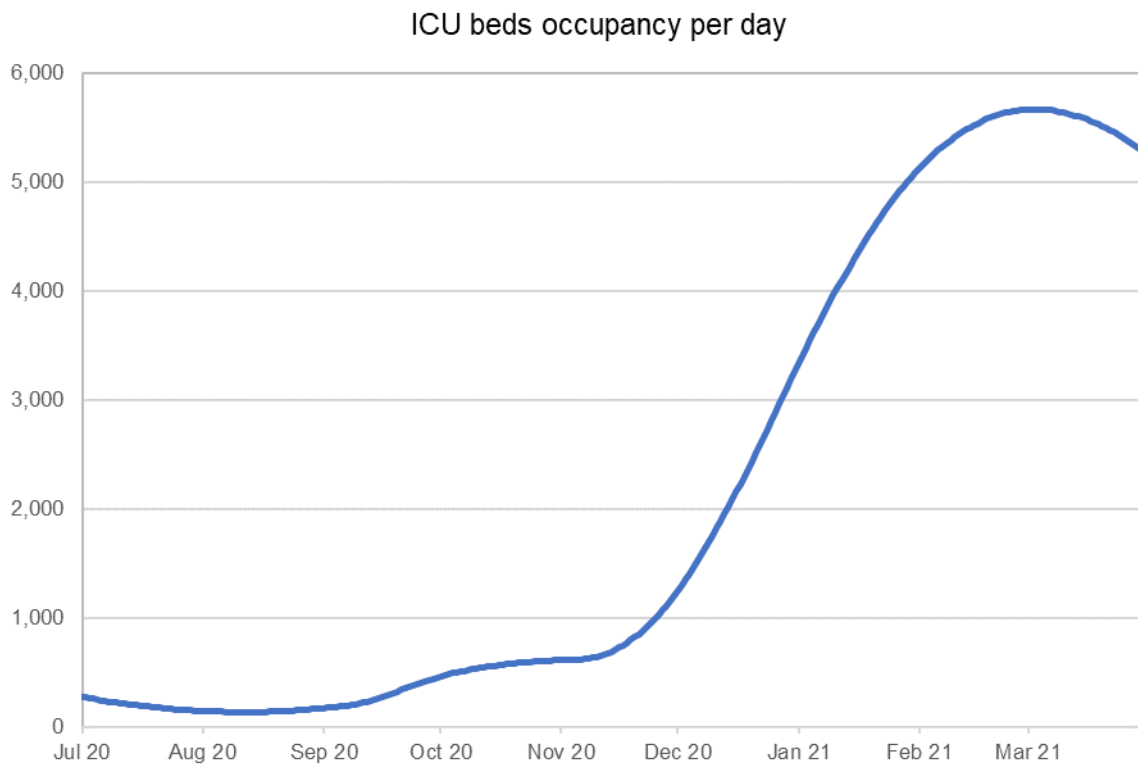
Figure 3: Number of hospital admissions per week under RWC planning scenario

New and newly confirmed patients in hospital per day
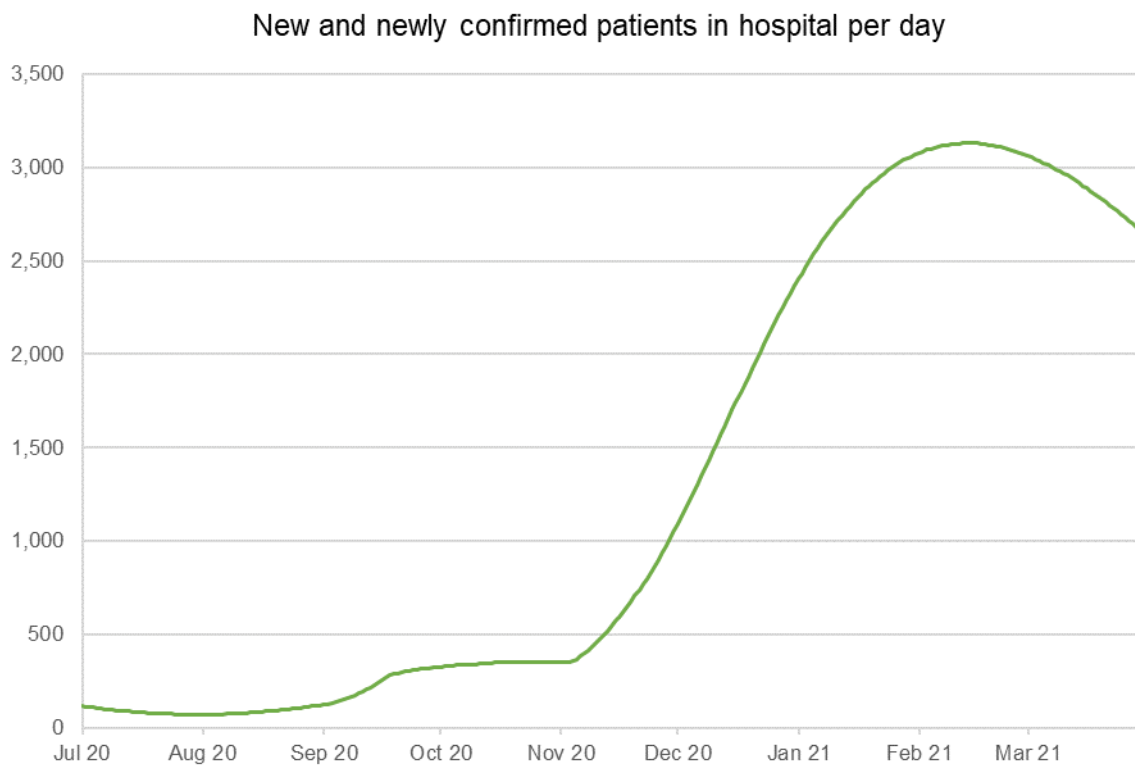
Figure 4: Number of new infections per week under RWC planning scenario
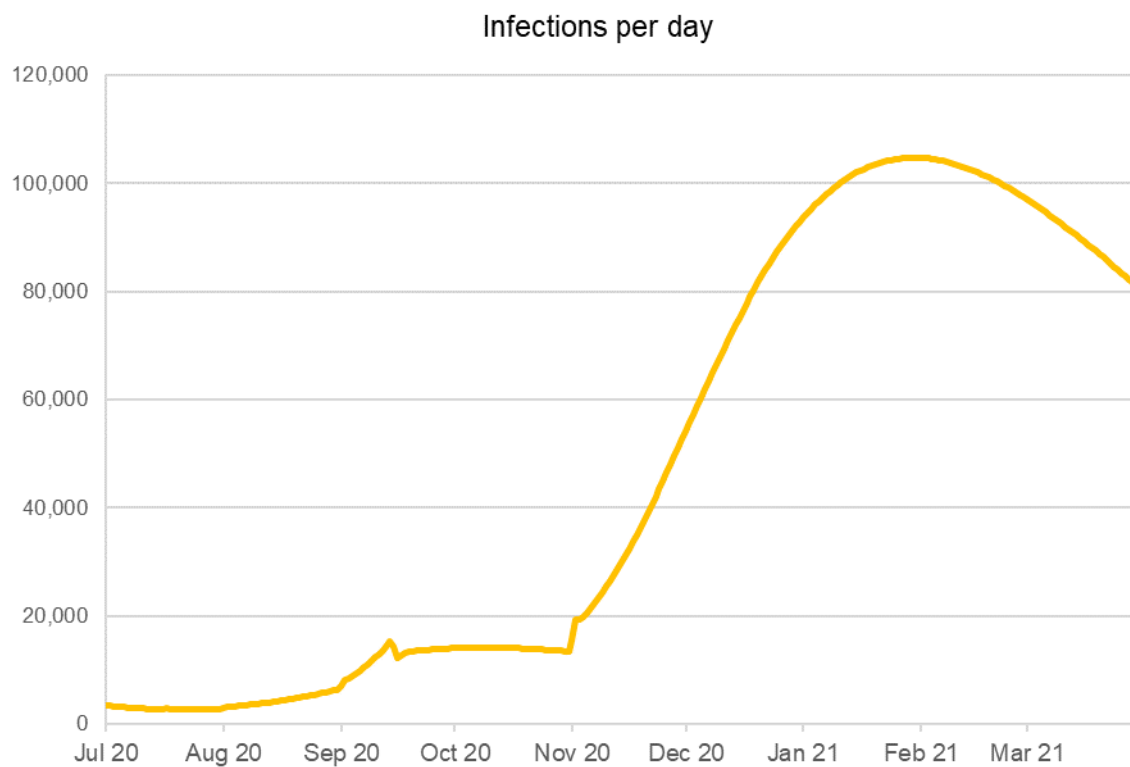
Infections per day

Annex B: RWCS Data Tables – UK

Dates	Deaths	Infections	Hospitalisations	Hospital occupancy (non-ICU)	ICU occupancy	Deaths (per 100k)	Infections (per 100k)	Hospitalisations (per 100k)
01 Jul 2020	0.3k	22.9k	0.8k	1.2k	0.3k	0.5	34.0	1.1
08 Jul 2020	0.3k	20.3k	0.6k	1.0k	0.2k	0.4	30.2	1.0
15 Jul 2020	0.2k	19.8k	0.6k	0.8k	0.2k	0.3	29.5	0.8
22 Jul 2020	0.2k	19.7k	0.5k	0.7k	0.2k	0.3	29.4	0.8
29 Jul 2020	0.1k	21.4k	0.5k	0.7k	0.1k	0.2	31.8	0.7
05 Aug 2020	0.1k	25.3k	0.5k	0.6k	0.1k	0.2	37.7	0.8
12 Aug 2020	0.1k	29.8k	0.6k	0.6k	0.1k	0.2	44.4	0.9
19 Aug 2020	0.2k	35.5k	0.7k	0.7k	0.1k	0.2	52.8	1.0
26 Aug 2020	0.2k	43.1k	0.8k	0.8k	0.2k	0.3	64.2	1.2
02 Sep 2020	0.2k	66.8k	1.0k	0.9k	0.2k	0.3	99.4	1.5
09 Sep 2020	0.3k	95.3k	1.5k	1.1k	0.2k	0.4	141.8	2.2
16 Sep 2020	0.4k	92.4k	2.0k	1.5k	0.3k	0.5	137.5	3.0
23 Sep 2020	0.5k	97.2k	2.2k	1.9k	0.4k	0.7	144.7	3.3
30 Sep 2020	0.5k	98.9k	2.3k	2.2k	0.5k	0.8	147.1	3.5
07 Oct 2020	0.5k	99.2k	2.4k	2.5k	0.5k	0.8	147.6	3.6
14 Oct 2020	0.6k	98.4k	2.4k	2.6k	0.6k	0.8	146.5	3.6
21 Oct 2020	0.6k	96.6k	2.5k	2.7k	0.6k	0.9	143.8	3.7
28 Oct 2020	0.6k	108.5k	2.5k	2.8k	0.6k	0.9	161.5	3.7
04 Nov 2020	0.6k	157.3k	2.8k	2.8k	0.6k	0.9	234.1	4.2
11 Nov 2020	0.7k	210.7k	3.8k	3.2k	0.7k	1.1	313.6	5.7

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Dates	Deaths	Infections	Hospitalisations	Hospital occupancy (non-ICU)	ICU occupancy	Deaths (per 100k)	Infections (per 100k)	Hospitalisations (per 100k)
18 Nov 2020	0.9k	275.1k	5.2k	4.1k	0.9k	1.4	409.4	7.7
25 Nov 2020	1.3k	347.5k	6.9k	5.3k	1.1k	1.9	517.2	10.2
02 Dec 2020	1.7k	423.2k	8.8k	7.0k	1.5k	2.5	629.7	13.1
09 Dec 2020	2.1k	496.4k	11.0k	8.9k	1.9k	3.2	738.7	16.3
16 Dec 2020	2.7k	562.3k	13.2k	11.1k	2.4k	4.0	836.8	19.6
23 Dec 2020	3.2k	617.8k	15.2k	13.5k	2.9k	4.8	919.4	22.7
30 Dec 2020	3.7k	661.7k	17.1k	15.8k	3.4k	5.6	984.7	25.4
06 Jan 2021	4.2k	694.1k	18.6k	17.9k	3.9k	6.3	1,032.9	27.7
13 Jan 2021	4.6k	716.0k	19.9k	19.8k	4.3k	6.9	1,065.6	29.5
20 Jan 2021	5.0k	728.5k	20.8k	21.4k	4.7k	7.4	1,084.2	30.9
27 Jan 2021	5.2k	732.8k	21.4k	22.6k	5.0k	7.8	1,090.6	31.9
03 Feb 2021	5.4k	729.7k	21.8k	23.6k	5.3k	8.0	1,085.9	32.4
10 Feb 2021	5.5k	720.1k	21.9k	24.2k	5.5k	8.2	1,071.7	32.6
17 Feb 2021	5.6k	705.0k	21.8k	24.6k	5.6k	8.3	1,049.1	32.5
24 Feb 2021	5.5k	685.4k	21.5k	24.7k	5.7k	8.3	1,020.0	32.1
03 Mar 2021	5.5k	662.3k	21.1k	24.6k	5.7k	8.2	985.6	31.4
10 Mar 2021	5.4k	636.4k	20.5k	24.2k	5.6k	8.0	947.1	30.5
17 Mar 2021	5.2k	608.7k	19.8k	23.7k	5.5k	7.8	905.9	29.5
24 Mar 2021	5.1k	579.6k	19.0k	23.0k	5.4k	7.5	862.6	28.3

Further data is available for regions and nations in the accompanying spreadsheet

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