

## Evidence check

3 April 2020

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## Ventilation use for COVID-19 patients

### Rapid review question

**What proportion of COVID-19 cases in intensive care units (ICUs) require ventilation?**

### In brief

- Across studies, the proportion of ICU cases requiring mechanical ventilation ranged from 47% to 88%.
- In a French model, the proportion of ICU cases requiring mechanical ventilation was assumed to be 71%, based on data from Yang et al. In a New Zealand model, it was assumed that 45% of cases in ICU require ventilation, with variation by age group.

### Background

Demand for intensive care, and in particular ventilation, is expected to be high throughout the COVID-19 pandemic. Without sufficient social isolation measures to slow the spread of the disease, demand for intensive care may surpass healthcare capacity. Many studies have reported on the proportion of cases requiring intensive care, but less is known about the proportion of cases that require ventilation.

### Limitations

These descriptive data should be interpreted with care as jurisdictions and hospitals vary widely in terms of context, footprint and thresholds for ventilating patients. New data on this topic are emerging rapidly.

### Methods

We searched Google and PubMed for articles on the proportion of COVID-19 ICU cases that require ventilation. The search strings are provided in Appendix 1.

**Results (Table 1 and 2)**

**Table 1: International data**

Study	Findings
Grasselli et al. 6 April 2020 (1) Baseline characteristics and outcomes of 1591 patients infected with SARS-CoV-2 admitted to ICUs of the Lombardy region, Italy	The study included 1591 critically ill patients in Lombardy. Among 1300 patients with available respiratory support data, 99% (1287) required respiratory support, including mechanical ventilation (88%), and non-invasive ventilation (11%).
Bhatraju et al. 30 March 2020 (2) COVID-19 in critically ill patients in the Seattle region – case series	Among 24 patients with confirmed COVID-19 admitted to ICU, 75% (18 patients) needed mechanical ventilation.
Mahase. 24 March 2020 (3) COVID-19: most patients require mechanical ventilation in first 24 hours of critical care	Two thirds (132 out of 196) of COVID-19 patients who required critical care in the UK had mechanical ventilation within 24 hours of admission, an audit of patients from England, Wales, and Northern Ireland has found.
Guan et al. 28 February 2020 (4) Clinical characteristics of coronavirus disease 2019 in China	Among 1099 patients with laboratory-confirmed COVID-19 from 552 hospitals in China, 67 (6.1%) underwent mechanical ventilation.
Yang et al. 24 February 2020 (5) Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study	Of 710 patients with SARS-CoV-2 pneumonia, 52 critically ill adult patients who were admitted to the ICU of Wuhan Jin Yin-tan hospital between late December 2019, and 26 Jan 2020 were included. 37 (71%) patients required mechanical ventilation.
Wang D et al. 7 February 2020 (6) Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China	Of 138 hospitalised patients with COVID-19, 36 patients were transferred to the ICU because of complications. Of the 36 cases in the ICU, 4 (11.1%) received high-flow oxygen therapy, 15 (41.7%) received non-invasive ventilation, and 17 (47.2%) received invasive ventilation (4 were switched to extracorporeal membrane oxygenation).

**Table 2: Models**

Study	Assumption
Wilson et al. 16 March 2020. (7) Potential age-specific health impacts from uncontrolled spread of the COVID-19 pandemic on the New Zealand population using the CovidSIM model: report to the NZ Ministry of Health	Assume 45% of cases in ICU require ventilation, with variation by age group (see Appendix 2 Table 2)
Massonnaud et al. 16 March 2020 (8) COVID-19: Forecasting short term hospital needs in France	Assume 71.1% of cases in intensive care will require mechanical ventilation, based on data from Yang et al.

Study	Assumption
Ferguson et al. 16 March 2020 (9) Report 9: Impact of non-pharmaceutical interventions (NPIs) to reduce COVID19 mortality and healthcare demand	Define critical care as invasive mechanical ventilation or ECMO and assume that 30% of cases that are hospitalised will require critical care. Age-specific rates are also provided (see Appendix 2 Table 1).

## Appendix 1

### PubMed search string

(2019-nCoV[title/abstract] or nCoV\*[title/abstract] or covid-19[title/abstract] or covid19[title/abstract] OR "covid 19"[title/abstract] OR "coronavirus"[MeSH Terms] OR "coronavirus"[title/abstract] OR sars-cov-2[title/abstract] OR "severe acute respiratory syndrome coronavirus 2"[Supplementary Concept]) AND (((((((((((("ventilated"[All Fields] OR "ventilates"[All Fields]) OR "ventilating"[All Fields]) OR "ventilation"[MeSH Terms]) OR "ventilation"[All Fields]) OR "respiration"[MeSH Terms]) OR "respiration"[All Fields]) OR "ventilate"[All Fields]) OR "ventilations"[All Fields]) ) OR "ventilator s"[All Fields]) OR "ventilators, mechanical"[MeSH Terms]) OR ("ventilators"[All Fields] AND "mechanical"[All Fields])) OR "mechanical ventilators"[All Fields]) OR "ventilator"[All Fields]) OR "ventilators"[All Fields]) OR "ventilation"[All Fields]

### Google search

“COVID-19 ventilation”

## Appendix 2

### Ferguson et al Table 1

**Table 1: Current estimates of the severity of cases. The IFR estimates from Verity et al.<sup>12</sup> have been adjusted to account for a non-uniform attack rate giving an overall IFR of 0.9% (95% credible interval 0.4%-1.4%). Hospitalisation estimates from Verity et al.<sup>12</sup> were also adjusted in this way and scaled to match expected rates in the oldest age-group (80+ years) in a GB/US context. These estimates will be updated as more data accrue.**

Age-group (years)	% symptomatic cases requiring hospitalisation	% hospitalised cases requiring critical care	Infection Fatality Ratio
0 to 9	0.1%	5.0%	0.002%
10 to 19	0.3%	5.0%	0.006%
20 to 29	1.2%	5.0%	0.03%
30 to 39	3.2%	5.0%	0.08%
40 to 49	4.9%	6.3%	0.15%
50 to 59	10.2%	12.2%	0.60%
60 to 69	16.6%	27.4%	2.2%
70 to 79	24.3%	43.2%	5.1%
80+	27.3%	70.9%	9.3%

Wilson et al Table 2

**Table 2: Age-specific parameters for modelling health impacts for the New Zealand population from the uncontrolled spread of the COVID-19 pandemic**

Age-group (years)	Census 2018 population	Population scaled to 2020	Proportion of symptomatic cases hospitalised*	Proportion of hospitalised cases admitted to ICUs*	Proportion of ICU cases requiring a ventilator*	Proportion of symptomatic cases dying (case fatality risk)*
0-4	294,921	310,718	1.25%	15.0%	35.0%	0.01%
5-17	809,576	852,940	0.50%	20.0%	30.0%	0.0075%
18-49	2,007,859	2,115,407	1.25%	15.0%	45.0%	0.045%
50-64	872,238	918,958	1.75%	20.0%	50.0%	0.10%
65+	715,170	753,477	16.0%	15.0%	45.0%	1.75%
<b>Overall</b>			<b>3.00%</b>	<b>15.0%</b>	<b>45.0%</b>	<b>0.25%</b>
<b>Total</b>	<b>4,699,764</b>	<b>4,951,500</b>				

\* Estimates supplied to the authors by the Ministry of Health.

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