

Swiss Policy Research

Geopolitics and Media

Studies on Covid-19 lethality

Last updated: August 20, 2020; **First published:** May 12, 2020

Share on: Twitter / Facebook; **Main article:** Facts about Covid-19

Overview: 1) Immunological studies; 2) Antibody studies; 3) PCR studies; 4) Modelling studies; 5) Other studies; 6) Age of death; 7) Hospitalization rate; 8) Nursing homes; 9) Overall mortality; 10) Development of the pandemic. **IFR:** Infection fatality rate (population-adjusted).

1) Immunological studies

Immunological research indicates that serological antibody studies, which measure antibodies in the blood (IgG and IgM) and typically found population-based IFR values between 0.1% and 1.0% (see below), may detect only about 20% of infections, as most people neutralize the coronavirus with their mucosal (IgA) or cellular (T cells) immune system while developing only mild symptoms or no symptoms. This means serological IFR values may drop by a factor of up to five.

Moreover, several population-based antibody studies found that of the people who reported anosmia (temporary loss of the sense of taste or smell) – a very typical Covid symptom – only about 18% to 50% had IgG antibodies against the new coronavirus (see table below).

See also: Coronavirus likely five times more common and less deadly than assumed

Country	Published	Focus	Factor	Source
Switzerland	May 23	IgA	5	Report / Study
China	June 16	IgG	6	Study ¹
Germany	June 16	T-cells	81%	Study ²
France	June 22	T-cells	75%	Study ³
Sweden	June 29	T-cells	2	Study

Spain	July 6	IgG	5	Study ⁴
Germany	July 16	IgG	2	Study
UK	July 23	IgG	60%	Study ⁵
Italy	August 3	IgG	4	Study ⁴
Brazil	August 12	IgG	5	Study ⁴
UK	August 14	IgG	2	Study ⁴

1) Only 16% of likely infected HCW had IgG; 2) 81% of unexposed individuals had cross-reactive T-cells; 3) 6 of 8 exposed family members had T-cells but no antibodies; 4) People with anosmia but without IgG antibodies; 5) 60% cross-reactive IgG antibodies in unexposed children.

2) Antibody seroprevalence studies

Population-based antibody seroprevalence studies. IFR values depend on demographics (age and risk structure), public policies (e.g. protection of nursing homes), and medical treatment.

Covid-19 IFRs are strongly age-dependent, with a steep increase above the age of 70. The median age of Covid-related deaths in most Western countries is 80 to 86 years (see section 6 below). In most Western countries, about half of all deaths occurred in nursing homes (see section 8).

In terms of Covid-19 IFRs, an important difference exists between places with and without a partial or total collapse of local health and elderly care, and between the early and late pandemic phase.

A. Places without a collapse of health and elderly care

Country	Published	Population	IFR (%)	Source
Switzerland	July 14 August 7	Geneva hotspot Zurich area	0.32 ¹ 0.30 ¹	Perez Aguzzi
India	July 31	Delhi Mumbai	0.07 ² 0.12 ²	Govt.
Africa	July 29 August 5	Kenya Malawi	0.01 0.01	Uyoga Grace
Austria	June 25	Ischgl hotspot	0.26	von Laer

Global	June 8	23 studies Below 70 years	0.25 ³ 0.04 ³	Ioannidis
Slovenia	May 6	General population	0.16	Govt.
Germany	May 4	Heinsberg hotspot	0.36 ⁴	Streeck
Iran	May 1	Guilan province	0.12	Shakiba
USA	April 30	Santa Clara County	0.17	Bendavid
	April 24	Miami-Dade County	0.18	Govt.
	April 21	Los Angeles County	0.20	Sood
Denmark	April 28	Blood donors (<70y)	0.08	Erikstrup

1) 0.64% and 0.60% including nursing homes; 2) 0.14% and 0.23% assuming 40% missing fatalities (more); 3) Median values; 4) The adjusted IFR is 0.28% (page 9).

B. Places with a partial or total collapse of health and elderly care

Overview: 1) Spain; 2) Northern Italy; 3) New York City; 4) England; 5) Belgium

Places with a partial or total collapse of local health and elderly care experienced significantly higher and very strongly age-dependent IFR values, especially during the early phase of the pandemic.

However, IgG antibody tests may underestimate the true prevalence of coronavirus infections and may thus overestimate the IFR by a factor of two to five (see section 1 above).

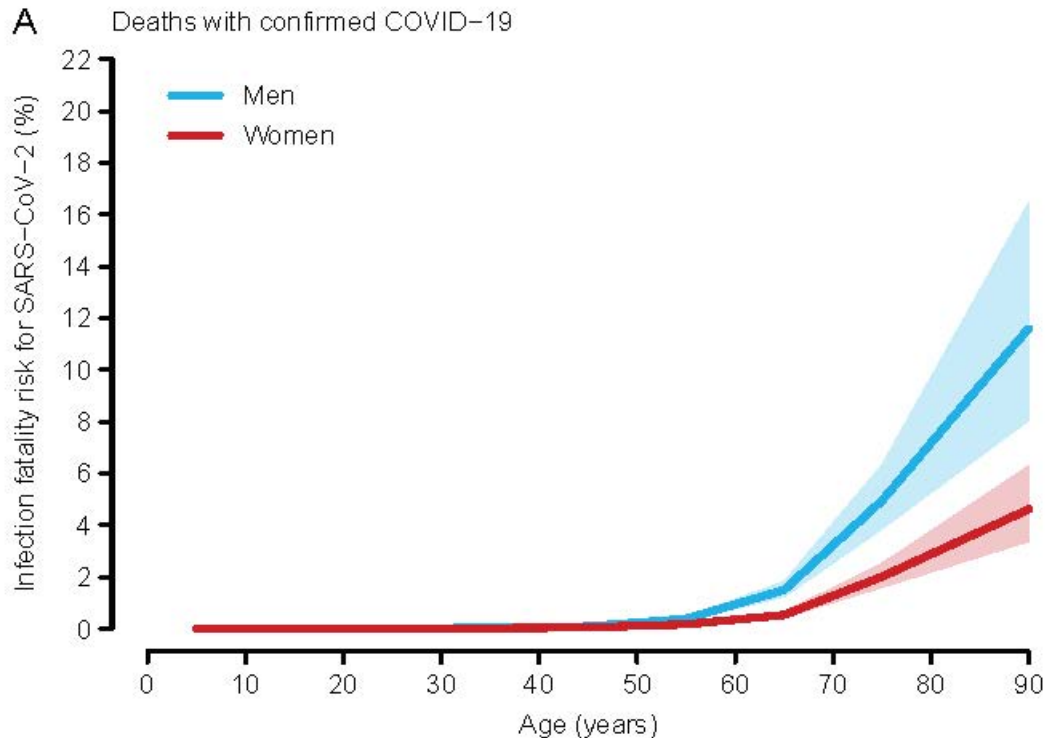
1) Spain

Country	Published	Population	IFR (%)	Source
Spain	August 7	Covid confirmed	0.82	Pollan
		Excess deaths	1.07	
		Below 50 years	<0.10	
		Below 40 years	<0.03	

A Spanish seroprevalence study found an overall IFR between 0.82% (based on confirmed Covid-19 deaths) and 1.07% (based on excess all-cause deaths). The study didn't include nursing homes, which accounted for about 50% of all deaths. The IFR was strongly age-dependent, with values below 0.03% until 40 and below 0.1% until 50 but reaching very high levels above 70 years.

The study found a country-wide IgG antibody seroprevalence of just 4.9% (about 12% in Madrid). However, less than 20% of symptomatic people (3+ symptoms or anosmia) had IgG antibodies. This may indicate that infections were up to five times more widespread than detected by IgG antibody tests (see section 2 below on this topic). If so, Spanish IFR values might drop below 0.5%.

Above 60 years, there was a significant difference in lethality between men and women. This might be due to e.g. genetic reasons, cardiovascular health, or certain habits like smoking.



Spain: IFRs by age group and gender in confirmed cases (Source)

2) Northern Italy

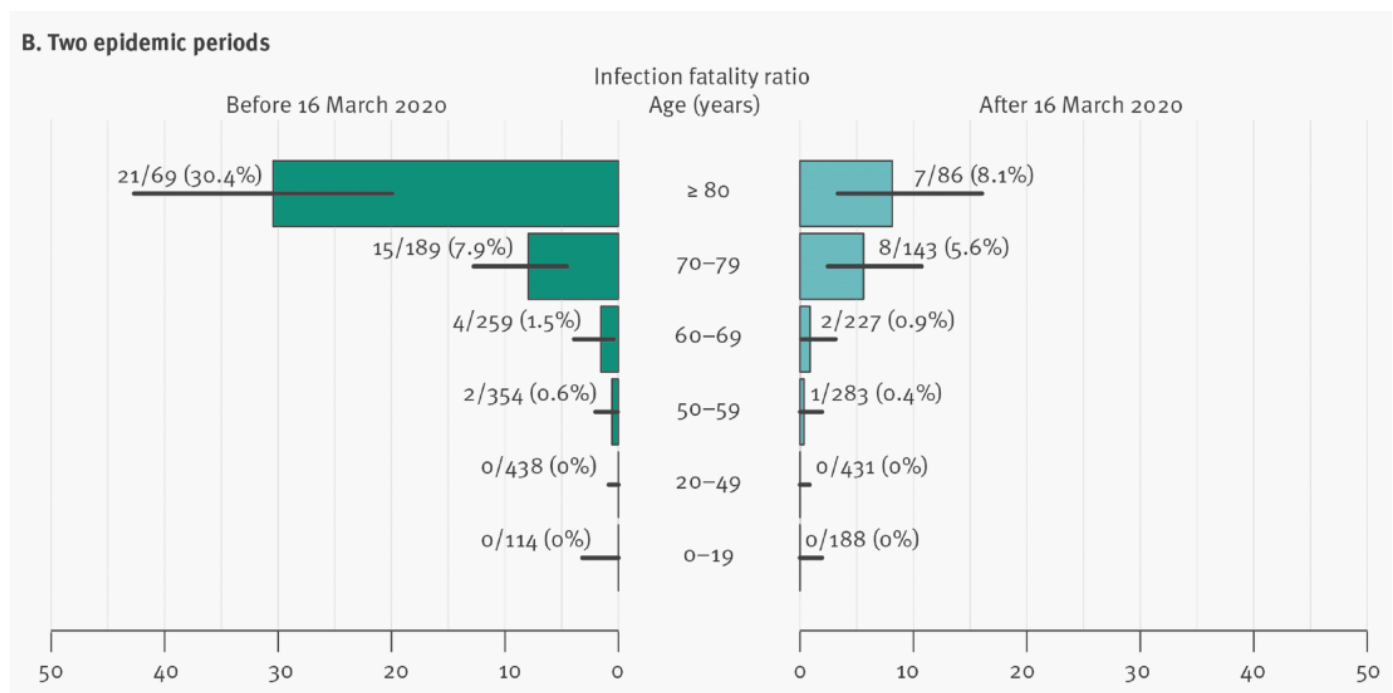
Country	Published	Population	IFR (%)	Source
Northern Italy	August 6	Above 70 years	10.5	Poletti
		Below 70 years	0.43	
		Below 50 years	<0.01	
		80+, first phase	30.40	
		80+, second ph.	8.10	

An Italian study considered contacts of confirmed Covid-19 cases in the Lombardy region, which includes hotspots like Bergamo and Cremona, to determine their fatality risk and their comorbidities. They found that the overall IFR was 62% lower in the second phase of

the pandemic (after March 16) compared to the first, cataclysmic phase (up to March 15).

This was particularly evident in people above 80, where the IFR dropped from 30% in the early phase to 8% in the later phase (4% for women, 16% for men). Below 50 years, IFRs were near 0%; below 70 years, IFRs were 0.43% (both phases combined). More than 80% of deaths occurred in patients with cardiovascular diseases, which are known to be an important risk factor.

Of note, among Italian people with anosmia (temporary loss of the sense of smell or taste), a very typical Covid symptom, only about 25% were found to have IgG antibodies. This could indicate that coronavirus infections are more widespread, and IFRs lower, than assumed.



Northern Italy: IFRs in early and late pandemic phase (Source)

3) New York City

City	Published	Population	IFR (%)	Source
New York City	June 29	Overall	0.70	Stadlbauer
New York City	June 29	Confirmed	1.10	Yang
		Probable	1.45	
		25 to 44 y.	0.12	
		<25 years	0.01	

Until May 2020, New York City counted about 20,000 confirmed and probable Covid-19 deaths among its 8.4 million citizens and registered an antibody prevalence of about 20%. Studies estimating the infection fatality rate (IFR) for New York City found values between 0.7% and 1.1% based on confirmed deaths and up to 1.45% based on confirmed and probable deaths.

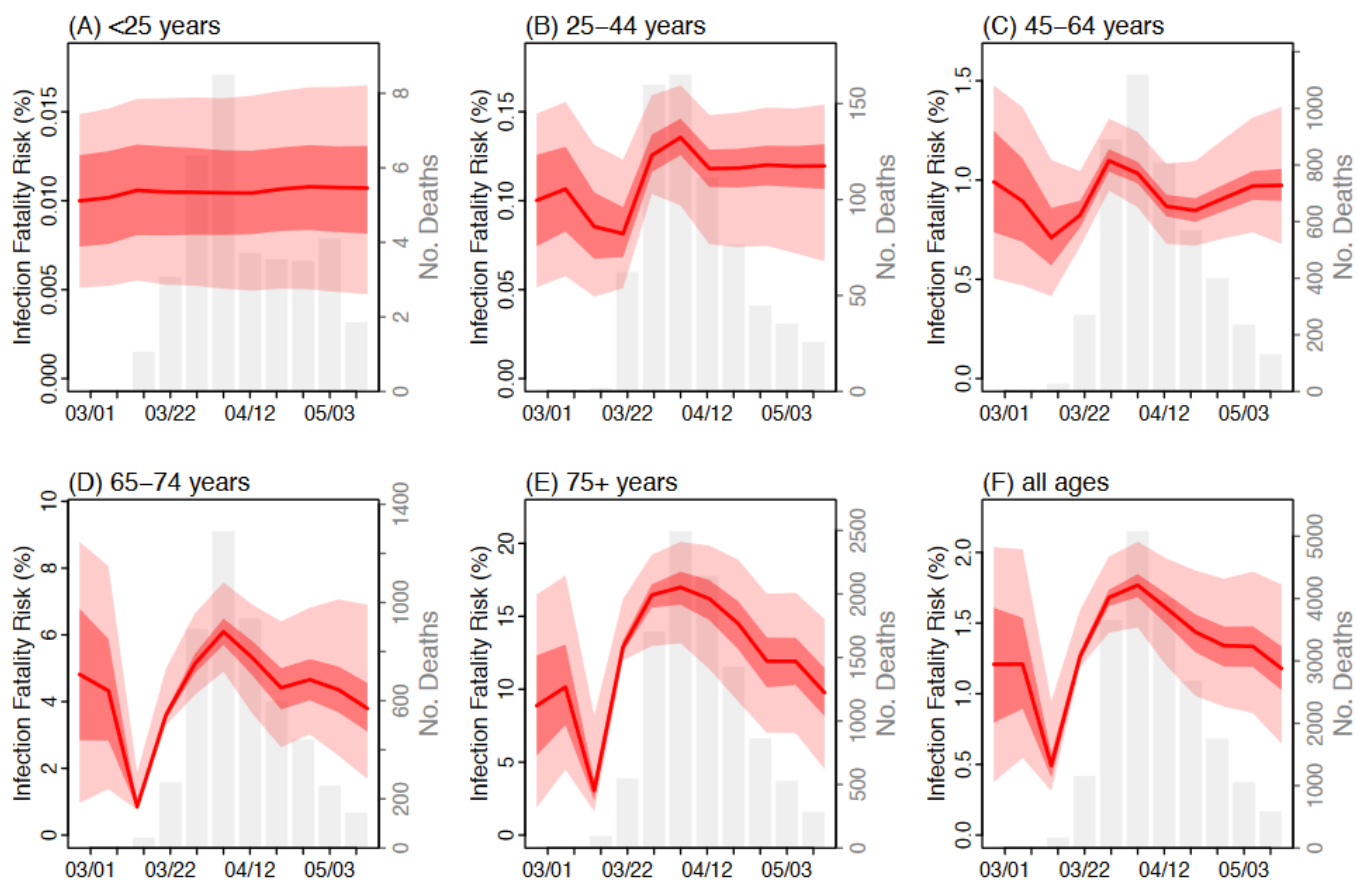
About 52% of Covid deaths in NYC occurred in the 75+ age group. This value is markedly lower than in Europe. In all of New York State, about 6,300 patients were sent from hospitals into nursing homes, which ultimately registered between 6,600 and 13,000 deaths.

As in Italy and other hard-hit places, the IFR for age groups above 65 dropped by about 50% during the course of the pandemic, possibly due to better medical preparedness and treatment strategies (see diagram below).

Assuming that serological IgG antibody tests do not capture the full extent of coronavirus infections (e.g. due to mild cases without IgG antibodies), the overall IFR in New York City might drop to about 0.50% or below, and the actual spread of the coronavirus might be above 50%.

	Confirmed	Probable
75+	9,290	2,498
65-74	4,701	979
45-64	4,260	996
18-44	723	141
0-17	12	3
Unknown	1	1
Data pending	0	10

Covid deaths in NYC by age group (Source: NYC.gov)



IFRs by age group per week (Source)

4) United Kingdom

Country	Published	Population	IFR (%)	Study
England	August 14	General population	0.90	Ward
		Incl. care homes	1.43	
		45 to 64 years	0.50	
		Below 44 years	0.03	

Until July 2020, England counted about 30,000 Covid deaths in the general population and about 20,000 Covid-related deaths in nursing homes (which had to receive patients).

The above study by Imperial College London estimates an IgG antibody seroprevalence of 6% overall and 13% in London by mid-July. However, according to Public Health England, London blood donors had an antibody seroprevalence of 17.5% already in May.

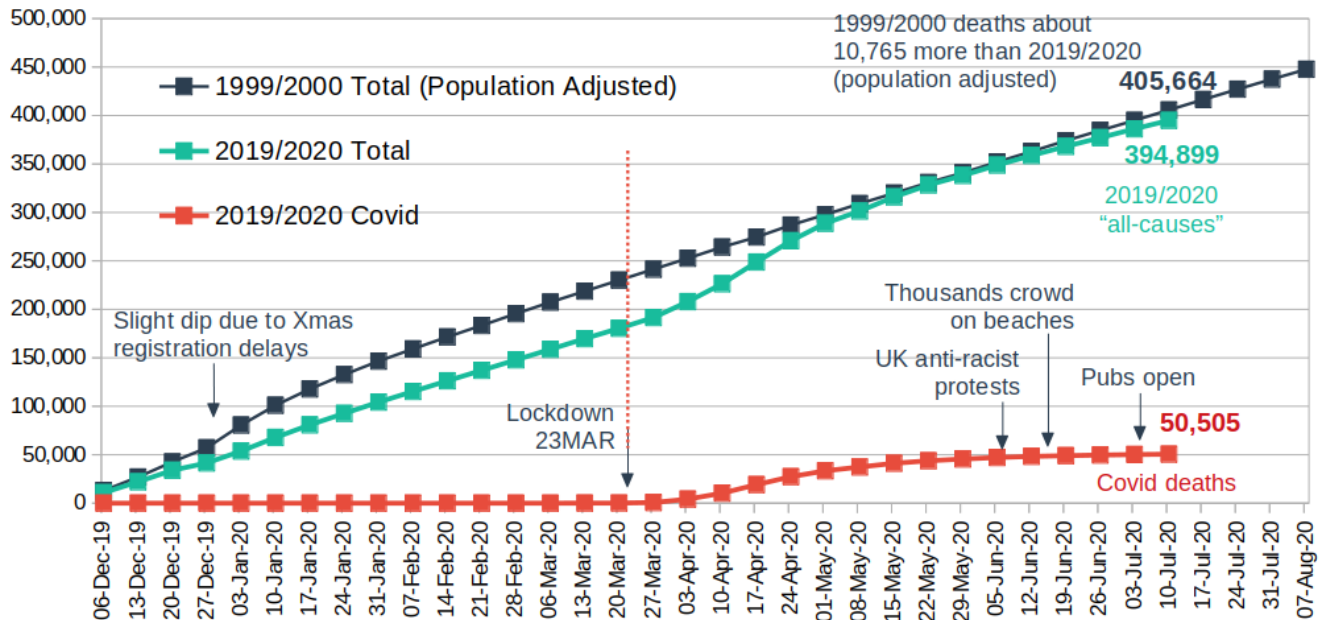
Of note, only about 50% of people with anosmia (temporary loss of the sense of smell or taste), a very typical Covid symptom, had IgG antibodies. Only 35% of people who were suspected to be Covid cases by a doctor, had IgG antibodies. And only 28% of people who

self-reported “severe symptoms” had detectable IgG antibodies against SARS-CoV-2.

If some of these people were indeed Covid cases (without detectable antibodies at the time of testing), the overall IFR value in the general population may drop to about 0.50% or below. The overall mortality of 2020 is comparable to the strong flu season of 1999/2000 (see below).

Cumulative Deaths England & Wales 2019/2020 compared to previous years

Inproportion2, source Office for National Statistics, updated 2020-07-21



England: Mortality 2020 compared to strong flu wave of 1999/2000 (Source)

5) Belgium

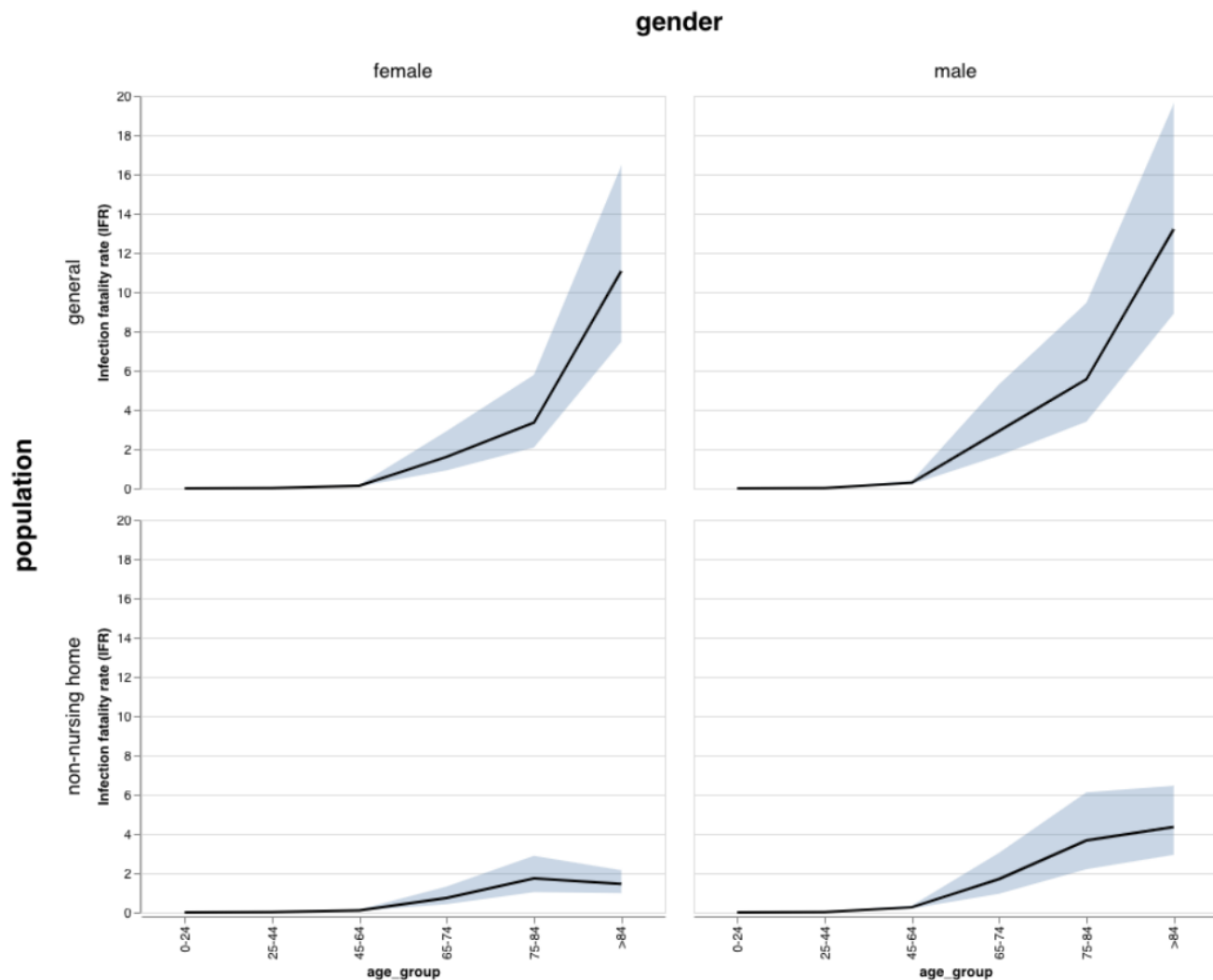
Country	Published	Population	IFR (%)	Study
Belgium	June 20	General population	0.43	Molenberghs
		Incl. care homes	1.25	
		45 to 64 years	0.21	
		Below 44 years	0.02	

Belgium reported one of the highest Covid death rates in Europe, in part because it always included confirmed and probable Covid deaths. 66% of excess deaths in Belgium occurred in nursing homes. Of these, only about a third were confirmed by a PCR test. It is possible that some of the non-confirmed nursing home deaths were not due to Covid, but due to the extreme circumstances.

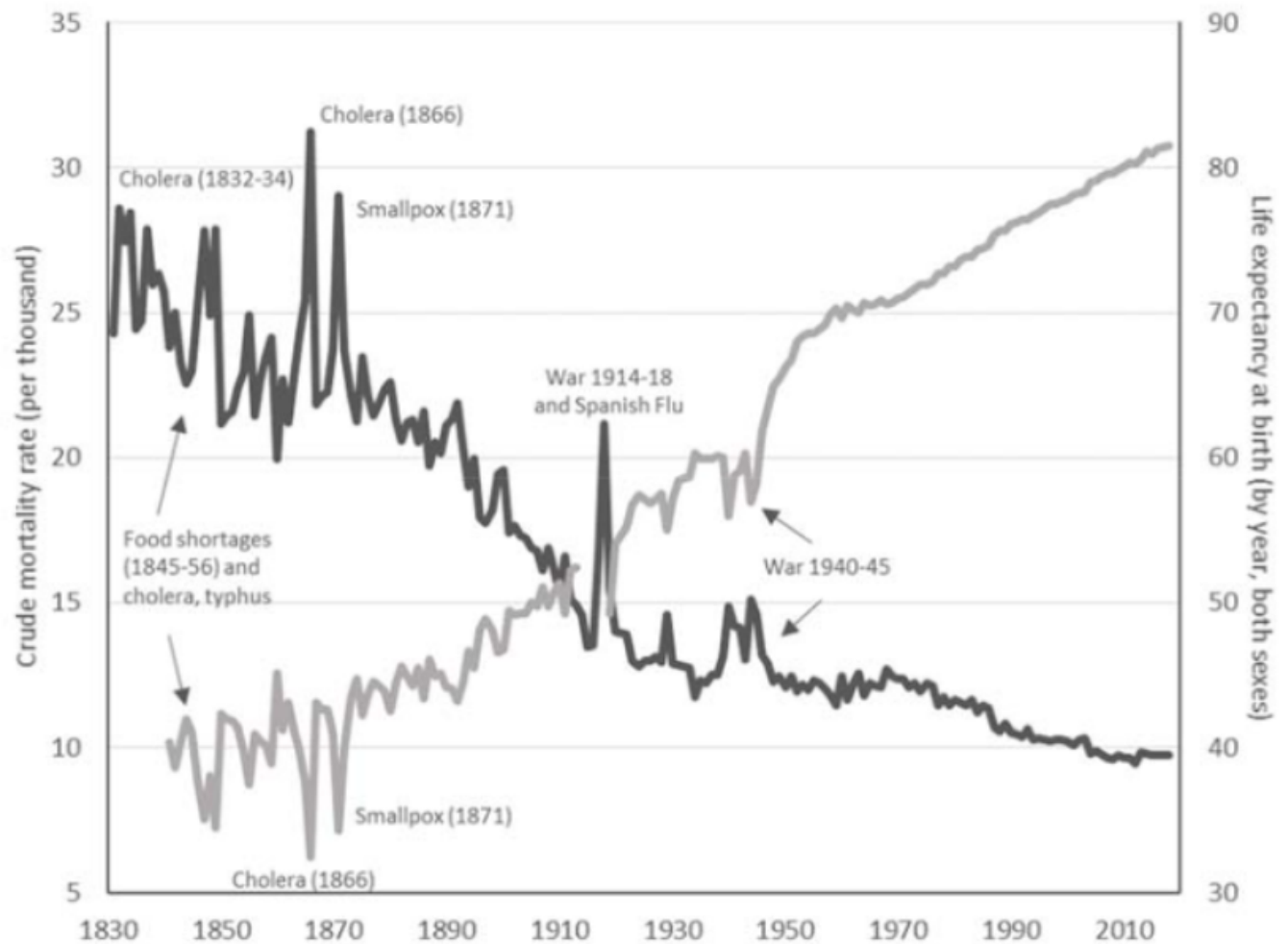
Due to the high proportion of nursing home deaths, IFRs differ markedly between the general population and the nursing home population. The IFR for the general population is estimated between 0.30% to 0.62%, while the IFR for the nursing home population is estimated between 28% and 45%. For people aged 45 to 64, the IFR is 0.21, and for people aged 25 to 44, the IFR is 0.02%.

Even without age-adjustment, the number of excess deaths due to Covid in April 2020 is comparable to the number of excess deaths in January 1951 and February 1960 due to strong seasonal influenza.

Belgium reported an overall IgG antibody seroprevalence of only about 6% by May 2020. If actual infections are more widespread (including mild cases without IgG), the IFR in the general population might drop below 0.30%. As in other countries, above 65 IFRs are higher for males than females.



Belgium: IFR by gender and age in (non) nursing home population (Source)



Beglian mortality and life expectancy, 1830-2014 (Eggerickx et al.)

3) Controlled PCR studies

Controlled PCR studies in population subgroups.

Country	Date	Population	Cases	IFR (%)	Source
Germany	July 25	Meat factory	1766	0.00	Study
France	May 21	Health workers	28050	0.05	Study
USA	May 10	MLB employees	5603	0.00	Report
France	May 10	Aircraft carrier	1046	0.00	Report
USA	May 10	Aircraft carrier	1156	0.09	Report
USA	May 1	Tennessee prison	1349	0.00	Report
Italy	April 28	Health workers	26657	0.30 ¹	Study

USA	April 17	Boston homeless	146	0.00	Report
USA	April 17	Boston blood donors	200	0.00	Report
Greece	April 16	Repatriations	40	0.00	Study
USA	April 13	NYC pregnant women	215	0.00	Study
Ship	March 17	Diamond Princess	700	0.13 ²	Study

1) See table below; 2) Age-adjusted IFR based on US population.

Classe d'età (anni)	Casi		Deceduti		Letalità (%)
	N	%	N	%	
18-29	2.859	10,7	0	0,0	0%
30-39	4.646	17,4	1	1,3	0%
40-49	7.499	28,1	4	5,0	0,10%
50-59	8.762	32,9	18	22,5	0,20%
60-69	2.745	10,3	43	53,8	1,60%
70-79	146	0,5	14	17,5	9,60%
Totale	26.657		80		0,30%

1) Deaths in Italian health care workers by age group (ISS, May 20)

4) Epidemiological models

Covid-19 IFR based on epidemiological models or predictions. These values are often somewhat higher than the actual values based on serological antibody studies (see above).

In May 2020, the **US CDC** published a best-estimate IFR of 0.26% (based on 35% asymptomatic cases). In July 2020, the CDC published an IFR of 0.65%. However, this second value wasn't based on new studies, but on a single meta-study that simply averaged all published IFR values, including those from early models that had predicted much higher values than later studies found.

Country	Published	Population	IFR (%)	Source
Europe	July 28	Six regions	0.5 – 1.40	Study
China	July 16	Wuhan	~0.10	Study
USA	May 20	CDC estimate	0.26 ¹	Study
France	May 13	France	0.70	Study
Switzerland	May 11	Switzerland	0.40	Study

UK	May 7	UK	0.08 ²	Study
France	May 7	France	0.80 ³	Study
Global	May 6	Metastudy	0.64	Study
Global	May 5	Global	0.17	Study
India	May 3	India	0.41	Study
Italy USA	April 20	Lombardia New York City	>0.84 >0.50	Study
China	March 30	Mainland China	0.66	Study
China	March 13	Wuhan city	0.12	Study
China	March 9	Mainland China	0.50	Study

1) 0.4% symptomatic CFR and 35% asymptomatic cases; 2) Based on 29% prevalence and 50,000 deaths; 3) The IFR is 0.50 excluding nursing homes.

5) Additional antibody and PCR studies

These studies determine the prevalence of recent or current Covid-19 infections in a population or region. In most cases, they find that Covid-19 is much more widespread than previously assumed, with most people showing no symptoms or only mild symptoms.

Immunological research (see above) indicates that antibody prevalence values may have to be multiplied by an *additional factor* of up to five to get the actual coronavirus prevalence values, because many mild cases neutralize the virus with their mucosal or cellular immune system.

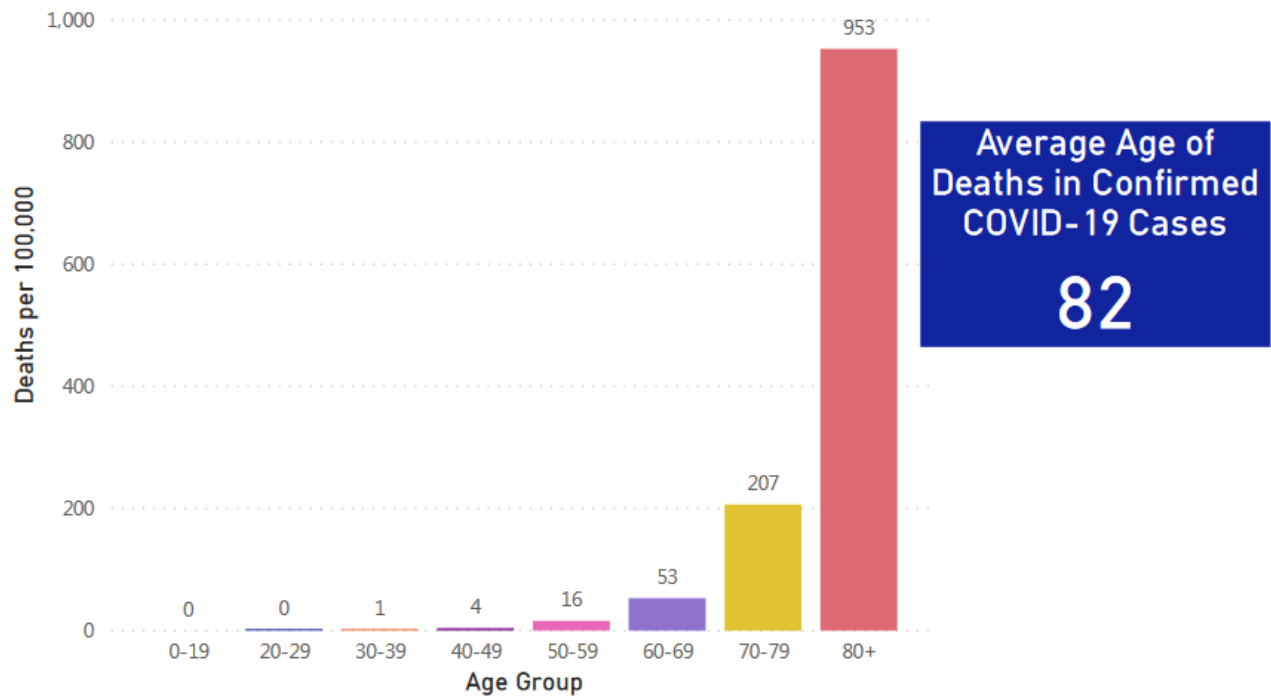
Country	Published	Population	Prev.	Factor	Source
Germany	June 30	Blood donors	1.3%		Study
Russia	June 10	Russia	14%	40x	Report
USA	May 15	Boston	12.5%	8x	Report
Czech Rep.	May 15	South Bohemia	5%	10x	Report
USA	May 13	Indiana	2.8%	11x	Report
Spain	May 13	Spain Madrid	5% 12%	10x	Study
UK	May 8	UK	29%	200x	Study
Switzerland	May 6	Geneva	9.7%	10x	Study
Global	May 5	< 65 years old			Study

Japan	May 5	Kobe City	2.7%	396x	Study
USA	May 2	New York State New York City	12.3% 19.9%	8x 10x	Report
Spain	May 2	Health workers	11.2%		Study
Netherlands	April 29	Blood donors	2.7%		Study
France	April 23	Northern France	3%		Study
USA	April 19	Chelsea MA	32%	16x	Report
Iceland	April 14	Iceland (PCR)	0.8%		Study

6) Median age of Covid-19 deaths per country

Half of all deaths were below, half were above the median age.

Country	Median age	Source
Australia	82 years	DOH
Austria	80+ years	EMS
Canada	86 years	HCSC
England	80+ years	NHS
France	84 years	SPF
Germany	82 years	RKI
Italy	82 years	ISS
Spain	82 years	MDS
Sweden	86 years	FOHM
Switzerland	84 years	BAG
USA	79 years	CDC



Example: Death rate by age group in Massachusetts (Source)

7) Hospitalization rate

Initial estimates based on Chinese data assumed a very high 20% hospitalization rate, which led to the strategy of ‘flattening the curve’ to avoid overburdening hospitals. However, population-based antibody studies (see above) have since shown that actual hospitalization rates are close to 1%, which is within the range of hospitalization rates for influenza (1 to 2%).

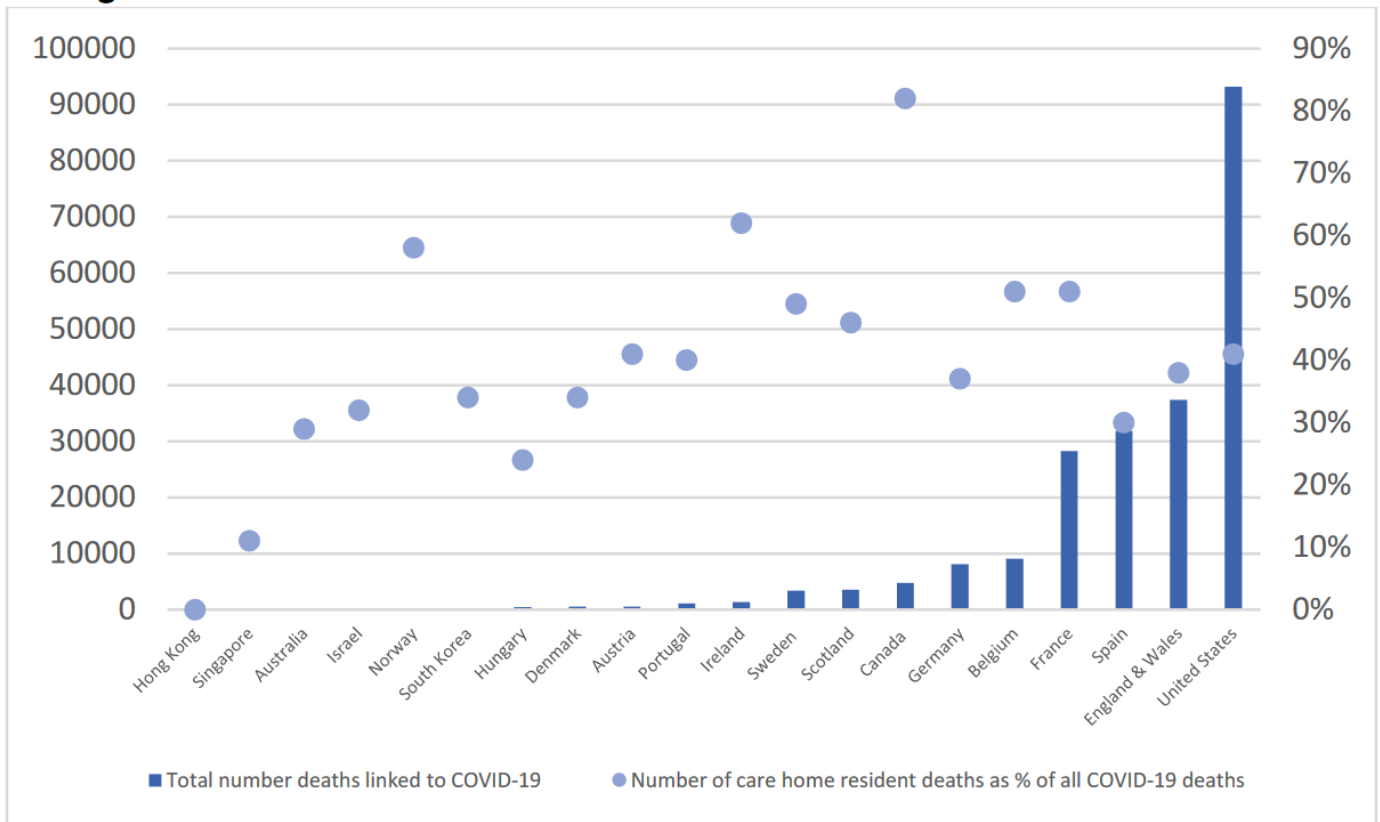
The US CDC found that Covid-19 hospitalization rates for people aged 65 and over are “within ranges of influenza hospitalization rates”, with rates slightly higher for people aged 18 to 64 and “much lower” (compared to influenza) for people under 18.

In local hotspots like New York City, the overall hospitalization rate based on antibody studies is about 2.5% (19.9% or 1.7 million people with antibodies and 43,000 hospitalizations by May 2).

The much lower than expected hospitalization rate may explain why most Covid-19 ‘field hospitals’ even in hard-hit countries like the US, the UK and China remained largely empty.

8) Percentage of Covid-19 deaths in care homes

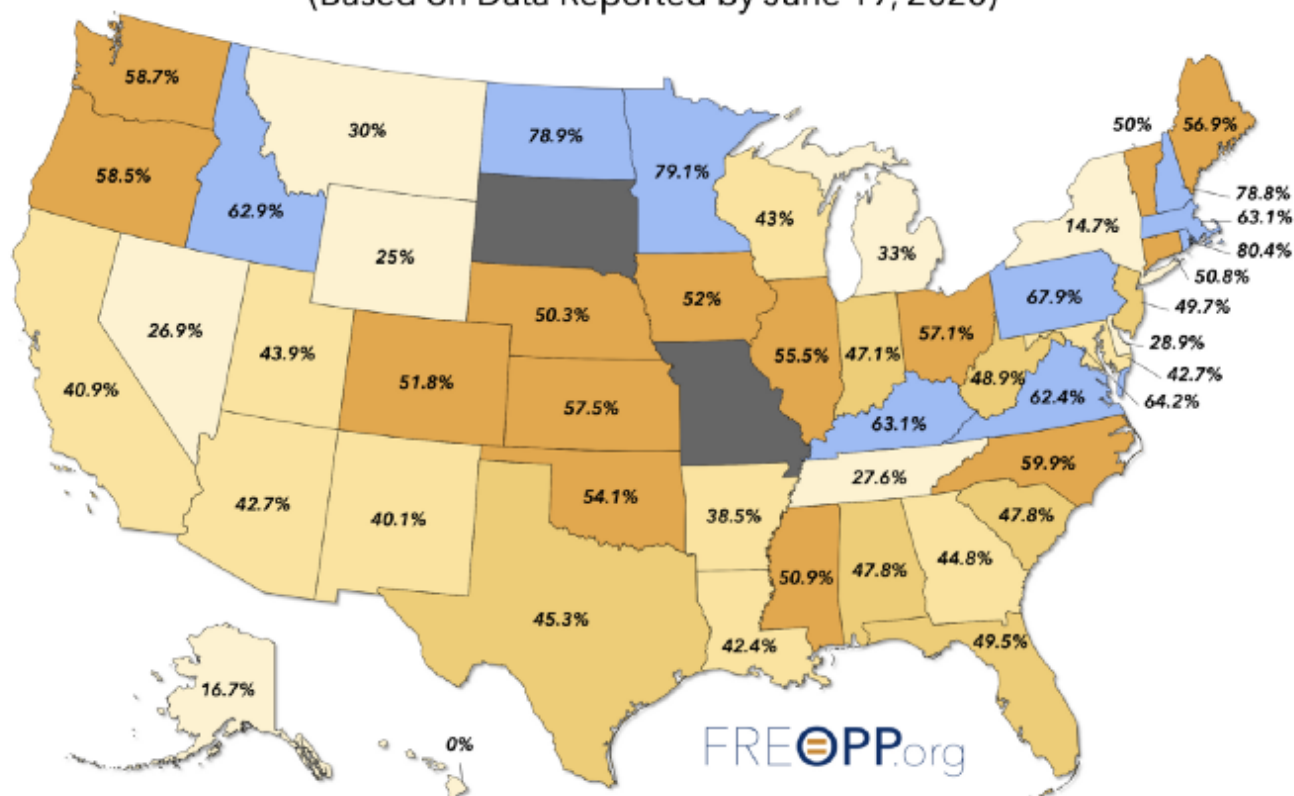
In many countries, deaths in care homes account for 30 to 60% of all additional deaths. In Canada and some US states, care homes account for up to 80% of all “Covid19-related” deaths. In Sweden, deaths in nursing homes plus nursing apartments account for 75% of all deaths.



Care home deaths: absolute numbers (bars, left scale) and percentages (dots, right scale)

Source: Mortality associated with COVID-19 outbreaks in care homes (LTC Covid, May 21, 2020)

Share of COVID-19 Deaths Occurring in Nursing Homes & Assisted Living Facilities (Based on Data Reported by June 19, 2020)

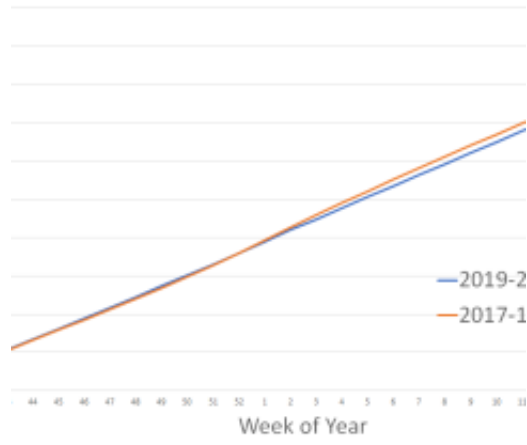


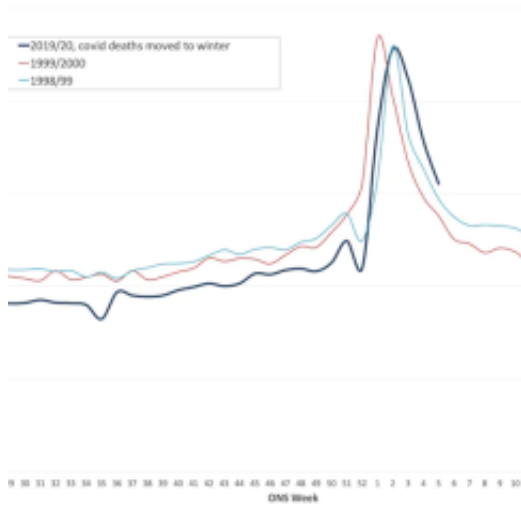
Source: The Covid-19 Nursing Home Crisis by The Numbers (Freopp, June 19, 2020)

9) Overall mortality

In countries like the US, the UK, and also Sweden (without a lockdown), overall mortality since the beginning of the year is in the range of a strong influenza season; in countries like Germany, Austria and Switzerland, overall mortality is in the range of a mild influenza season.

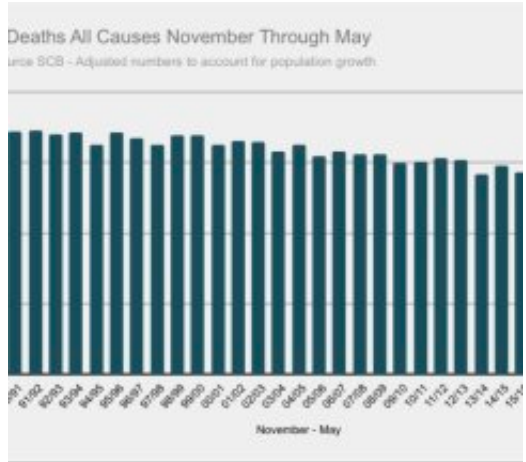
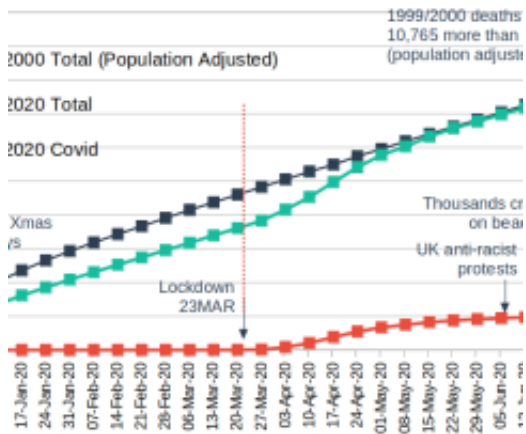
US Cumulative All Cause Mortality NCHS Data week 40-week 17
2017-18 vs 2019-20 (adjusted for population)



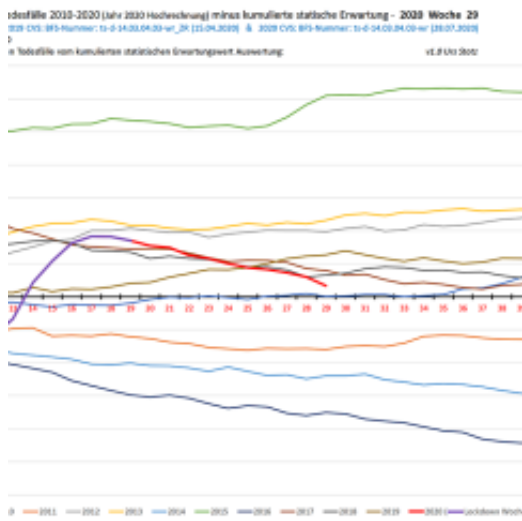


England & Wales 2019/2020 compared to previous

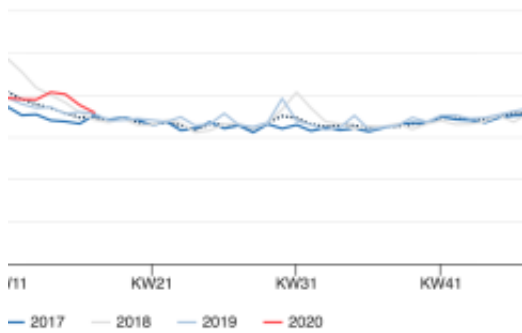
for National Statistics, updated 2020-07-21



data from the scb.se/pwweb/sw/sd/START__BE__BE0101__BE0101G/Ma
of deaths in order to account for population growth



befallzahlen in Deutschland



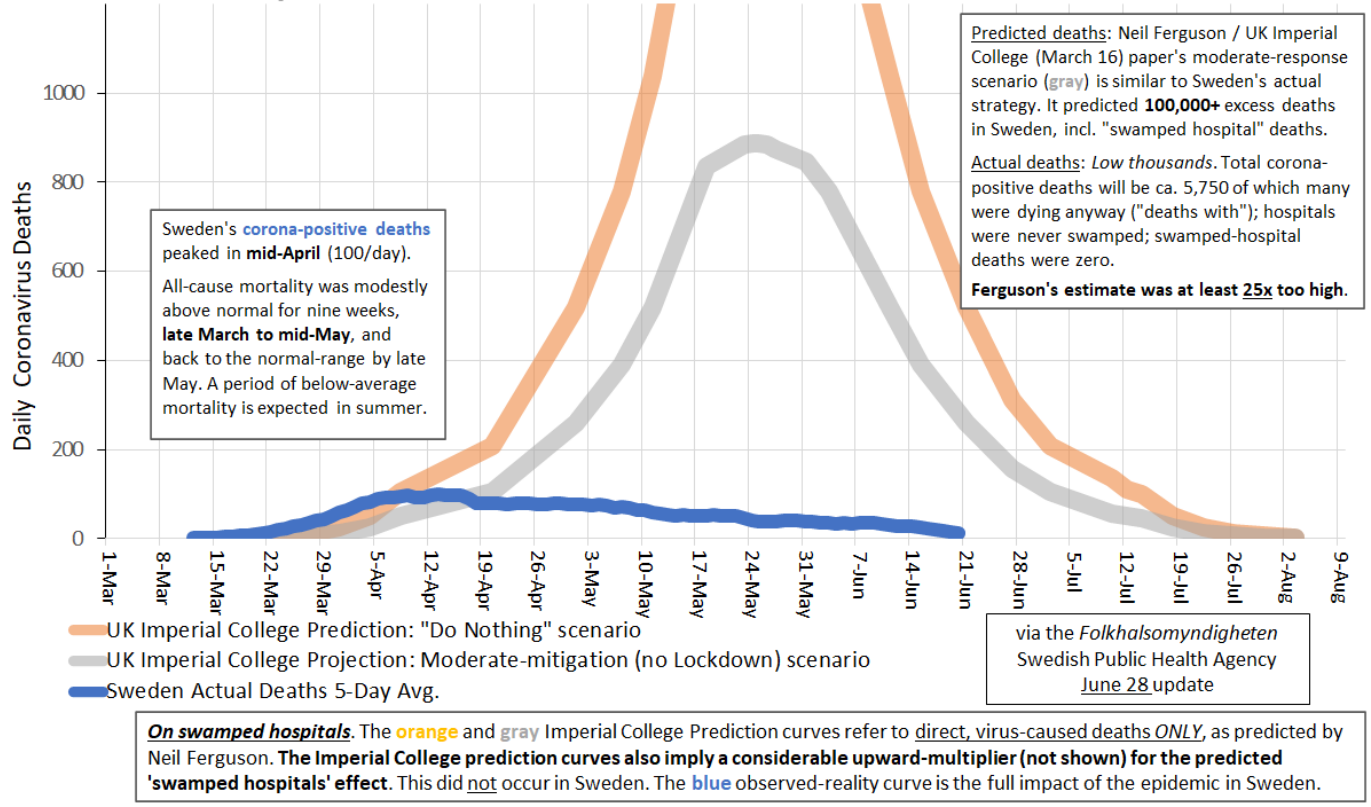
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Sources: US, UK-1, UK-2, Sweden, Switzerland, Germany

A comparison between the number of coronavirus deaths predicted by the influential model of Imperial College London (no measures or moderate measures) and the actual number of deaths in Sweden shows that the model strongly overestimated the impact of the epidemic:

Coronavirus in Sweden: Predictions vs. Reality

The Imperial College predictions (orange, gray) vs. Sweden's actual, observed (blue) corona-deaths



Sweden: ICL model predictions versus actual Covid-19 deaths (HTY/FOHM)

10) Development of the pandemic

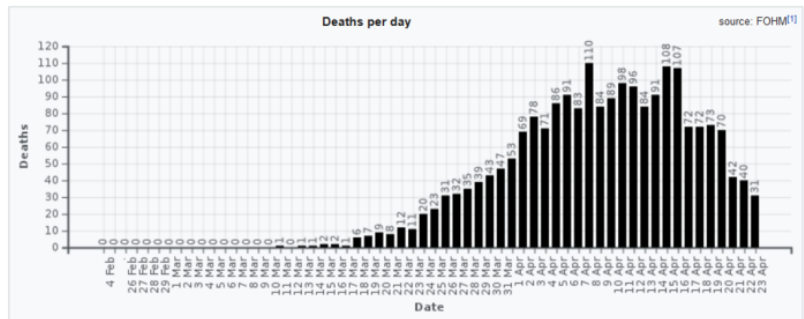
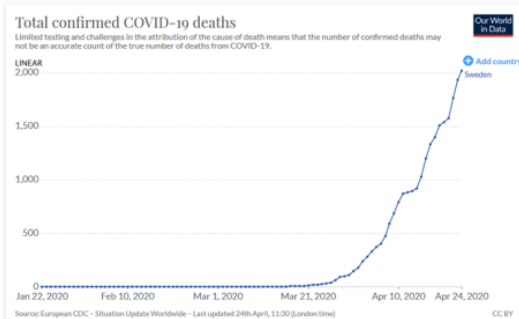
Even in states *without* a lockdown, the epidemic usually reached its peak within a few weeks of the outbreak. However, some reports showed *cumulative* deaths per *day of report* (left) instead of *daily* deaths per *day of death* (right), falsely implying an ever escalating situation.

Coronavirus in Sweden



Cumulative, day of report

Per day, day of death

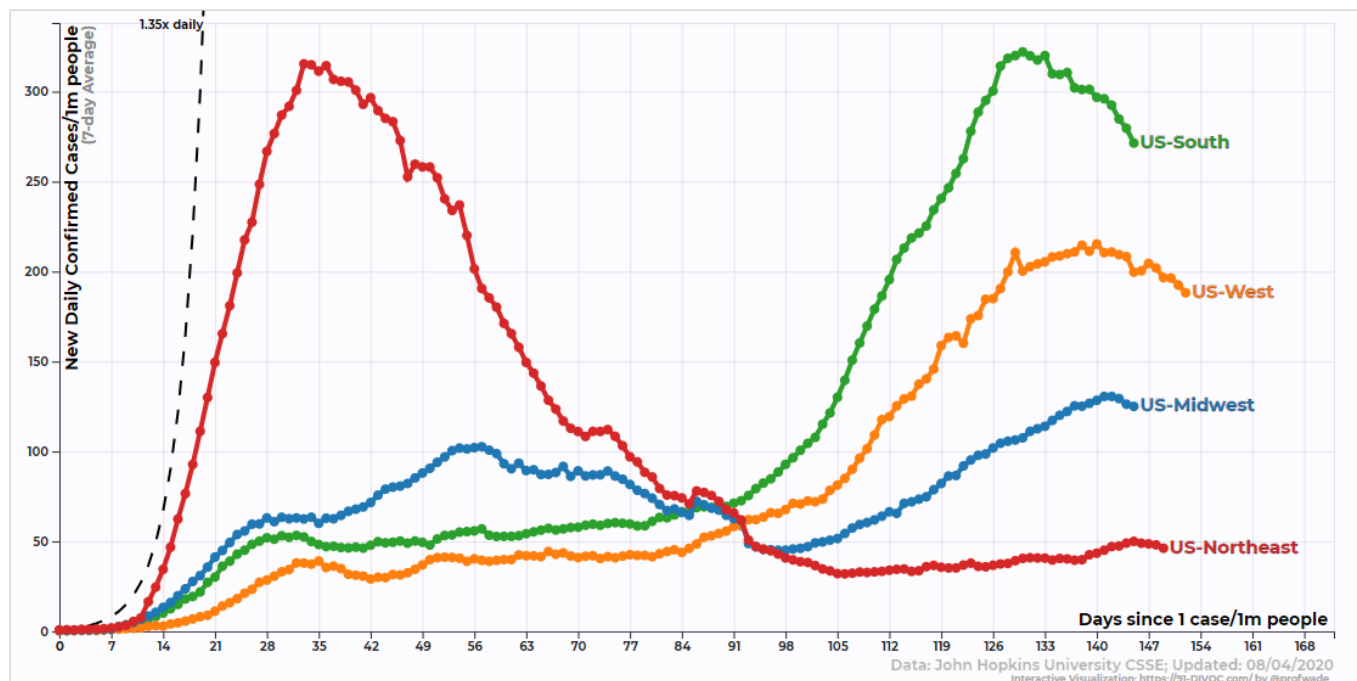


Date of comparison: April 24, 2020

Cumulative deaths per day of report vs. daily deaths per day of death. (OWD/FOHM; April 24)

The United States is no exception to this dynamic. Rather, the US has seen several regional waves that were delayed due to lockdowns but then each peaked within a few weeks of the outbreak.

New Confirmed COVID-19 Cases per Day by US States/Territories, normalized by population



US: Covid cases by region (Source)

See also

- On the treatment of Covid-19
- The evidence on face masks
- On the origin of SARS-CoV-2

Main article: Facts about Covid-19

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