Briefing: International comparisons of COVID-19 death data

Question: How does the death data for COVID-19 compare internationally?

Summary: Two measures are commonly looked at to understand the mortality from a disease. Deaths per 100k population, and deaths per case (the case fatality ratio, or CFR). The U.K currently has a deaths per capita of 22.7 per 100k, lower than Italy (38.4), Spain (42.8) and France (29.6), but nearly five times as high as Germany's (5.1). We would expect the U.K. to tend to overestimate its deaths per 100k as we count all deaths where an individual died with COVID-19 as 'COVID-19' deaths. Other countries (notably Germany), only count those where an individual died because of COVID-19 (or there was no other obvious cause).

However, deaths per 100k population does not control for the number of people infected with COVID – if COVID-19 is more widespread in Italy than in the U.K., we would expect a higher number of deaths per 100k. CFR is one means to do this. The U.K. has a very high CFR – roughly the same as Italy's (UK, 13.3%, Italy 13.2%). For comparison, Germany's is 2.2%, Wuhan's 5.1%, and China (excl. Wuhan) 1%. However, CFR is also a problematic measure of mortality. This is because it is heavily dependent on the number of tests being carried out. Issues that underestimate the number of COVID-19 cases (such as only testing hospitalised symptomatic cases in the U.K.) will artificially inflate the CFR. The U.K.'s CFR is similar to Italy's, but the U.K. has tested fewer than 400,000 people, whereas Italy has processed 1.3mil samples. 24% of U.K. tests were positive, compared to 13% in Italy. **We should not look at the U.K. CFR and conclude that we are one of the worst performers in Europe.**

A third measure looks at the number of deaths per test conducted. This is helpful as, unlike the CFR, it takes account of the number of tests done, but should also (to some extent) take into account the prevalence of the disease. It shows the U.K. has a very high number of deaths per 100k tests (41.6, roughly the same as France). Italy had 17.7 deaths per 100k tests, and Germany only 2.5. Given that the U.K. and Italy have similar numbers of deaths, this metric suggests that we likely have more cases (and therefore a lower 'actual' mortality rate). Therefore we are either (a) testing more severe cases (which is likely true) (b) doing a better job of caring for patients (ICUs not overwhelmed) and/or (c) a different segment of the population is getting infected.

Each of these measures has major limitations, but triangulating between them can help us to unpick who is performing well and less well. However, none of these conclusions are entirely robust. **Useful next steps would be** to (a) include some data on disease prevalence (once, for example, PHE's surveillance study is complete) and (b) where possible, try to control for case mix.

Table 1: Cases, deaths, and tests in 10 countries *(N.B. conditional formatting used to highlight quartiles.)*

Country	Total deaths	Cases per million	Deaths per 1000 tests	Deaths per million
United States	38910	2220.8	10.5	117.6
Italy	23227	2909.7	17.8	384.2
Spain	20043	4100.7	21.5	428.7
France	19323	1713.1	41.7	296.0

United Kingdom	15464	1682.5	41.5	227.8
Germany	4294	1669.7	2.5	51.3
Sweden	1511	1368.6	20.3	149.6
Canada	1467	883.4	2.8	38.9
Ireland	571	2988.8	6.3	115.6
Australia	69	258.3	0.2	2.7
New Zealand	12	227.7	0.1	2.5

(Source: our world in data)

See annex 3 for full analysis.

Annex 3: International comparisons of COVID-19 death data

How is death data reported?

Multiple morbidity measures are used when reporting COVID-19 deaths, each with their own issues:
- **Mortality rate:** the number of people that died of COVID-19 within the entire population
- **Infection fatality ratio (IFR):** the number of people that die out of those infected with COVID-19 (including asymptomatic and undiagnosed cases)
- **Case fatality ratio (CFR):** the number of people that die out of those with confirmed cases of COVID-19

Mortality rate is not confounded by any other measures; however, the accuracy issues reported below prove that it is not a perfect measure. Comparing IFR is not feasible without mass population screening as it is estimated that up to 80% of COVID-19 cases are asymptomatic and unlikely to have been tested.

CFR is widely used in the media to compare mortality and, by association, effectiveness of COVID-19 response. CFR is an inaccurate comparative measure as it is confounded by discrepancies in testing policy and the proportion of COVID-19 cases counted within the data. In the UK testing is mostly limited to symptomatic patients hospitalised due to COVID-19, likely a large underestimation of total cases. In comparison, Germany and South Korea have broader testing policies not limited to those requiring hospitalisation. The number of confirmed cases in countries with broad testing regimes is likely to be much higher than in the UK. As CFR equates to the number of COVID-19 deaths per confirmed COVID-19 cases low proportions of confirmed cases (as in the UK) will artificially inflate the CFR.

What is the mortality rate and CFR in other countries?

Differences in mortality rate per 100,000 and CFR exemplify the issues with different mortality measures. The UK and Italy have very similar CFR's but the UK has a much lower mortality per 100,000. This may reflect a wider testing policy in Italy, lessening the CFR. In Italy over 1.3 million samples have been tested while less than 400k people have been tested in the UK. Caution should be taken when comparing testing measurements as some countries (like UK and South Korea) report people tested while others (Italy and Germany) report samples tested. One person may have several samples collected to confirm diagnosis.

Table 1: Summary of mortality rate and CFR in select countries

	Deaths	Mortality per 100k pop.	Tests reported	Confirmed cases	Case fatality ratio
UK	16,095	24.21	372,967 people as of 19/05	121,172	13.3%
Germany	4,586	5.53	1,728,357 samples as of 12/05	145,184	3.2%
South Korea	234	0.45	559,109 people as of 19/05	10,661	2.2%
Italy	23,660	39.15	1,305,833 samples as of 18/05	178,972	13.2%

Source: John Hopkins; testing Our World in Data

How are COVID-19 deaths defined in the UK?

The UK definition of COVID-19 deaths may lead to inaccurate reporting, making international comparison difficult:
- **Overestimation in hospitals:** This definition may overestimate the number of COVID-19 deaths as it does not distinguish between dying *with* COVID-19 and dying *because of* COVID-19. Hospitalised COVID-19 patients often have severe and multiple co-morbidities which may also have contributed to their death.
- **Overestimation in the community:** This definition can include suspected cases without test confirmation required. This definition may overestimate the number of COVID-19 deaths as patients may have died of similar presenting illnesses (e.g. flu).
- **Difference in reporting lag:** Hospital deaths are reported up to 4 days faster than community deaths; the most recent figures are likely to underestimate the true figure.

Table 2: COVID-19 death measurement in the UK

Source	Death certification	Reporting	Geography
PHE	• Deaths in all UK NHS services of patients who have had a positive test result for COVID-19	• Published daily as of 5pm the previous day • Lag of 1 to 2 days expected	UK
ONS	• Every death registered with COVID-19 mentioned on the death certificate (as the underlying cause of death or not) • Can include suspected cases without testing, which is not explicitly recommended for post-mortem	• Published weekly on a Tuesday • Deaths in the community expected to have a lag of up to 5 days based on certification by a doctor	England and Wales

How are COVID-19 deaths reported in other countries?

Some countries (including Italy, South Korea, France and Spain) are also reporting COVID-19 deaths as anyone who died with a positive COVID-19 diagnosis. Alongside the issues reported above there are additional reasons death data cannot be accurately compared:
- **Different collection:** It is unclear whether international reports cover deaths in the community (as collected by ONS). If this is not the case the total number of COVID-19 deaths from other countries may be underestimated.
- **Different definitions:** In Germany death is only attributed to COVID-19 for those with underlying diseases when it is impossible to prove the ultimate cause of death. This could lessen overestimation of COVID-19 deaths as some patients with more severe co-morbidities may have had deaths attributed to this.

Table 3: COVID-19 death reporting internationally

Issue	UK	Germany	South Korea	Italy	France	Spain
What is counted as a COVID-19 death	All people that died with a positive COVID-19 diagnosis	Anyone that died with a positive COVID-19 diagnosis without a clear alternate cause of death	All people that died with a positive COVID-19 diagnosis	All people that died with a positive COVID-19 diagnosis	All people that died with a positive COVID-19 diagnosis	All people that died with a positive COVID-19 diagnosis
Where COVID-19 deaths are reported from	PHE reports deaths in the hospital. ONS reports all deaths (England and Wales)	Robert Koch Institut reporting from hospitals and care homes	Definitely in hospitals with some community reporting	Definitely in hospitals with limited community reporting	Monitoring of deaths outside hospitals since April 1	Definitely in hospitals. Reporting from care homes in certain regions (including Catalonia and Madrid)
How suspected COVID-19 deaths are counted	Suspected cases can be considered as COVID-19 deaths, even without post-mortem testing	Speculation of no post-mortem testing. Unclear if still considered in death stats.	Wide spread testing limits the number of suspected deaths. Reports of post-mortem testing	Reports of post-mortem testing	Some post mortem testing, reports that suspected cases are also considered as COVID-19 deaths	Reports of post-mortem testing
Reporting lag	Varies by measure, up to 5 days	Unclear	Unclear	Unclear	Unclear, at least a day	Unclear, up to 4 days at least