The COVID-19 counting fiasco: Is the real total of deaths closer to 10 million?
In-depth analysis from India and other countries.

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Abstract

As of May 1st, 2021 the "reported" COVID-19 death toll stands at >3.2 million. The 3.2 million total had been exceeded by 8pm (GMT) of that day. Is the real death toll far higher than this? Low levels of testing for COVID-19 are common in around half of world countries. All these countries share common features, namely, high proportion of the population living in slums, relatively low healthcare resources as reflected in low hospital bed numbers (much COVID-19 testing will occur in hospitals), high population density in large towns/cities. Most African countries, except for South Africa, Egypt, and several others do not have a mandatory death registration process. In most cases death certificates are paper records. Annual deaths are an estimate and monthly/weekly deaths are not available. Most of the large Asian countries such as Bangladesh, India, Indonesia, Pakistan, and the Philippines, have many of the same problems. A minority of countries stopped or do not report COVID-19 deaths. Censorship in China meant that deaths stopped being reported just as COVID-19 deaths were undergoing a huge surge. In the early days of the pandemic countries such as Iran, Tajikistan, etc were denying that a problem even existed. Some Indian states have reported fewer than 5 COVID-19 deaths. There is reason to believe that the real death toll is probably closer to 10 million.

Facts about India and COVID-19

- India is a federal collection of 40 states and territories.
- Each state/territory has a higher population than many countries.
- Bihar, the largest state by population, has an estimated 124.8 million people and only 2,560 "reported" Covid-19 deaths. One assumes this is a vast underestimate.
- Lakshadweep, Daman and Diu, Dadra and Nagar Haveli have reported less than 5 Covid deaths. True death count completely unknown.
- Some 33% of the entire Indian Covid death count comes from Maharashtra state, some 68,813 "reported" deaths and even that is probably a gross underestimate!
- Even the capital of Maharashtra, Mumbai, has a larger population than many world countries - 62% of Mumbai live in slums.
- Only the minority of "wealthy" in India can afford to access the relatively small number of private hospital beds. State run hospitals are generally poorly funded.
- The real COVID-19 death toll is probably >>10-times higher than the official toll.

Key Words: COVID-19; excess mortality; testing capacity; slums; death registration; new variants

Introduction

The news is currently full of horror stories regarding the COVID-19 epidemic in India. World deaths from COVID-19 now stand at 3.2 million, however, how accurate is the whole issue of COVID-19 deaths counting?

After an initial world-shortage of reagents and laboratory capacity for testing of COVID-19 many of the developed countries have implemented wide ranging testing. However, this is not the case everywhere.

Testing varies dramatically between world countries

Figure 1 illustrates the state of world testing for COVID-19 plus "reported" deaths per cases from the virus. The key metric is the cumulative tests per million population on the Y-axis.

Figure 1: World countries with reported cases per 1,000 tests, deaths per 1,000 cases and tests per million population on 21st April 2021. Data is from Worldometers[1]
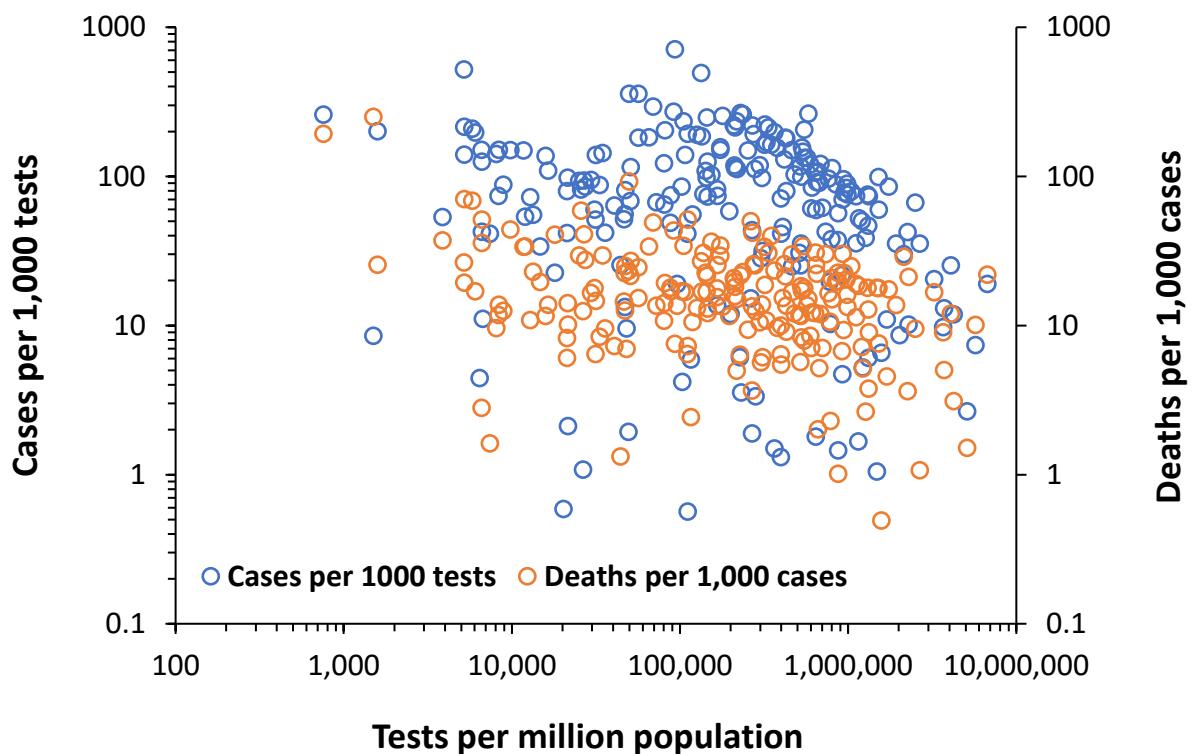

Most of the wealthy countries had achieved > 1 million cumulative tests per million population by the 21st April 2021 (Figure 2). Some of these are repeat tests on healthcare workers, however, this is a good benchmark. The fewer tests a country makes implies that the cases detected per 1,000 tests should rise. However, when testing drops below 100,000 tests per million population the case detection rate paradoxically drops. The detection rate will depend on where testing is concentrated and on the real level of COVID-19 in that country as influenced by population density, delayed initiation in some countries, and

[1] COVID Live Update: 152,638,857 Cases and 3,201,766 Deaths from the Coronavirus - Worldometer (worldometers.info)

preventative measures such as lockdown. Many of the low testing countries are poor and have a high proportion of the population living in slums (Figure 2).

Figure 2: Tests per million population and proportion of the population living in slums. Data from World Bank[2]

$$y = 851,100e{-0.056x}$$
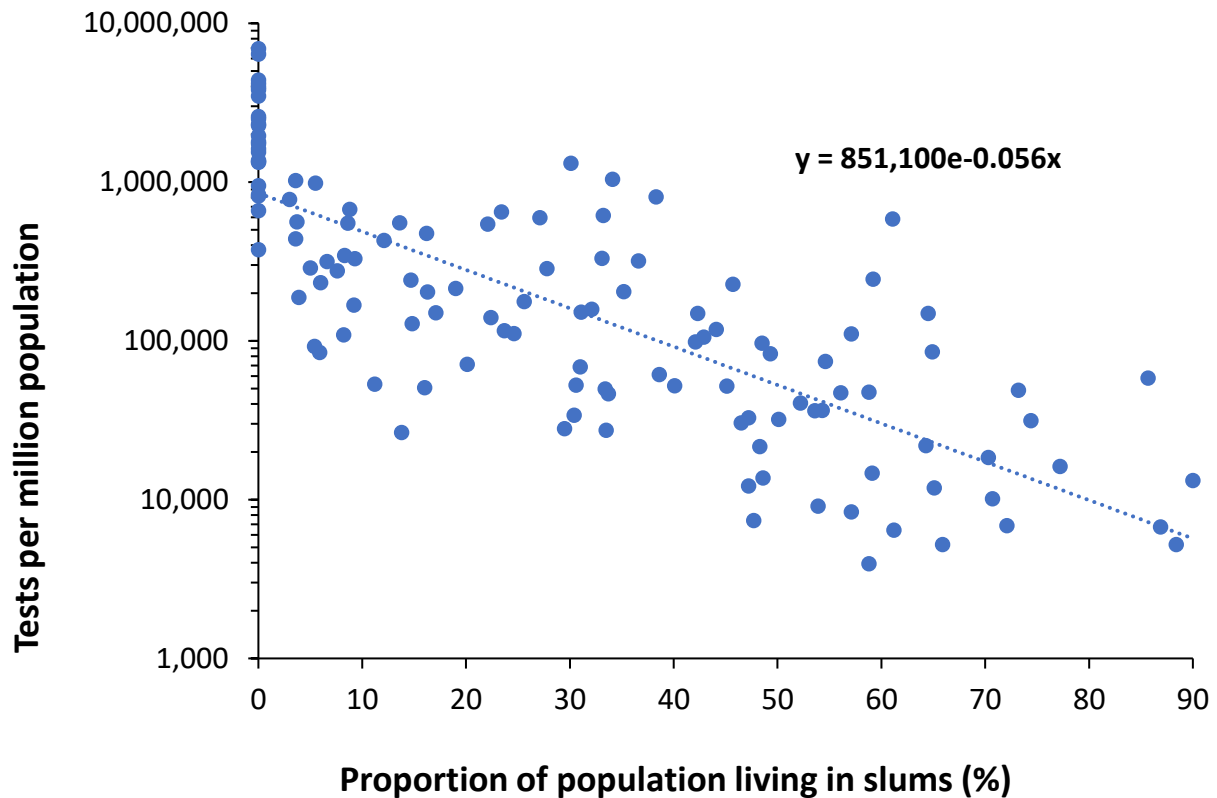
Countries such as South Korea operate at the 100,000 tests per million population simply because they have a well-practised track and trace system[3] which operates both forwards and backwards to isolate all contacts and locate the source of the infection. South Korea had such a system in place due to the threat of biological warfare by North Korea. An effective track and trace were also present in a few of India's southern states.[4] In the case of COVID-19 infection is usually via a few super-spreaders. [5,6] Large mass gatherings acting as "super-spreader events" in India are believed to be the source of India's current problems.[6]

Deaths per 1,000 cases is greatly influenced by the population age structure and where testing principally occurs. Hence testing mainly focussed on hospitalized patients will yield a higher death rate per case.

In most instances, the distance between the upper boundary and actual data points in Figure 1 represents the likelihood of gross under reporting of COVID-19 deaths. Recall that

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[2] Population living in slums (% of urban population) | Data (worldbank.org)

[3] South Koreans offer world lessons on how to tame coronavirus | Asia| An in-depth look at news from across the continent | DW | 28.10.2020

[4] Largest COVID-19 study highlights role of super-spreaders - Los Angeles Times (latimes.com)

[5] COVID-19: The truth about super-spreaders (openaccessgovernment.org)

[6] India's deadly COVID-19 surge rooted in crowded super-spreader events - National | Globalnews.ca

during the first three months of the pandemic testing was mostly in short supply as countries ramped up their capacity to test. Under reporting was therefore widespread in the first three months. However, in general around half of world countries look to fall into the high risk of serious undercounting category, especially when testing drops below 100,000 per million population. Low GDP per head of population, and hence a high slum population, is one of the main factors associated with low testing rates[7], and thus the risk of gross undercounting.

Undercounting during 2020 in countries which report monthly and weekly deaths

Reagents for testing of Covid-19 infection were in world-wide short supply at the start of the Covid-19 pandemic and evidence for gross undercounting of both Covid-19 cases and deaths during 2020 is beginning to emerge on an international basis. In the absence of accurate counts researchers have turned to the measurement of excess mortality as a way of estimating the extent of under counting. The measurement of excess mortality depends on the availability of monthly or weekly death statistics.

A key piece of investigative reporting by the BBC identified that fact that only eight African countries (Egypt, South Africa, Tunisia, Algeria, Cape Verde, São Tomé and Príncipe, Seychelles, and Mauritius) have a functioning compulsory death registration process.[8] The rest of Africa has a voluntary process which is mainly paper based. Annual deaths (all-cause) are an "estimate" and monthly and weekly deaths are not available.

This is repeated in Asia where just over half of countries have a functional compulsory death registration process.[8] Those missing out on death registration will largely live in slums. As indicated in Figure 1 the likelihood of gross undercounting is present in over half of world countries.

Based on excess mortality in those countries reporting monthly or weekly deaths such estimates appear to cluster around 50% undercounting during 2020, although in some countries stringent protection measures may have reduced excess mortality. This is specific to the developed countries where accurate monthly and weekly deaths data is available.[9],[10],[11],[12],[13] Spatial clustering (spatiotemporal granularity) within a country is also observed.[14] In Africa, both Egypt and South Africa showed far higher excess mortality compared to the official number of reported COVID-19 deaths.[8]

The best estimate for the real-world death count from COVID-19 is around 10 million.[15]

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[7] Total COVID-19 tests per 1,000 vs. GDP per capita (ourworldindata.org)
[8] Measuring Africa's Data Gap: The cost of not counting the dead - BBC News
[9] Estimation of the fraction of COVID-19 infected people in U.S. states and countries worldwide (plos.org)
[10] (20) (PDF) Covid-19 and excess mortality rates not comparable across countries (researchgate.net)
[11] Tracking covid-19 excess deaths across countries | The Economist, (25)
[12] Excess mortality during the Covid-19 pandemic: Early evidence from England and Wales - PubMed (nih.gov)
[13] (20) Assessing the lockdown effect from excess mortalities (researchgate.net)
[14] (20) (PDF) Small-scale spatial distribution of COVID-19-related excess mortality (researchgate.net)
[15] (20) (PDF) How many extra deaths have really occurred in the UK due to the Covid-19 outbreak? XXXIV. 10 million Covid-19 deaths and rising? (researchgate.net)

Slums, communicable diseases and gross under counting

Around 1 billion persons live in slums. The population density in slums is estimated to be around 270,000 persons per square Km. Social distancing and contact tracing is almost impossible.[16] Both noncommunicable and communicable diseases are highly prevalent with notable levels of tuberculosis and HIV/AIDS.[17] Poor sanitation means that enteric infections are frequent.[18]

Slums will therefore be the ideal breeding ground for COVID-19 and will be the least likely place for testing and counting of COVID-related deaths. They act as a persistent reservoir of infection and the potential for massive under counting.

The emergence of new variants

Many will be aware of the Kent variant which was first identified in the UK and has an extremely high transmission rate.[19] Excess winter mortality (EWM) is the difference between average deaths during the four winter months versus the eight non-winter months. It is a variant of 'excess mortality' referred to above. Figure 3 shows the impact of this variant on an excess winter mortality (EWM) calculation in the local authority area of Maidstone in Kent – which seemed to be the epicentre of the outbreak of this variant.

By way of comparison EWM in Denmark during the 1918 "Spanish Flu" pandemic reached + 98% (authors calculation) compared to +136% during the outbreak of the Kent variant in Maidstone in early 2021. Prior to this the highest value for EWM in Maidstone during the past 20 years was +36% in the winter of 2004/05. This was a lethal outbreak. Note that Maidstone was not greatly touched by the first wave COVID-19 outbreak in the winter of 2019/20.

Also for comparison is the fact that in the period 2020 to 2021 the highest excess all-cause mortality in the UK occurred in Gravesham (Kent) at +60%, followed by Newham, Redbridge and Brent (all in London) at >50% (authors calculation). The excess mortality depends on the combined deaths during both the first and subsequent waves in the UK.

This figure implies that in these local authorities the total deaths during COVID-19 were >50% higher than in the 12-months before the arrival of COVID-19. This is a sobering statistic and illustrates the truth that all infectious diseases show high spatiotemporal granularity. Which has been demonstrated for COVID-19 in the USA and elsewhere.[20]

The big question is whether the emergency of the Indian variant triggered the explosion in COVID-19 deaths in that country, perhaps aided by very unwise large super-spreader cultural festivals and political rallies where social distancing was completely ignored.[21]

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[16] COVID-19 Comes to Asia's Most Densely Populated Slum – The Diplomat

[17] Slum health: Diseases of neglected populations | BMC International Health and Human Rights | Full Text (biomedcentral.com)

[18] Can we 'WaSH' infectious diseases out of slums? - PubMed (nih.gov)

[19] Covid-19: Kent virus variant 'on course to sweep world' - BBC News

[20] Journal of Health Care Finance (healthfinancejournal.com)

[21] India's deadly COVID-19 surge rooted in crowded super-spreader events - National | Globalnews.ca

This variant was first reported in October 2020 but by March 2021 was present in 15% to 20% of samples.[22] This variant is now spreading in the UK and is being monitored as a variant 'of interest'.[23] This spread was not at all helped by the UK governments somewhat lax approach to travel to and from India. Refusal of entry only commenced on the 23rd of April when India was added to the red list.[24]

Figure 3: Excess winter mortality in Maidstone (Kent), UK. Trend from winter 2001/02 through to 2020/21. Data is from the Office for National Statistics[25]
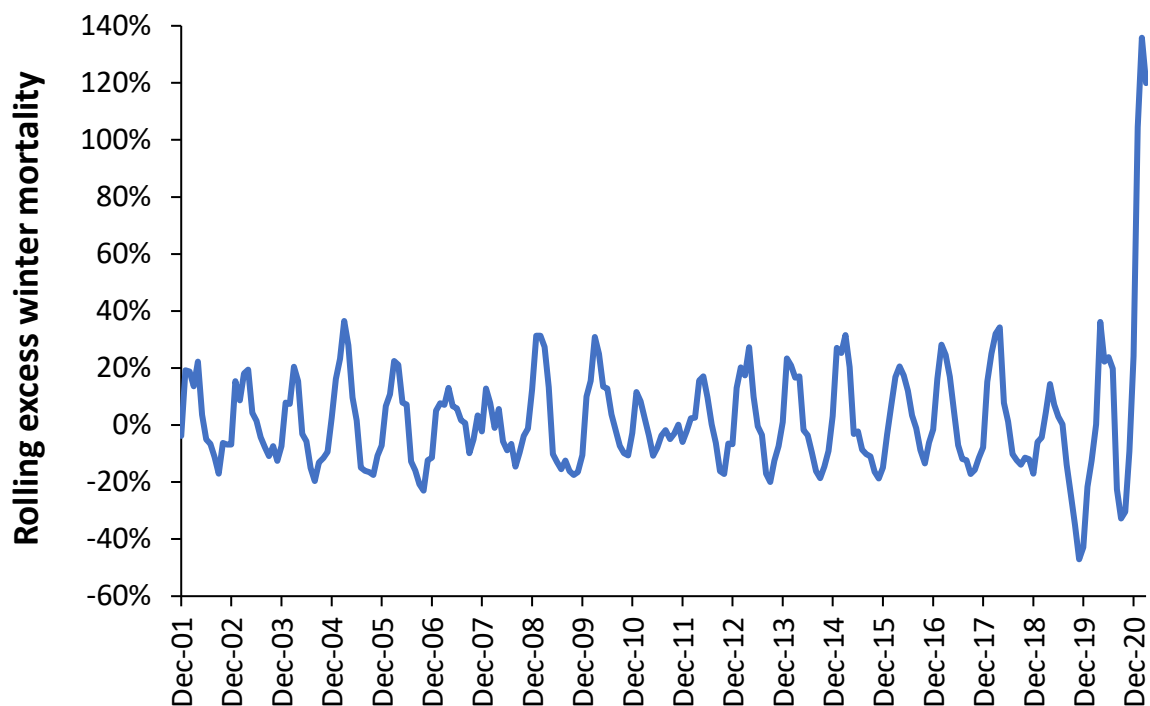
Potential for undercounting in large Asian countries

Based on the unreliable death registration processes in over half of Asia and the prevalence of slums in its most heavily populated countries there is very high potential for gross under counting. This is illustrated in Figure 4 which shows the trajectory of "reported" COVID-19 deaths in five large Asian countries.

As can be seen the trajectory for 'reported' COVID-19 deaths is exceptionally low, especially in Bangladesh and Pakistan. All five countries show trajectories which look too good to be true when compared to other countries with reliable death registration processes.

[22] India's new COVID variant: When did it emerge? Should we worry? | Coronavirus pandemic News | Al Jazeera
[23] COVID-19: 55 new cases of Indian 'double mutation' variant found in UK in latest week | UK News | Sky News
[24] Covid-19: India added to coronavirus 'red list' for travel - BBC News
[25] Deaths registered monthly in England and Wales - Office for National Statistics (ons.gov.uk)

For example, by the beginning of May South Africa had reached 99 reported COVID deaths per 1,000 deaths prior to COVID. This official number is known to be a gross underestimate against all-cause excess mortality and the true number for South Africa is probably close to 200 COVID deaths per 1,000 deaths – which is probably replicated across much of Africa!

Figure 4: Trajectory of "reported" COVID-19 deaths in five large Asian countries with high slum populations. COVID-19 deaths have been divided by total deaths prior to COVID to give an 'excess' mortality equivalent.
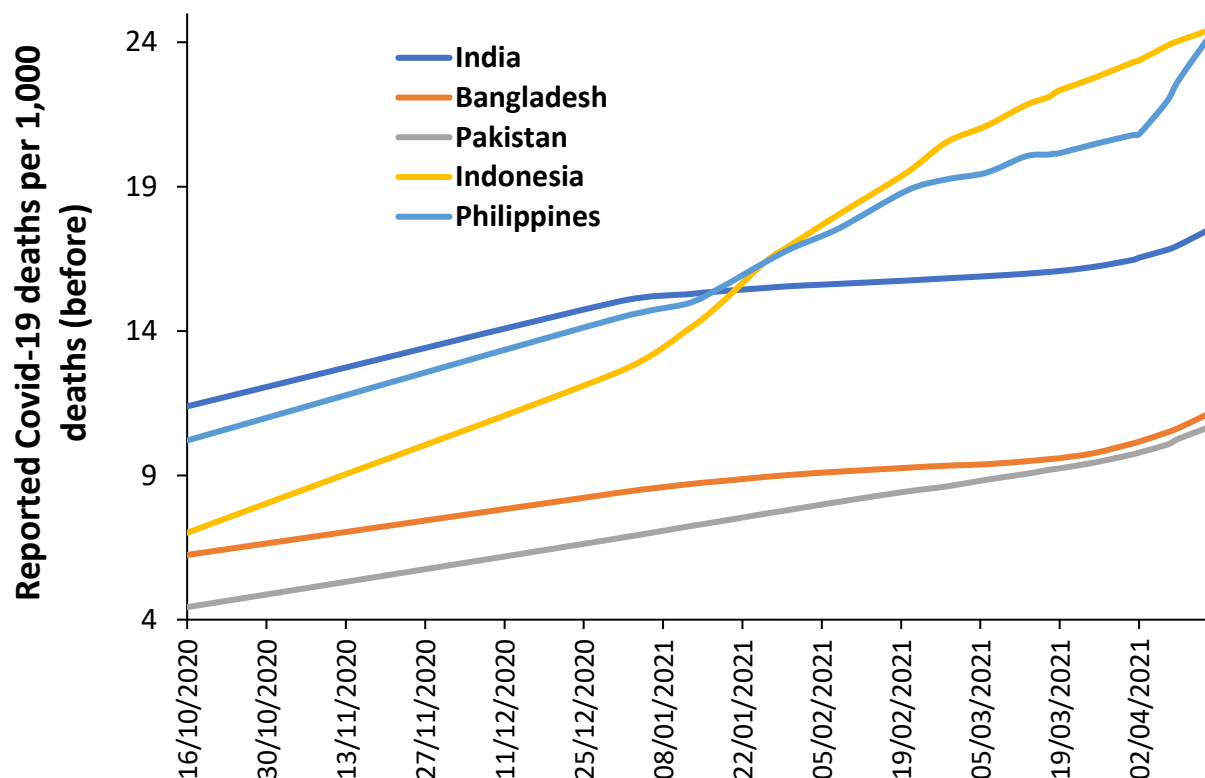
A true COVID-19 mortality estimate for India

To investigate the situation in India in greater detail the levels of "reported" COVID-19 deaths have been calculated for each state and shown against raw population density in Figure 5. All data is shown in the Appendix.

As can be seen just three states have managed to get somewhere close to reality – the dashed line, while the rest show evidence for gross undercounting. Several states have reported fewer than 5 COVID-19 deaths.

To give a comparison, the raw population density in US sates is all well below 1,000 per square Km. The raw population density in the UK is just 280 per square Km, but around 40% of the UK population lives at small-area population density above 4,000 per square Km.[26] This is merely to give you some idea of the vast difference between raw population density

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[26] https://doi.org/10.12968/bjhc.2013.19.1.44

in Figure 5 and the actual population density experienced at small areas. Whole families in slums live in a small shack.

Figure 5: Reported COVID-19 deaths per 1,000 deaths (before COVID in 2019) for each Indian state and the raw population density in each state. Deaths in 2019 is from Healthdata.org,[27] while population density is from
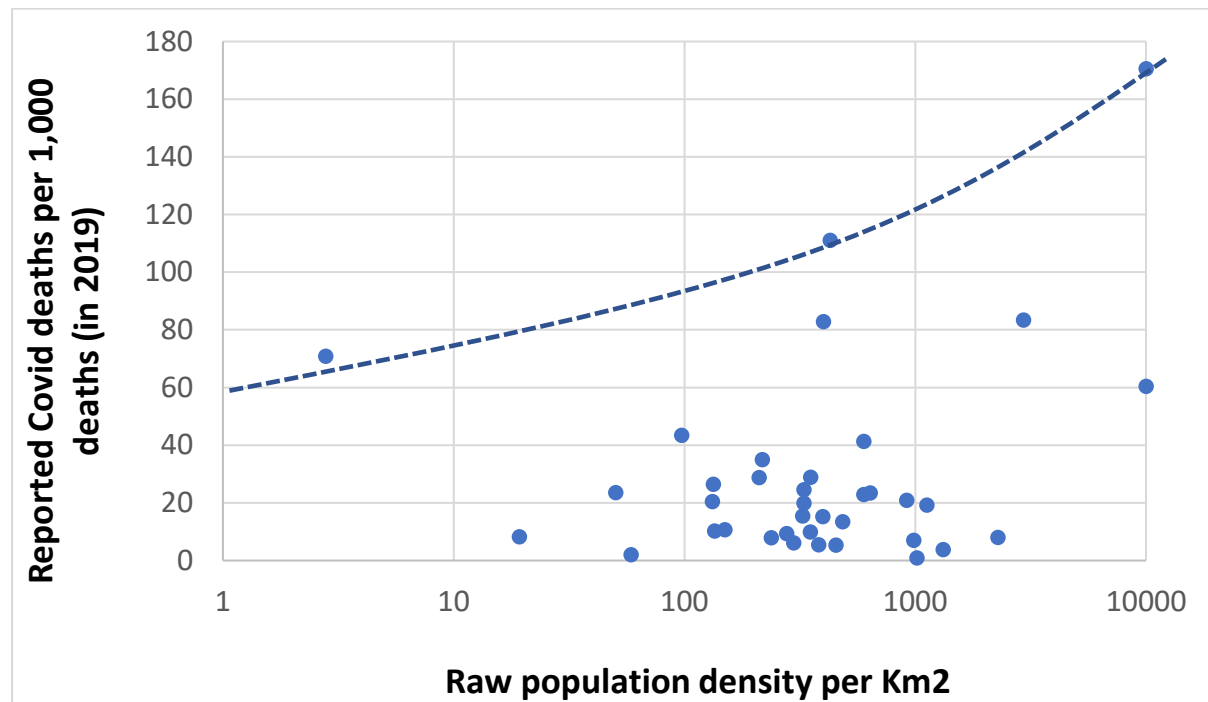
Conclusion

Evidence for gross undercounting of COVID-19 deaths has been steadily mounting. The surprising thing is that governments around the world seemingly took the COVID-19 death statistics from India at face value. Seemingly no one took the opportunity to investigate at state level. Such negligence could cost the world another major wave of deaths.

Further reading:

This study is based on an extended series of studies on COVID-19 mortality which can be accessed at http://www.hcaf.biz/2020/Covid_Excess_Deaths.pdf

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[27] GBD India Compare | IHME Viz Hub (healthdata.org)

Appendix: Relevant data for Indian states. Note deaths in 2019 (**in red**) have been estimated from the raw mortality rate for India.

State or union territory	2019 Population	Deaths in 2019	Reported Covid-19 deaths	Deaths per million pop	Covid deaths per 1,000 deaths	Percent rural	Area km2	Population Density
Andaman and Nicobar Islands	417,036	*2,850*	67	160.7	23.5	62%	8,249	50
Andhra Pradesh	53,903,393	402,063	7,992	148.3	19.9	71%	162,968	329
Arunachal Pradesh	1,570,458	7,151	59	37.6	8.3	77%	83,743	19
Assam	35,607,039	243,024	1,307	36.7	5.4	86%	78,438	454
Bihar	124,799,926	672,585	2,560	20.5	3.8	89%	94,163	1,321
Chandigarh	1,158,473	*7,917*	478	412.6	60.4	3%	114	10,155
Chhattisgarh	29,436,231	245,145	8,581	291.5	35.0	77%	135,191	218
Dadra & Nagar Haveli & Daman & Diu	615,724	*4,208*	4	6.5	1.0	42%	603	1,018
Delhi	18,710,922	94,688	16,147	863.0	170.5	3%	1,484	12,591
Goa	1,586,250	10,521	1,168	736.3	111.0	38%	3,702	428
Gujarat	63,872,399	464,253	7,183	112.5	15.5	57%	196,024	325
Haryana	28,204,692	179,909	4,216	149.5	23.4	65%	44,212	637
Himachal Pradesh	7,451,955	56,167	1,484	199.1	26.4	90%	55,673	134
India	**1,371,360,351**	**9,371,319**	**51,246**	**37.4**	**5.5**	**69%**	**3,287,240**	**382**
Jammu and Kashmir	13,606,320	*92,980*	2,283	167.8	24.6	74%	42,241	330
Jharkhand	38,593,948	198,384	2,660	68.9	13.4	76%	79,714	484
Karnataka	67,562,686	537,464	15,523	229.8	28.9	61%	191,791	353
Kerala	35,699,443	254,836	5,309	148.7	20.8	52%	38,863	918
Ladakh	289,023	*1,975*	140	484.4	70.9	16%	96,701	3
Lakshadweep	73,183	*500*	4	54.7	8.0	22%	32	2,285
Madhya Pradesh	85,358,965	598,712	5,616	65.8	9.4	72%	308,245	277
Maharashtra	123,144,223	830,509	68,813	558.8	82.9	55%	307,713	400
Manipur	3,091,545	19,850	405	131.0	20.4	70%	22,327	132
Meghalaya	3,366,710	15,982	171	50.8	10.7	80%	22,429	150
Mizoram	1,239,244	6,827	14	11.3	2.1	48%	21,081	59
Nagaland	2,249,695	10,199	104	46.2	10.2	71%	16,579	135
Odisha	46,356,334	342,517	2,096	45.2	6.1	83%	155,707	297
Puducherry	1,413,542	*9,660*	805	569.5	83.3	32%	479	2,943
Punjab	30,141,373	218,320	9,022	299.3	41.3	63%	50,362	599
Rajasthan	81,032,689	534,544	4,239	52.3	7.9	75%	342,239	238
Sikkim	690,251	3,384	147	213.0	43.4	75%	7,096	97
Tamil Nadu	77,841,267	613,919	14,046	180.4	22.9	52%	130,051	599
Telangana	39,362,732	227,498	2,261	57.4	9.9	61%	112,077	351

State or union territory	2019 Population	Deaths in 2019	Reported Covid-19 deaths	Deaths per million pop	Covid deaths per 1,000 deaths	Percent rural	Area km2	Population Density
Tripura	4,169,794	25,881	393	94.2	15.2	74%	10,486	397
Uttar Pradesh	237,882,725	1,795,972	12,570	52.8	7.0	78%	240,928	986
Uttarakhand	11,250,858	91,197	2,624	233.2	28.8	70%	53,483	211
West Bengal	99,609,303	590,496	11,344	113.9	19.2	68%	88,752	1,123