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Low COVID-19 Testing in the Majority of Nations Has Resulted in Gross Undercounting of Infections and Deaths

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Abstract: The volume of COVID-19 testing in the world's countries shows an exponential decline that is correlated with GDP per capita and ranges from relative testing levels starting at a low of 3,300 cumulative tests per million persons (during the first 18 months of the pandemic) in the Democratic Republic of Congo (DRC) to a high of 13.7 million cumulative tests per million in Denmark. Somewhere greater than 1 million cumulative tests per million population is needed to obtain a reasonable estimate of the true extent of COVID-19 mortality. Around 155 countries (70% of world countries) lie below this threshold. In addition to having a relatively low amount of testing, these countries are also often characterised by a deficient mortality reporting process. My research points to a finding that gross undercounting of COVID-19 infection and mortality is occurring in at least half of world countries. These countries then act as a reservoir for the virus and travel from these countries then spreads the virus feeding further international outbreaks. The situation is made even more confused by a reliable definition of a genuine COVID-19 caused death, and by countries reporting according to different standards. The UK reports a "with COVID" death as any person testing positive in the 28 days prior to decease, which is probably an over-estimate, although this is counterbalanced by low testing in the first 9 months of the pandemic. Consequently, the reported fatality rate per person testing positive varies by over 10-fold between both high and low testing countries. The big unknown is whether asymptomatic COVID-19 infection can precipitate death from seemingly unrelated causes. At the end of August 2021, a conservative estimate is greater than 14 million COVID-19 deaths around the world.

Key words: Death reporting; COVID-19; COVID testing; underestimation of deaths; official statistics; processes of government; pandemic preparedness.

Introduction

Recent articles in this series have highlighted the potential extent of the undercounting of COVID-19 mortality in countries around the world.[1] Factors such as:

1. low expenditure on health care
2. low testing for COVID-19
3. the proportion of the population living in slums, and/or remote rural areas

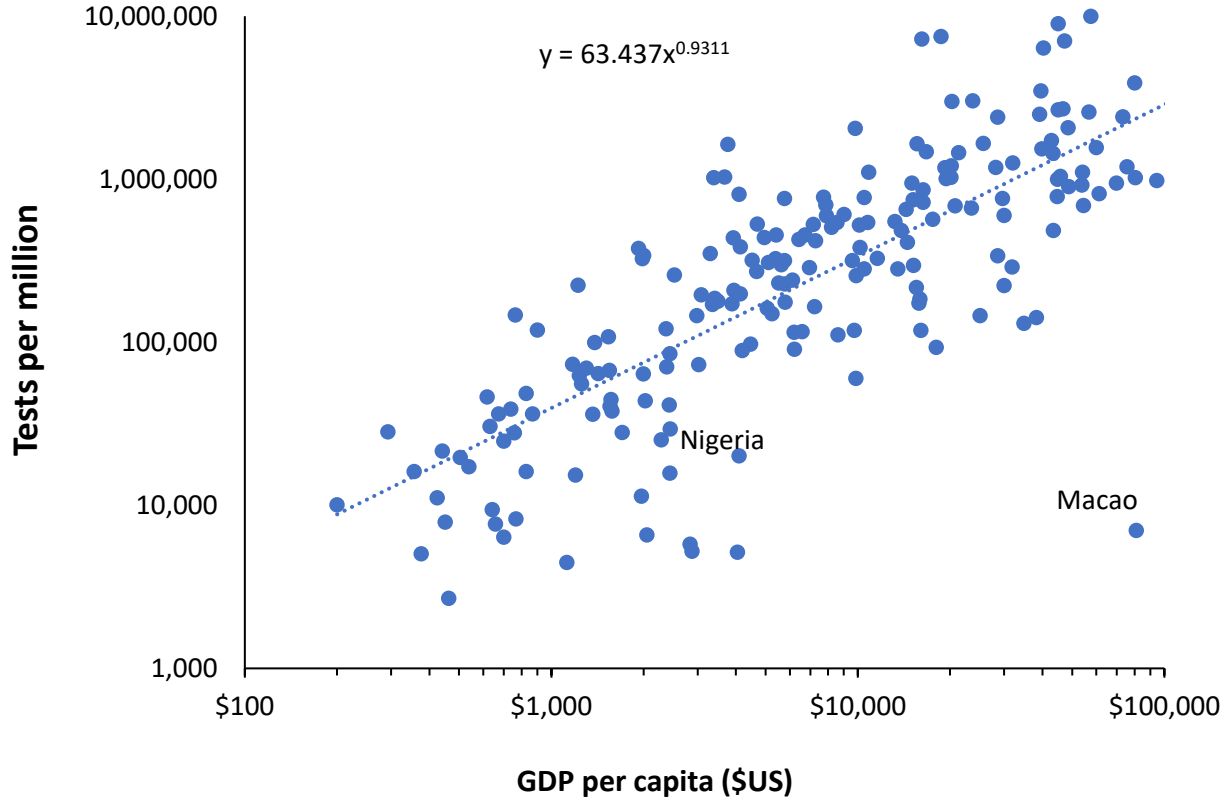
[1] Special Guest Authors (healthfinancejournal.com)

4. a defective mortality reporting process

are common causes of gross undercounting. The risk of COVID-19 infection or death from over half of world countries has been grossly underestimated and in hindsight international air travel from these countries should have been subject to additional scrutiny for many months, i.e., whole countries should have been placed into additional precautionary measures regarding outward/inward travel.

One problem is that determined travellers can use obscure travel routes to avoid quarantine.[2,3,4] Moreover the proportion of asymptomatic cases (up to 70%), i.e., persons with no discernible symptoms, is now known to be much higher than previously thought.[5] Indeed, it was already known *before* the arrival of COVID-19 that all common viral infections have a high proportion of asymptomatic cases.[6] This explains why initial screening of air travellers using elevated body temperature totally failed to prevent global spread.

Figure 1: GDP per capita and COVID-19 tests per million population



[2] CBC News: The National - Travellers use land-border loophole to avoid quarantine hotels | Facebook
[3] Covid: Britons fly via Turkey to avoid costly quarantine - BBC News
[4] Red list laundrette: how to avoid hotel quarantine legally and responsibly | The Independent
[5] Duration of SARS-CoV-2 sero-positivity in a large longitudinal sero-surveillance cohort: the COVID-19 Community Research Partnership | BMC Infectious Diseases | Full Text (biomedcentral.com)
[6] Rates of asymptomatic respiratory virus infection across age groups (nih.gov)

In a previous article I made a conservative estimate that India had experienced somewhere greater than 1.2 million COVID-19 deaths.[7] This has been broadly confirmed by a recent study which estimated 3- to 7-times under reporting of deaths in India during the ***2020*** first wave.[8] More recent estimates using all-cause mortality and household survey data have estimated around 4 to 5 million total COVID deaths in India.[9] My initial estimate of greater than 10 million total COVID-19 worldwide deaths is now looking to be an underestimate, and some are suggesting a worldwide total exceeding 15 million.[10]

To investigate how the relative wealth of world countries influences the level of COVID-19 testing Figure 1 shows cumulative tests per million population plotted against GDP per capita. All data on deaths and COVID-19 testing is from Worldometers.[11] GDP per capita is also from worldometers.[12]

As can be seen testing capacity decreases in an exponential manner as GDP per capita reduces. Relative wealth and relative levels of testing are intimately linked.

Figure 2 shows the relationship between tests per million and reported cases of persons testing positive and deaths per million. As can be seen "reported" cases and deaths also decline in a log-log manner with levels of lower levels of testing. On this occasion the word "cases" means any person with a positive PCR test result and will include asymptomatic persons.

Clearly the less you test the fewer COVID cases, i.e., infected persons, and deaths you will find. Many of these countries have entirely deficient mortality reporting processes, and annual deaths are often just an estimate[13],[14] – which opens such numbers up to political interference to maintain the appearance that the epidemic was controlled.

There are some exceptions. China and Chinese territories (Hong Kong and Macao) are all low because the Chinese government stopped reporting any COVID-19 statistics on the 18th April ***2020***. Real deaths are entirely unknown and likely to remain so.

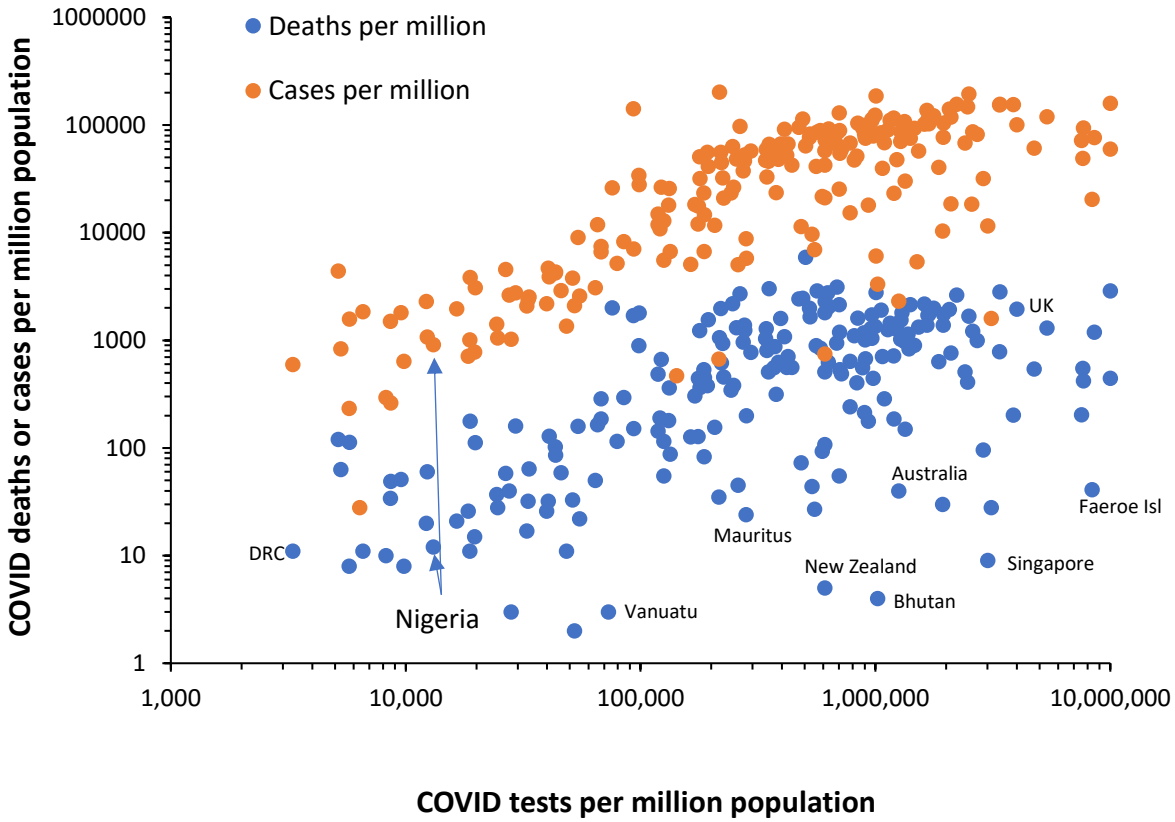
The Central African Republic (CAR) is another example with a mere 99 reported deaths based on just 12,230 cumulative tests per million. The DR Congo claims just 1,053 deaths

7 Special Guest Authors (healthfinancejournal.com)
8 A comparison of five epidemiological models for transmission of SARS-CoV-2 in India | BMC Infectious Diseases | Full Text (biomedcentral.com).
9 Three New Estimates of India's All-Cause Excess Mortality during the COVID-19 Pandemic | Center For Global Development (cgdev.org)
10 True global Covid death toll 'may be more than 15 million' | News | The Times
11 COVID Live Update: 215,180,084 Cases and 4,483,081 Deaths from the Coronavirus - Worldometer (worldometers.info)
12 GDP by Country - Worldometer (worldometers.info)
13 Measuring Africa's Data Gap: The cost of not counting the dead - BBC News
14 (PDF) Mortality surveillance in India: Past, present, and future (researchgate.net)

but manages only a cumulative 3,280 tests per million, i.e., around 180 tests per million per month. Actual deaths could be over 100-times higher.

Nigeria is highlighted as a relatively wealthy less developed country which is testing far fewer people than similar countries of equal GDP per capita. The perception that COVID-19 is under control in that country are without any supporting evidence due to the very low level of testing. The very low reported COVID-19 deaths in Nigeria, a tiny 2,260, are too good to be true – a mere 11,000 cumulative tests per million people – which is the cumulative total over 17 months! Alas politicians are more than happy to craft an alternative reality to maintain public support and portray an international message regarding how well COVID-19 has been managed. A sad reality that has marred the whole COVID-19 story.

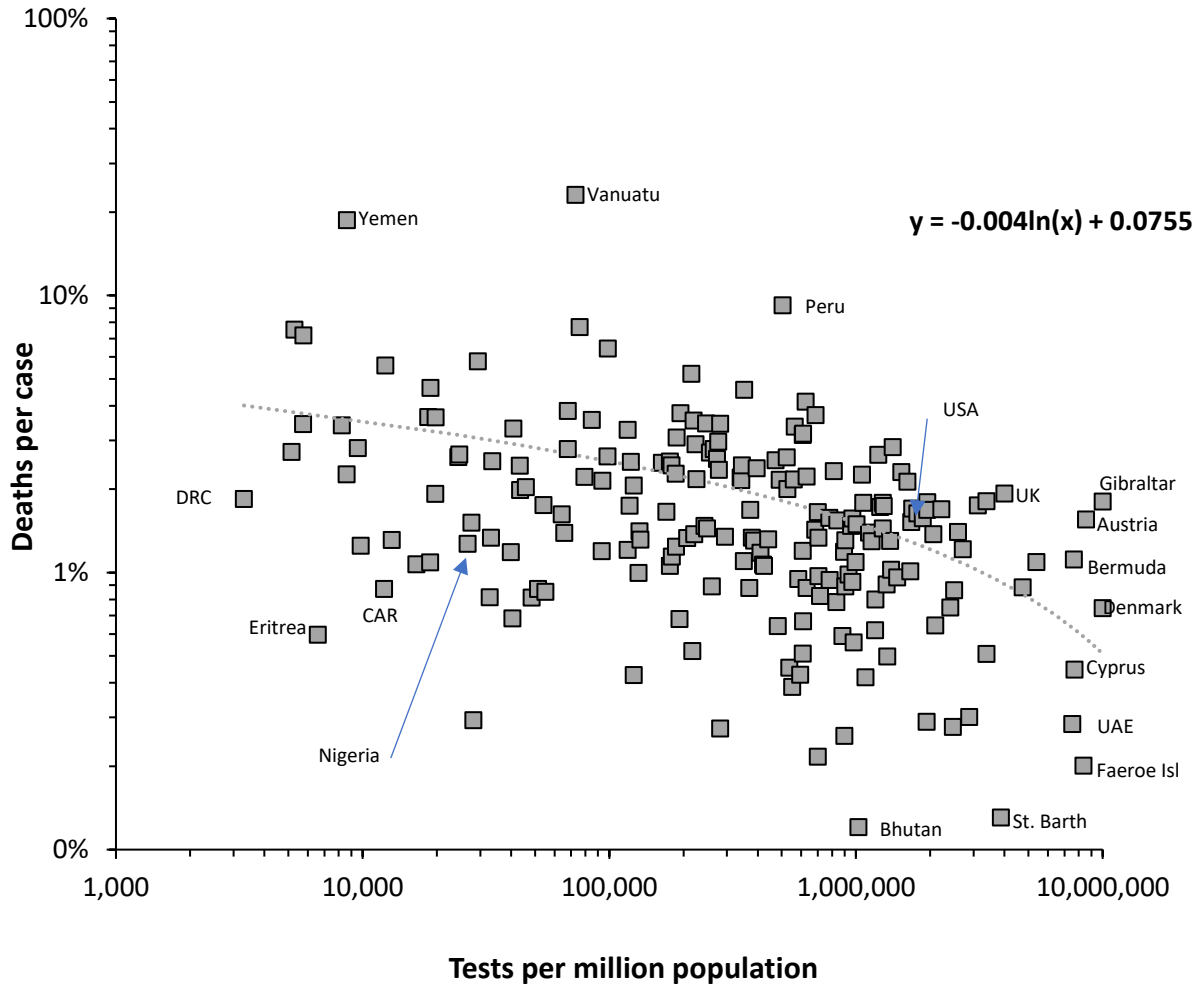
Figure 2: COVID-19 tests per million population and "reported" COVID-19 cases and deaths per million population. Cumulative data up to 3rd September 2021.



At the very low levels of testing seen in many countries it is highly likely that testing is disproportionately located in certain locations, i.e., mainly in hospitals or in easy to access locations, etc. In countries with high levels of corruption, statistics may even be partly fraudulent. Testing will be further skewed in countries where the individual needs to pay for tests.

To further investigate the status of testing Figure 3 shows the case (infected persons) mortality rate versus the cumulative number of tests. As can be seen the case fatality rate rises with fewer deaths but shows considerable scatter. In addition to the ambiguity of the definition of a genuine COVID death, additional scatter arises from several competing forces. Low GDP countries tend to have younger populations hence the case fatality rate would be expected to be lower.

Figure 3: Proportion of reported COVID-19 deaths per reported confirmed cases, i.e., any person with a positive PCR test result. Cumulative results up to 3rd September 2021.



Likewise, over-testing will lead to a lower infected persons fatality rate as more asymptomatic individuals are uncovered. On the other hand, low GDP countries are characterised by a high proportion of the population living in slums with poor sanitation and

high levels of background communicable and non-communicable diseases, [15,16,17] and this should act to substantially increase the case fatality rate.[18] Higher COVID-19 deaths among children are observed under such conditions.[19] Concentration of testing in hospitals will also act to increase the 'reported' case fatality rate. Failure to conduct adequate testing among the very large slum populations is likely to underestimate the fatality rate, i.e., the apparent infected persons fatality rate is a balance between competing forces unique to each country.

The unusually low case fatality rate in Nigeria tends to support the notion that biased sampling and/or COVID death reporting is occurring – indeed as it may well be in many other countries such as DRC, Eritrea, Central African Republic (CAR), Bhutan, etc.

However, the situation is not as simple as it first seems. In the earlier part of the pandemic some 45% of Nigerian frontline healthcare workers who were totally asymptomatic tested positive for COVID-19[20] implying that the virus was present in significant quantities in the population. To further complicate the situation different brands of commercial tests gave markedly different levels of apparent infection,[21] which was potentially due to high levels of parasites and other background infections in Africa.

Indeed, the greater than 10-fold variation in the "reported" infected persons fatality rate across both high and low testing countries indicates the reality of why analysis of changes in all-cause mortality is needed to confirm potential death rates[22,23,24] - most unfortunately Africa and parts of Asia is the very place where accurate all-cause mortality data is least available, and monthly data is difficult to source.

COVID-19 has revealed the gross disparity between countries in terms of genuine pandemic preparedness. Admittedly everyone had assumed that the next pandemic was going to be from influenza.

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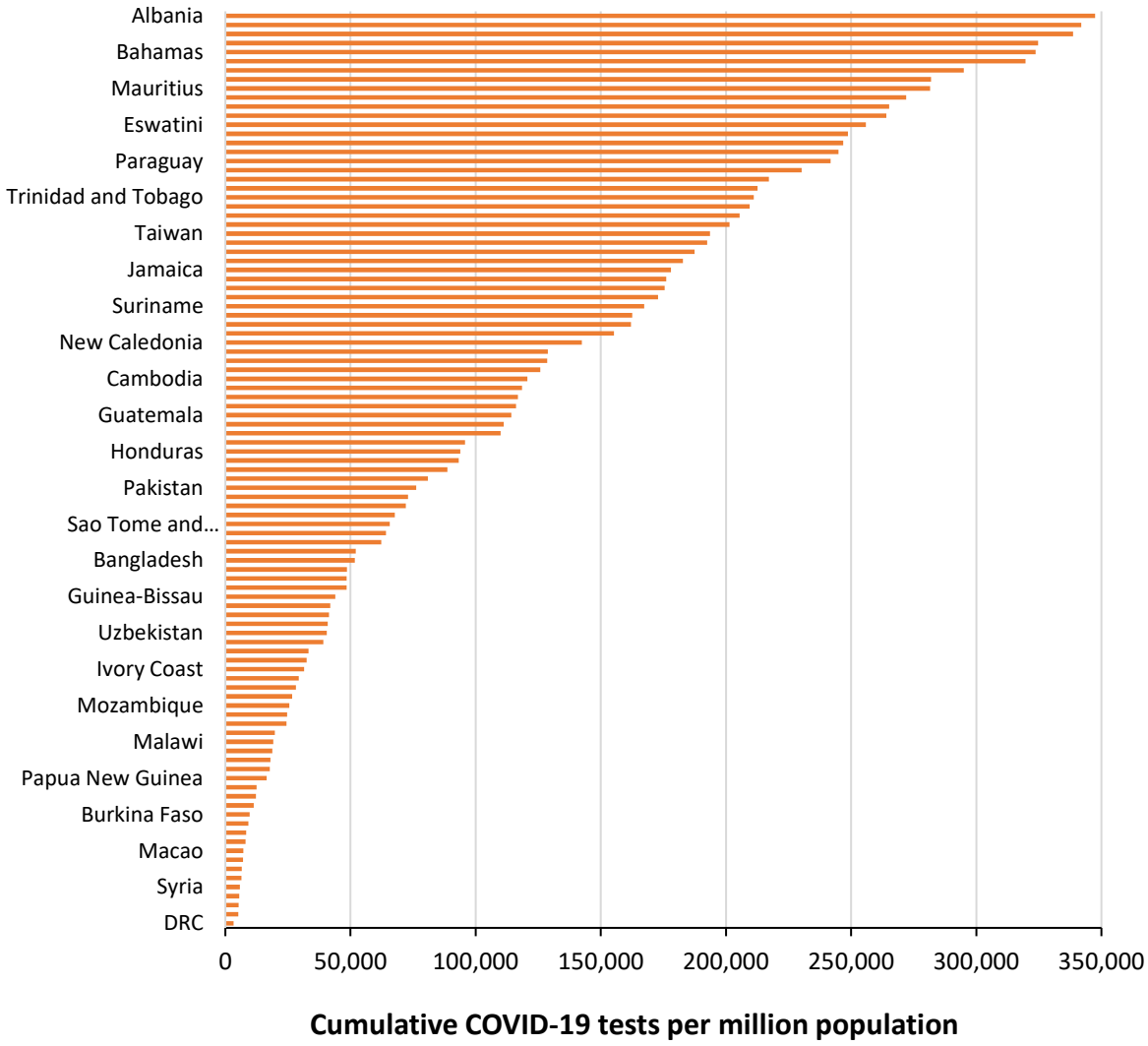
[15] Slum health: Diseases of neglected populations | BMC International Health and Human Rights | Full Text (biomedcentral.com)
[16] Can we 'WaSH' infectious diseases out of slums? - PubMed (nih.gov)
[17] Risk factors for COVID-19 death revealed in world's largest analysis of patient records to date | University of Oxford
[18] Covid-19 deaths in Africa: prospective systematic postmortem surveillance study | The BMJ
[19] Non-communicable diseases, sociodemographic vulnerability and the risk of mortality in hospitalised children and adolescents with COVID-19 in Brazil: a cross-sectional observational study | BMJ Open
[20] SARS-CoV-2 Seropositivity in Asymptomatic Frontline Health Workers in Ibadan, Nigeria - PubMed (nih.gov)
[21] Challenges in interpreting SARS-CoV-2 serological results in African countries - The Lancet Global Health
[22] http://www.hcaf.biz/2020/Covid_Excess_Deaths.pdf
[23] Excess Deaths Associated with COVID-19 (cdc.gov)
[24] Factors associated with increased all-cause mortality during the COVID-19 pandemic in Italy - PubMed (nih.gov)

Figure 4 shows the ranking for all countries having fewer than 350,000 cumulative tests per million which is about one-third the level adequate to estimate of real deaths. Finally, Table 1 lists data for some of the lowest testing countries based on data at the 22nd July 2021.

Figure 4: Countries with fewer than 350,000 cumulative COVID-19 tests per million population up to 21st August 2021. Every 4th name shown. Note that data for China was truncated early in the pandemic.



As an example of undercounting, Peru has recently revised its official COVID-19 death toll up from 69,000 to 185,000.[25] Peru is estimated to contain 33% of its urban population living in slums,[26] and spends around 5% of GDP on health care compared to 10% in the UK, and 12%

[25] Peru Revises COVID-19 Death Total to Triple Official Figures - The New York Times (nytimes.com)
[26] Population living in slums (% of urban population) | Data (worldbank.org)

for OECD countries.[27] Since the beginning of the COVID-19 pandemic Peru has only managed 0.39 million tests per million population compared to 1.5 million per million in the USA and 2.7 million per million in the UK.[28] Such low levels of testing imply that the true extent of COVID deaths will be grossly underestimated – which Peru attempted to address in its revision. By way of comparison India has tested fewer than Peru at just 0.26 million tests per million population. The potential for gross undercounting was enormous, as is now being confirmed.

I continue to maintain, as do others, that greater than 10 million genuine COVID-19 deaths are closer to reality. In fact, if you move each country with fewer than 1 million tests per million population up along the trend in Figure 2 the result is somewhere greater than 14 million total world COVID-19 deaths. See Table 2 for an example. As they say, lies, dammed lies and COVID-19 statistics.

Table 1: Countries with lowest levels of cumulative COVID testing over the 17 months of the pandemic.

Country	"Reported" Deaths	GDP per capita	Tests per million	Deaths per million
DR Congo	1,021	$462	2,686	11
Yemen	1,372	$1,123	4,467	45
Niger	195	$376	5,035	8
Algeria	4,042	$4,048	5,166	90
Sudan	2,776	$2,879	5,218	62
Syria	1,905	$2,835	5,770	106
Solomon Islands	-	$700	6,386	Unknown
Eritrea	33	$2,050	6,585	9
Macao (China)	-	$80,890	7,002	Unknown
Chad	174	$657	7,667	10
Madagascar	939	$450	7,884	33
Haiti	523	$766	8,244	45
Burkina Faso	169	$642	9,409	8
Somalia	781	$200	10,088	48
Central African Republic	98	$424	11,145	20
Nigeria	2,131	$1,969	11,355	10
South Sudan	117	$1,200	15,358	10
Papua New Guinea	192	$2,434	15,778	21
Mali	530	$828	16,087	25
Malawi	1,439	$357	16,130	73
Afghanistan	6,393	$538	17,265	160
Sierra Leone	118	$504	19,681	14
Angola	981	$4,096	20,077	29
Mozambique	1,232	$441	21,556	38
Liberia	148	$699	24,744	29
Ethiopia	4,365	$2,286	25,231	37
Ivory Coast	324	$758	27,903	12

[27] Current health expenditure (% of GDP) | Data (worldbank.org)

[28] COVID Live Update: 173,729,927 Cases and 3,736,526 Deaths from the Coronavirus - Worldometer (worldometers.info)

Country	"Reported" Deaths	GDP per capita	Tests per million	Deaths per million
Congo	176	$1,703	27,963	31
Burundi	8	$293	28,193	0.7
Egypt	16,477	$2,441	29,402	158
Uganda	2,496	$631	30,479	53
Senegal	1,264	$1,366	36,138	73
Guinea	197	$868	36,333	15
Gambia	197	$673	36,395	79
Kenya	3,838	$1,578	37,832	70
Guinea-Bissau	74	$737	38,912	37
Uzbekistan	826	$1,554	40,549	24
Laos	5	$2,424	41,290	0.7
Ghana	819	$2,026	43,744	26
Bangladesh	19,046	$1,564	44,571	114
Togo	143	$618	46,212	17
Benin	107	$827	48,510	9
Myanmar	6,459	$1,256	55,646	118
Lesotho	357	$9,863	60,101	165
Mexico	237,954	$1,234	62,467	1,825
Sao Tome and Principe	37	$1,995	63,862	166
Cameroon	1,334	$1,422	64,305	49
Zimbabwe	2,961	$1,548	67,192	196
Pakistan	22,971	$1,300	69,305	102
Timor-Leste	26	$2,377	70,670	19
Vanuatu	1	$3,022	73,084	3
Mauritania	520	$1,173	73,118	109
Honduras	7,594	$2,437	85,209	754
Indonesia	82,013	$4,200	89,168	297
Ecuador	30,797	$6,214	90,773	1,718
French Polynesia	145	$18,000	93,250	513
Guatemala	10,063	$4,471	97,327	551
Cambodia	1,254	$1,384	99,534	74
Zambia	3,250	$1,535	108,249	172
China	n/a	$8,612	111,163	Unknown
Réunion	266	$6,200	115,206	295
Thailand	3,930	$6,579	116,162	56
Equatorial Guinea	123	$9,741	118,290	85
Venezuela	3,458	$16,050	118,481	122
Nepal	9,695	$900	118,846	327
Vietnam	370	$2,366	121,001	4
New Caledonia	-	$34,780	130,489	Unknown
Japan	15,116	$38,214	141,653	120
Philippines	27,131	$2,982	145,675	244
Taiwan	786	$25,026	145,705	33
Rwanda	718	$762	147,239	54
Suriname	627	$5,251	149,802	1,059
Jamaica	1,168	$5,061	161,652	393
Dominican Republic	3,931	$7,223	165,305	359
Bolivia	17,613	$3,351	170,480	1,487
El Salvador	2,538	$3,883	172,303	389
Antigua and Barbuda	43	$15,825	173,577	435
Libya	3,344	$5,791	175,836	480
Tunisia	18,052	$3,494	178,695	1,511
Trinidad and Tobago	1,026	$15,952	184,009	731

Country	"Reported" Deaths	GDP per capita	Tests per million	Deaths per million
Djibouti	155	$3,409	185,976	155
Morocco	9,559	$3,083	195,835	256
Sri Lanka	4,054	$4,135	197,812	188
Eswatini	742	$3,942	208,053	633
Seychelles	89	$15,536	217,232	899

Table 2: Calculated likely COVID-19 deaths in the 25 lowest testing countries. The method is conservative and even after scaling deaths look low relative to population in some countries.

Country	Reported deaths	Test per million	Scaling factor	Potential deaths	Population
DRC	1,061	3,303	108	114,237	92,739,070
Algeria	5,373	5,156	75	401,619	44,777,440
Sudan	2,837	5,296	73	207,454	45,045,787
Niger	199	5,743	68	13,617	25,228,063
Syria	2,029	5,754	68	138,619	17,997,416
Solomon	0	6,369	63	Unknown	706,565
Eritrea	38	6,574	61	2,328	3,603,891
Chad	174	8,243	51	8,854	16,976,125
Madagascar	956	8,604	49	46,969	28,522,595
Yemen	1,513	8,627	49	74,172	30,593,882
Haiti	586	9,557	45	26,416	11,565,333
Burkina Faso	171	9,814	44	7,543	21,572,607
CAR	100	12,222	37	3,685	4,928,023
Somalia	992	12,358	37	36,224	16,410,958
Nigeria	2,495	13,105	35	86,830	212,108,984
Papua New	192	16,497	29	5,533	9,145,271
Mali	540	18,474	26	14,184	20,931,769
South Sudan	120	18,764	26	3,112	11,347,446
Afghanistan	7,128	18,830	26	184,317	39,953,127
Sierra Leone	121	19,681	25	3,018	8,166,682
Malawi	2,203	19,767	25	54,743	19,707,380
Angola	1,248	24,394	21	26,102	34,059,241
Liberia	148	24,679	21	3,066	5,196,605
Mozambique	1,872	26,630	19	36,438	32,277,870
Ethiopia	4,731	27,578	19	89,485	118,290,702
Burundi	38	28,100	19	708	12,304,133
Egypt	16,766	29,339	18	301,436	104,592,162
Ivory Coast	455	32,745	16	7,476	27,141,454
Congo	183	33,154	16	2,977	5,676,782

Suggested further reading

A full series of articles on COVID-19 deaths can be found at http://www.hcaf.biz/2020/Covid_Excess_Deaths.pdf these can also be found via Research Gate. Research on outbreaks of a new type or kind of disease can also be found at http://www.hcaf.biz/2010/Publications_Full.pdf