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Original Research Article

Global, regional, and national incidence and mortality of COVID-19 in 237 countries and territories, January 2022: a systematic analysis for World Health Organization COVID-19 Dashboard

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Abstract

Objective: To estimate global, regional, and national incidences and mortality of the coronavirus disease 2019 (COVID-19) in 237 countries and territories since the outbreak of the COVID-19 pandemic to 31 January, 2022.

Methods: Comprehensive estimates were produced through global, regional, and national studies of cumulative severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections for the duration of the COVID-19 pandemic. The incidence and mortality rate of COVID-19 was analyzed based on the World Health Organization (WHO) COVID-19 Dashboard data since the outbreak of the COVID-19 pandemic to 31 January, 2022. The number of cumulative total confirmed cases, the number of cumulative total confirmed cases (cumulative incidence) per 100,000, the number of cumulative total death cases, and the number of cumulative total death cases (cumulative death rate) per 100,000 population were calculated according to the WHO regions, World Bank income groups, and each country.

Results: A total of 349,641,119 of confirmed COVID-19 cases were reported globally on 31 January, 2022 (cumulative incidence of COVID-19, 4,485.72 per 100,000 population). Europe demonstrated the highest cumulative incidence of COVID-19 (14,039.95 per 100,000 population), followed by the Americas (12,512.57 per 100,000 population) showing a cumulative total death cases and cumulative death rate of COVID-19 of 5,592,266 and 71.75 per 100,000 population, respectively. The Americas presented highest cumulative death rate of COVID-19 (14,039.95 per 100,000 population), followed by Europe (12,512.57 per 100,000 population). The nation with the highest cumulative total cases of COVID-19 was the United States of America (n=69,727,991). However, the cumulative death rate of the COVID-19 was found higher in developing and underdeveloped countries.

Conclusion: From the start of the COVID-19 pandemic to 31 January, 2022, 349.6 million of the worldwide population suffered symptoms of SARS-COV-2 and 5.6 million lost their lives due to it. The population in Europe and other high-income groups showed high incidence rates of COVID-19 while the death rate was high in Americas and other upper middle-income nations. According to figures of nationalities, the countries with compromised economic status presented a higher death rate despite relatively lower incidence of COVID-19 than the developed countries. The results of this study may provide crucially important for COVID-19 research and proper public health policies and strategies.

Keywords: COVID-19; SARS-CoV-2; incidence; death

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic era has lasted for more than 2 years since first case was reported in December 2019.[1] Viral factors of severe acute respiratory

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syndrome coronavirus 2 (SARS-CoV-2) and host defense strategies have been developed during the COVID-19 pandemic.[2] In order to sustain and spread infections, the virus constantly developed novel variants.[3] Such variants have been reported as the alpha, beta, delta, and omicron SARS-CoV-2.[4, 5] By the end of December 2021, the omicron variant consisted of about 95% of the total COVID-19 confirmed cases.[6] Compared to the delta variant, the omicron variant presented a higher breakthrough of infections in the vaccinated population, while showing a milder clinical severity with less admission (odds ratio [OR], 0.33; 95% confidence interval [CI], 0.21- 0.52), less intensive care admission (OR, 0.38; 95% CI, 0.17 to 0.87), and less mortality rate (OR, 0.26; 95% CI, 0.06-1.02).[6]

Efforts to suppress the COVID-19 infection and mortality have been introduced including quarantine and vaccinations.[7] Governments and public strategies have executed quarantine measures, such as selective or transient lockdown periods, social distancing, enforcing wearing of facial masks, and other preventive measures.[8, 9] A various types of vaccines against the SARS-CoV-2 have been developed to prevent transmission of SARS-CoV-2 and clinically serious disease [10] Moreover, pharmaceutical therapeutics against COVID-19 became available, although with limited efficiency in eradicating or ending the pandemic.[11] All of these host and viral factors can be seen to have influence on the epidemiology of the COVID-19.

The number of cases and severity of COVID-19 have been dynamically changing which made it challenging to be estimated. In this study, we aimed to give a long term global trend of incidences and mortality of SARS CoV-2 infection by presenting the total number of cases and mortality rate according to geographic region, ethnicity, and economic status. Many previous researches on the prevalence and mortality of COVID-19 have focused on Europe or America, which were estimated to account for about 78 % of the evidence.[12] Although there are inconsistencies in the data, the global infection fatality rate was estimated about 0.15% in 1.5 to 2.0 billion of COVID-19 cases in February 2022.[12]

This study investigated the incidence and death rate of COVID-19 based on data from the World Health Organization (WHO) from the start of the COVID-19 pandemic up to 31 January, 2022. The epidemiology of COVID-19 was analyzed according to regions, income levels, and nationalities. This epidemiologic updates on COVID-19 aims to give an insight into the ways to the endemic phase of COVID-19.

2. Methods

Global, regional and national estimates of cumulative SARS-CoV-2 infection during COVID-19 pandemic was analyzed The cumulative incidence and mortality rate of COVID-19 were calculated based on the WHO COVID-19 Dashboard data from the start of the COVID-19 pandemic to 31 January, 2022, which referred to WHO's officially reported numbers of SARS-CoV-2 infection cases and related deaths under the International Health Regulation.

Cases primarily defined as laboratory-confirmed SARS-CoV-2 cases or deaths based on WHO's guideline are those as the followings; [13] 1) a patient with a positive nucleic acid amplification test; 2) a patient with a positive SARS-CoV-2 antigen rapid diagnostic test and meeting either the probable case definition; or 3) an asymptomatic patient with positive SARS-

CoV-2 antigen rapid diagnostic test who had contact of a probable or confirmed case. Underestimations or overestimations of truce cases and mortality may exist due to local adaptations such as testing strategies, reporting practice, lag times, and case detection methods. Such factors may have influence on collecting the accurate numbers and can possibly delay issue of global data.

2.1 Statistical Analysis

All efforts from governments, international, national, and regional authorities have been made to ensure the reliability and accuracy of the dataset and significant data errors been detected by the WHO, which may be revised at more frequent intervals. The number of cumulative total confirmed cases, the number of cumulative total confirmed cases (cumulative incidence) per 100,000, the number of cumulative total death cases, and the number of cumulative total death cases (cumulative death rate) per 100,000 population were collected from WHO data and analyzed according to the regions classified by the WHO (Europe, Americas, South-East Asia, Eastern Mediterranean, Western Pacific, and Africa), income groups (high-income, upper middle-income, lower middle-income, and lower income), and each country (total of 237 countries). We systematically reviewed input registration data and all figures were generated using R software version 3.1.1 (R Foundation, Vienna, Austria).

2.2 Patient and Public Involvement

No patients were directly involved in designing the research question or conducting the research. No patients were asked to interpret or write up the results. There are no plans to involve patients or relevant patient communities in dissemination at this moment.

3. Results

A total of 349,641,119 of cases were confirmed COVID-19 globally on 31 January, 2022 (Table 1 and Fig. 1). The cumulative incidence of COVID-19 was 4,485.72 people per 100,000 of the population. Among the six WHO regions, Europe demonstrated the highest

Table 1. Cumulative total cases and total deaths of COVID-19 by WHO regions and World Bank income groups

Name	Cumulative total confirmed cases (number)	Cumulative incidence, per 100,000 population (number)	Cumulative total death cases (number)	Cumulative death rate, per 100,000 population (number)
Global	349,641,119	4,485.72	5,592,266	71.75
By WHO Region				
Europe	131,002,165	14,039.95	1,742,509	186.75
Americas	127,975,395	12,512.57	2,471,381	241.63
South-East Asia	50,112,782	2,479.13	731,020	36.16
Eastern Mediterranean	18,299,374	2,503.94	319,704	43.75

Table 1. Continued

Name	Cumulative total confirmed cases (number)	Cumulative incidence, per 100,000 population (number)	Cumulative total death cases (number)	Cumulative death rate, per 100,000 population (number)
Western Pacific	14,308,546	728.33	165,066	8.40
Africa	7,942,093	707.89	162,576	14.49
By World Bank income group				
High-income	181,054,222	42,742.51	2,086,351	419.10
Upper middle-income	104,060,725	33,935.34	2,513,818	619.14
Lower middle-income	62,028,291	13,066.81	945,047	260.83
Lower income	1,784,154	98.32	40,729	18.99

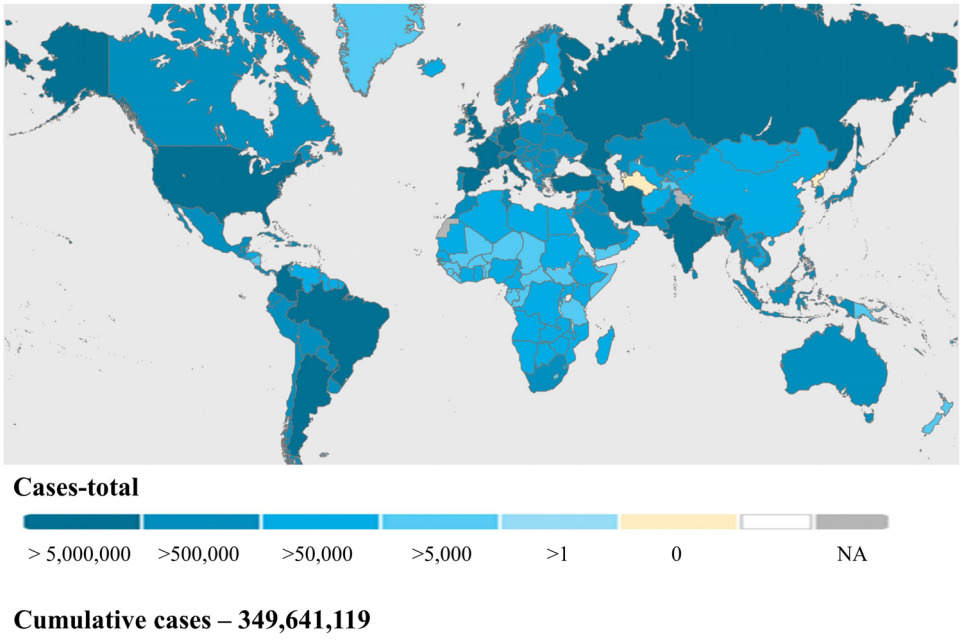

Fig. 1. Global cumulative total cases of SARS-CoV-2 infections, since the outbreak of the COVID-19 pandemic to 31 January, 2022.

cumulative incidence of COVID-19 followed by Americas (14,039.95 and 12,512.57 per 100,000 population, respectively). Cumulative total death cases related to COVID-19 is calculated as 5,592,266 (Fig. 2). The cumulative death rate of COVID-19 was 71.75 per 100,000 population and (Fig. 2 to 4). The Americas presented the highest cumulative death rate of COVID-19, followed by Europe (241.63 and 186.75 per 100,000 population, respectively).

When focusing on income levels, groups with the highest income demonstrated the highest

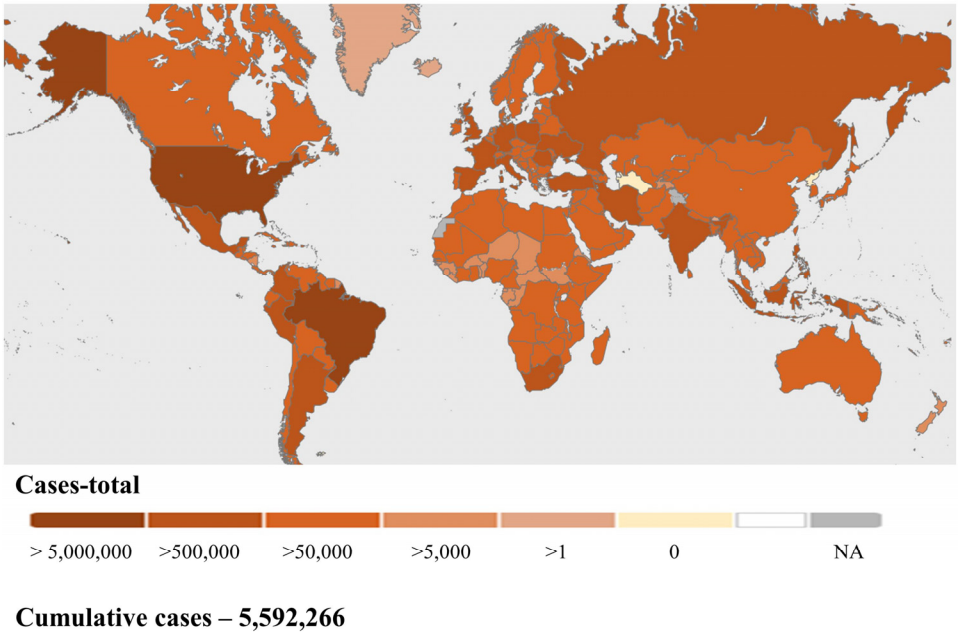

Fig. 2. Global cumulative total deaths cases of SARS-CoV-2 infections, since the outbreak of the COVID-19 pandemic to 31 January, 2022.

cumulative incidence of confirmed COVID-19, followed by the upper middle-income group (42,742.51 and 33,935.34 per 100,000 population, respectively). The cumulative death rate of COVID-19 was highest in the upper middle-income group, followed by the high-income group (619.14 and 419.10 per 100,000 population, respectively).

The nation with the highest cumulative total cases of COVID-19 was the United States of America (n=69,727,991) (Table 2). However, the cumulative incidence of COVID-19 in the USA was 21,065.69 per 100,000 population and countries such as Andorra, Seychelles and Gibraltar showed higher cumulative incidence than USA and higher in other countries such as Andorra, Seychelles, and Gibraltar. The total cumulative deaths of COVID-19 was highest in United States of America (n=858,470) but the cumulative death rate of COVID-19 was highest in Peru (619.137 per 100,000 population). Republic of Korea indicated a relatively low incidence and death rate of COVID-19, demonstrating 1446.118 per 100,000 population of the cumulative incidence of COVID-19 and 12.805 per 100,000 population of the cumulative death rate of COVID-19.

Table 2. Cumulative total cases and total deaths of COVID-19 according to each countries

Name	Cumulative total confirmed cases (number)	Cumulative incidence, per 100,000 population (number)	Cumulative total death cases (number)	Cumulative death rate, per 100,000 population (number)
Global	349,641,119	4,485.72	5,592,266	71.75
United States of America	69,727,991	21,065.69	858,470	259.35

Table 2. Continued

Name	Cumulative total confirmed cases (number)	Cumulative incidence, per 100,000 population (number)	Cumulative total death cases (number)	Cumulative death rate, per 100,000 population (number)
India	39,543,328	2,865.45	489,848	35.50
Brazil	23,909,175	11,248.23	622,801	293.00
France	16,286,388	25,040.82	125,921	193.61
The United Kingdom	15,859,292	23,361.65	153,862	226.65
Russian Federation	11,108,191	7,611.77	326,767	223.91
Turkey	10,946,238	12,978.85	85,969	101.93
Italy	9,923,678	16,638.88	143,523	240.64
Spain	8,834,364	18,664.43	91,599	193.52
Germany	8,744,840	10,514.83	116,746	140.38
Argentina	7,792,652	17,241.99	119,103	263.53
Iran (Islamic Republic of)	6,250,490	7,441.68	132,230	157.43
Colombia	5,714,092	11,229.89	132,023	259.46
Mexico	4,646,957	3,604.17	303,085	235.07
Poland	4,547,315	11,979.82	103,846	273.58
Indonesia	4,289,305	1,568.17	144,227	52.73
Netherlands	3,889,669	22,344.68	21,211	121.85
Ukraine	3,870,370	8,849.85	99,282	227.02
South Africa	3,581,359	6,038.51	94,177	158.79
Philippines	3,417,216	3,118.44	53,472	48.80
Peru	2,894,215	8,777.84	204,141	619.14
Canada	2,868,862	7,601.21	32,220	85.37
Malaysia	2,832,945	8,752.84	31,892	98.54
Czechia	2,763,800	25,844.55	37,050	346.46
Belgium	2,697,239	23,408.58	28,780	249.77
Israel	2,385,826	27,564.15	8,454	97.67
Thailand	2,384,639	34,16.39	22,045	31.58
Portugal	2,221,825	21,579.69	19,569	190.07
Japan	2,169,653	1,715.46	18,506	14.63
Iraq	2,154,237	5,355.80	24,287	60.38
Viet Nam	2,141,422	2,199.97	36,719	37.72
Romania	2,017,129	10,435.85	59,547	308.07
Chile	1,965,393	10,281.30	39,512	206.69

Table 2. Continued

Name	Cumulative total confirmed cases (number)	Cumulative incidence, per 100,000 population (number)	Cumulative total death cases (number)	Cumulative death rate, per 100,000 population (number)
Switzerland	1,871,445	21,623.66	12,164	140.55
Greece	1,793,311	16,730.89	22,635	211.18
Sweden	1,784,005	17,274.17	15,674	151.77
Bangladesh	1,699,964	1,032.22	28,238	17.15
Australia	1,657,485	6,499.97	3,103	12.17
Austria	1,609,872	18,086.29	13,519	151.88
Serbia	1,544,900	22,303.53	13,271	191.59
Hungary	1,441,385	14,753.89	40,944	419.10
Denmark	1,397,833	24,006.35	3,608	61.96
Pakistan	1,367,605	619.13	29,097	13.17
Kazakhstan	1,243,220	6,621.08	18,391	97.95
Ireland	1,145,968	23,083.53	6,087	122.61
Jordan	1,141,048	11,183.31	13,073	128.13
Morocco	1,098,413	2,975.88	15,132	41.00
Georgia	1,059,392	26,556.67	14,732	369.30
Cuba	1,022,112	9,023.98	8,363	73.84
Slovakia	921,422	16,882.44	17,675	323.84
Nepal	918,448	3,152.19	11,659	40.02
Bulgaria	880,228	12,662.45	32,664	469.89
Croatia	877,060	21,612.23	13,407	330.37
Lebanon	865,229	12,676.52	9,487	139.00
Tunisia	853,905	7,225.08	25,988	219.89
United Arab Emirates	825,699	8,348.49	2,214	22.39
Bolivia (Plurinational State of)	804,677	6,893.48	20,570	176.22
Republic of Korea	741,413	1,446.12	6,565	12.81
Belarus	726,860	7,692.19	5,933	62.79
Guatemala	669,012	3,734.25	16,263	90.78
Ecuador	664,664	3,767.28	34,287	194.34
Saudi Arabia	652,354	1,873.83	8,920	25.62
Costa Rica	643,496	12,632.14	7,451	146.27
Panama	637,519	14,775.28	7,583	175.75
Azerbaijan	633,731	6,250.32	8,610	84.92

Table 2. Continued

Name	Cumulative total confirmed cases (number)	Cumulative incidence, per 100,000 population (number)	Cumulative total death cases (number)	Cumulative death rate, per 100,000 population (number)
Norway	622,753	1,1602.12	1,414	26.34
Lithuania	612,500	2,1921.27	7,762	277.80
Slovenia	603,341	2,8787.26	6,250	298.21
Sri Lanka	601,886	2,810.81	15,299	71.45
Uruguay	580,066	16,698.65	6,303	181.45
Dominican Republic	539,580	4,974.05	4,287	39.52
Myanmar	534,071	981.57	19,310	35.49
Paraguay	532,648	7,467.86	16,953	237.69
Kuwait	497,454	11,648.42	2,486	58.21
occupied Palestinian territory, including east Jerusalem	484,979	9,506.76	5,056	99.11
Venezuela (Bolivarian Republic of)	467,864	1,645.33	5,402	19.00
Ethiopia	462,107	401.96	7,244	6.30
Puerto Rico	442,080	15,452.73	3,696	129.19
Mongolia	428,368	13,066.81	2,021	61.65
Finland	426,826	7,724.95	1,815	32.85
Egypt	410,098	400.74	22,368	21.86
Republic of Moldova	409,397	10,148.75	10,522	260.84
Libya	405,425	5,900.27	5,921	86.17
Honduras	387,515	3,912.47	10,469	105.70
Armenia	352,399	11,892.38	8,028	270.92
Latvia	335,541	17,589.00	4,795	251.35
Bosnia and Herzegovina	333,131	10,153.91	14,026	427.52
Bahrain	330,621	19,430.29	1,399	82.22
Qatar	323,345	11,223.15	634	22.01
Oman	322,438	6,314.11	4,128	80.84
Kenya	320,229	595.54	5,554	10.33
Singapore	313,772	5,363.31	848	14.50

Table 2. Continued

Name	Cumulative total confirmed cases (number)	Cumulative incidence, per 100,000 population (number)	Cumulative total death cases (number)	Cumulative death rate, per 100,000 population (number)
Zambia	301,630	1,640.72	3,895	21.19
Estonia	296,466	22,307.85	2,008	151.09
North Macedonia	256,281	1,2301.21	8,218	394.46
Nigeria	252,187	122.34	3,124	1.52
Albania	248,070	8,620.13	3,305	114.85
Botswana	243,946	10,373.50	2,544	108.18
Cyprus	239,073	26,922.48	712	80.18
Algeria	236,670	539.71	6,495	14.81
Zimbabwe	228,254	1,535.73	5,294	35.62
Mozambique	222,596	712.18	2,157	6.90
Uzbekistan	215,063	642.57	1,542	4.61
Montenegro	213,135	33,935.34	2,507	399.16
Kyrgyzstan	195,820	3,001.45	2,851	43.70
Kosovo	181,403	10,102.27	2,988	166.40
Uganda	160,419	350.71	3,479	7.61
Afghanistan	159,682	410.20	7,393	18.99
Ghana	155,496	500.42	1,367	4.40
Namibia	155,027	6,101.25	3,902	153.57
Luxembourg	137,570	21,972.25	943	150.61
China	137,350	9.34	5,700	0.39
Réunion	133,617	14,924.07	462	51.60
Lao People's Democratic Republic	129,953	1,786.16	526	7.23
Rwanda	128,009	988.32	1,432	11.06
El Salvador	127,012	1,958.19	3,855	59.43
Cambodia	121,026	723.89	3,015	18.03
Jamaica	119,565	4,037.77	2,594	87.60
Maldives	117,461	21,730.15	269	49.77
Cameroon	114,113	429.87	1,867	7.03
Trinidad and Tobago	105,969	7,571.98	3,286	234.80
Angola	96,582	293.86	1,888	5.74
Democratic Republic of the Congo	84,519	94.37	1,278	1.43

Table 2. Continued

Name	Cumulative total confirmed cases (number)	Cumulative incidence, per 100,000 population (number)	Cumulative total death cases (number)	Cumulative death rate, per 100,000 population (number)
Senegal	84,295	503.44	1,925	11.50
Malawi	83,823	438.18	2,523	13.19
Côte d'Ivoire	80,176	303.95	779	2.95
Martinique	77,075	20,538.82	821	218.78
Guadeloupe	73,660	18,409.29	835	208.69
French Guiana	72,819	24,380.11	359	120.20
Mauritius	70,218	5,521.29	786	61.80
Suriname	69,741	11,888.37	1,237	210.87
Eswatini	68,081	5,868.22	1,369	118.00
Malta	65,866	12,800.35	532	103.39
Fiji	60,931	6,796.96	768	85.67
Iceland	58,409	16,040.52	44	12.08
Mauritania	57,384	1,234.16	927	19.94
Madagascar	57,375	207.20	1,223	4.42
Guyana	56,585	7,194.06	1,130	143.67
Cabo Verde	55,306	9,947.36	389	69.97
Sudan	55,149	125.77	3,404	7.76
Syrian Arab Republic	50,985	291.33	2,968	16.96
French Polynesia	47,656	16,964.99	636	226.41
Gabon	45,909	2,062.65	300	13.48
Belize	45,753	11,506.48	616	154.92
Barbados	39,212	13,644.89	275	95.69
Burundi	37,042	311.52	14	0.12
Papua New Guinea	36,480	407.73	597	6.67
Togo	36,313	438.63	266	3.21
Mayotte	35,966	13,183.29	187	68.55
Guinea	35,857	273.03	414	3.15
Curaçao	35,307	21,516.46	210	127.98
Seychelles	35,178	35,769.27	136	138.29
Andorra	33,025	42,742.51	144	186.37
United Republic of Tanzania	32,393	54.23	753	1.26

Table 2. Continued

Name	Cumulative total confirmed cases (number)	Cumulative incidence, per 100,000 population (number)	Cumulative total death cases (number)	Cumulative death rate, per 100,000 population (number)
Lesotho	32,049	1,496.05	690	32.21
Bahamas	31,915	8,115.83	726	184.62
Aruba	31,835	29,817.55	187	175.15
Mali	29,678	146.55	705	3.48
Haiti	28,250	247.75	780	6.84
Jersey	27,591	25,595.57	96	89.06
Benin	26,309	217.01	163	1.35
Somalia	24,322	153.03	1,335	8.40
Congo	23,485	425.60	371	6.72
Isle of Man	20,586	24,209.71	70	82.32
Guam	20,567	12,186.05	276	163.53
Burkina Faso	20,514	98.14	353	1.69
Timor-Leste	19,869	1,507.00	122	9.25
Saint Lucia	19,468	10,601.93	316	172.09
Tajikistan	17,578	184.30	125	1.31
South Sudan	16,711	149.29	137	1.22
Brunei Darussalam	16,132	3,687.49	59	13.49
Equatorial Guinea	15,690	1,118.33	179	12.76
New Caledonia	15,331	5,369.92	282	98.78
Djibouti	15,311	1,549.70	189	19.13
New Zealand	15,250	316.24	52	1.08
United States Virgin Islands	14,398	13,787.89	96	91.93
Faroe Islands	14,340	29,346.16	17	34.79
Cayman Islands	13,734	20,897.75	15	22.82
Nicaragua	13,646	205.99	219	3.31
Central African Republic	13,509	279.70	109	2.26
Gibraltar	11,810	35,053.87	100	296.82
San Marino	11,786	34,728.03	108	318.23
Gambia	11,572	478.84	347	14.36
Grenada	11,303	10,045.06	205	182.19

Table 2. Continued

Name	Cumulative total confirmed cases (number)	Cumulative incidence, per 100,000 population (number)	Cumulative total death cases (number)	Cumulative death rate, per 100,000 population (number)
Guernsey	10,641	16,505.86	30	46.54
Yemen	10,585	35.49	1,995	6.69
Bermuda	9,766	15,682.56	112	179.85
Greenland	9,485	16,707.18	4	7.05
Eritrea	9,297	262.15	93	2.62
Saint Martin	9,143	23,650.38	40	103.47
Sint Maarten	8,965	20,906.21	77	179.56
Niger	8,544	35.30	296	1.22
Dominica	8,421	11,697.30	49	68.06
Liechtenstein	7,874	20,321.57	68	175.50
Comoros	7,812	898.34	159	18.28
Sierra Leone	7,590	95.15	125	1.57
Monaco	7,583	19,322.70	45	114.67
Guinea-Bissau	7,293	370.58	153	7.77
Liberia	7,243	143.21	289	5.71
Chad	6,889	41.94	185	1.13
Saint Vincent and the Grenadines	6,615	5,962.68	90	81.13
Antigua and Barbuda	5,931	6,056.43	122	124.58
Sao Tome and Principe	5,832	2,661.08	69	31.48
British Virgin Islands	5,649	18,682.41	47	155.44
Bonaire	5,594	26,746.35	26	124.31
Turks and Caicos Islands	5,570	14,386.07	33	85.23
Saint Kitts and Nevis	5,254	9,877.43	28	52.64
Northern Mariana Islands (Commonwealth of the)	4,246	7,377.04	22	38.22
Bhutan	3,811	493.90	3	0.39

Table 2. Continued

Name	Cumulative total confirmed cases (number)	Cumulative incidence, per 100,000 population (number)	Cumulative total death cases (number)	Cumulative death rate, per 100,000 population (number)
Saint Barthélemy	3,282	33,201.82	4	40.47
Anguilla	2,187	14,578.06	7	46.66
Other	764		13	
Palau	502	2,774.71	0	0.00
Saint Pierre and Miquelon	482	8,317.52	0	0.00
Wallis and Futuna	453	4,028.10	7	62.24
Solomon Islands	289	42.07	0	0.00
Sint Eustatius	280	8,920.04	1	31.86
Saba	198	10,243.15	0	0.00
Montserrat	155	3,100.62	1	20.00
Falkland Islands (Malvinas)	86	2,469.14	0	0.00
Kiribati	59	49.39	0	0.00
Holy See	26	3,213.84	0	0.00
American Samoa	18	32.61	0	0.00
Samoa	17	8.57	0	0.00
Vanuatu	7	2.28	0	0.00
Marshall Islands	4	6.76	0	0.00
Tonga	1	0.95	0	0.00
Cook Islands	0	0.00	0	0.00
Democratic People's Republic of Korea	0	0.00	0	0.00
Micronesia (Federated States of)	0	0.00	0	0.00
Nauru	0	0.00	0	0.00
Niue	0	0.00	0	0.00
Pitcairn Islands	0	0.00	0	0.00
Saint Helena	0	0.00	0	0.00

Table 2. Continued

Name	Cumulative total confirmed cases (number)	Cumulative incidence, per 100,000 population (number)	Cumulative total death cases (number)	Cumulative death rate, per 100,000 population (number)
Tokelau	0	0.00	0	0.00
Turkmenistan	0	0.00	0	0.00
Tuvalu	0	0.00	0	0.00

Global trend of cumulative total cases of COVID-19 and cumulative total death cases can be seen in Fig. 3 and 4 respectively. Unfortunately both trends are still rising up by at the end of December 2021.

4. Discussion

Present study showed a global picture of current COVID-19 epidemiology. Not only the number of cumulative total cases but cumulative incidence shown with number of cases per 100,000 population are highest in Europe region when compared with other WHO regions. Besides high-income group had the highest number of cumulative total cases and cumulative incidence. Although Americas group comes second after Europe in mean of cumulative total cases and cumulative incidence, WHO region of Americas includes not only high-income countries like USA and Canada but also middle and lower-income countries from South and

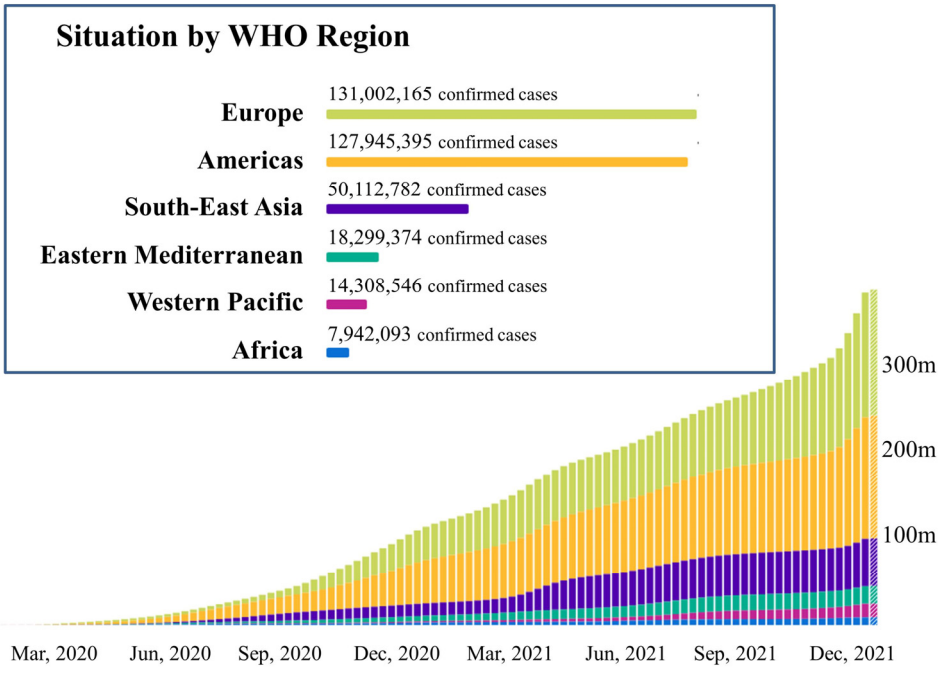

Fig. 3. Global trend of cumulative total cases of SARS-CoV-2 infections by the WHO regions, since the outbreak of the COVID-19 pandemic to 31 January, 2022.

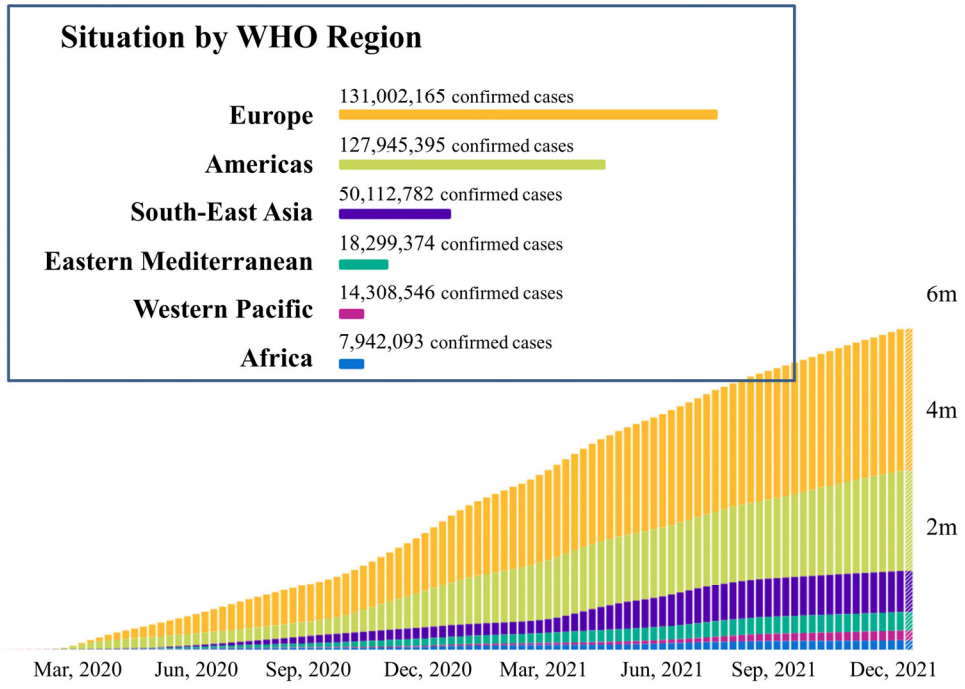

Fig. 4. Global trend of COVID-19 related deaths by the WHO regions, since the outbreak of the COVID-19 pandemic to 31 January, 2022.

Central America. Lower-income groups and regions of Africa which mostly consists from lower-income countries had reported the lowest total cumulative cases and cumulative incidence.

When total cumulative death cases and death rate defined as total cumulative death cases per 100,000 population calculations were analyzed, different outcome was found compared with total cumulative cases and cumulative incidence. Region of Americas data showed the highest cumulative total deaths and death rate. Europe comes second after Americas in mean of these two measures of WHO dashboard. Africa and Eastern Mediterranean are at the bottom of these measure lists.

It can be assumed that the economic inequality had influence on both the incidence and death rates of COVID-19. Although disproportionate impact of COVID-19 on different countries and regions can be conceived as arising from biological and genetic differences, it mostly comes from the social determinants of health-care systems.[14, 15] It is possible that the availability to medical access for COVID-19 testing may have impact on the high incidence of COVID-19 in the high-income group. The death rates of COVID-19 were high in developing or underdeveloped countries, although the incidence of COVID-19 was higher in many advanced countries. The higher death rates in developing or underdeveloped countries could be attributed to the shortage or insufficient medical care. These results support the prior reports on the economic inequalities during the COVID-19 pandemic.[14-16]

These results must be interpreted cautiously because one country comes forward with its measures of WHO COVID-19 Dashboard and socio-demoghraphic features. USA reported

highest total cumulative cases and one of the high cumulative incidence. This result is in accordance with the region of Europe because developed or high-income countries usually reported high total cumulative cases and cumulative incidence attributed to the easy access to healthcare facilities. Despite its developed situation, USA has the highest total cumulative death cases and one of the highest death rate by 259 deaths per 100,000 population. USA is accepted as richest country on earth but it has heterogeneity for its citizens in mean of access to healthcare. Especially ethnic and racial minorities are more vulnerable to COVID-19 pandemic and death rates are higher in these groups when compared with their percentage in USA's population.[17]

4.1 Global Trend of Incidence and Mortality of COVID-19

Almost two and a half years have been passed during pandemic when this paper was written. In the beginning of the pandemic, questions about the duration of the pandemic cannot be answered due its ambiguous nature. Despite many restrictions and prevention strategies have been implemented by various governments or organizations and introduction of various type of vaccine against SARS-CoV-2- as can be seen in Fig. 3 and 4 pandemic is still going on. It is expected not to end but to transform into endemic state.[18]

A number of factors can have influence on the incidence of COVID-19. The variant type of SARS-CoV-2 is one of the main factors in determining the infection rates of COVID-19. In January 2022, the omicron variant, a predominant mutant type of SARS-CoV-2, emerged, which had clinical characteristics of attenuated infections with mild or absence of symptoms, while it harbors high transmission rates.[19, 20]

The status of vaccination is another factor which has influence on the incidence of COVID-19. The COVID-19 vaccination reported to be effective in preventing and attenuating the infection rates of SARS-CoV-2 in many countries.[21, 22] However, because the novel variant of SARS-CoV-2 can escape most neutralizing antibodies against SARS-CoV-2, the high number of vaccinated population cannot guarantee a lower incidence of COVID-19.[23]

Public health measures, such as wearing facial mask can also have impact on the incidence of COVID-19. It was reported that the wearing of surgical masks reduced the SARS-CoV-2 infection rate more than 50% in Denmark.[24]

Another determinant of incidence of COVID-19 is testing strategies and the types of tests. Individuals who are offered test can affect the cumulative total case number and incidence. Individuals who had symptoms and individuals who had test for screening (for example before surgical interventions or before airway travelling) will show different test results. Tests for clinical purposes must have higher sensitivity. Reverse transcriptase PCR is the recommended test type for individuals who had symptoms. On the other hand for mass screening purposes and rapid antigen tests can be chosen given the lower cost but lower sensitivity.[25] Jurisdictions and governments had chosen different testing strategies, reporting practice based on their healthcare system and resources that affect the measures. Furthermore, lag times may have increase in reporting biases.

In this study, we suggested that the death rate was relatively high in developing or

underdeveloped nations. The economic inequality for medical care may induce higher mortality rate in the developing or underdeveloped nations than developed nations. In addition, the epidemic features of SARS-CoV-2 variants could result in different mortality rates according to geographic regions. Some regions assumed to consist of low-income countries like Africa had reported lower numbers for all four measures of WHO COVID-19 Dashboard. We hypothesized that this difference come from the case detection methods and access to heathcare and data collection and reporting systems of jurisdictions. These kinds of health determinant may cause biases and incidence or death rate data cannot be collected adequately.

Death rate of COVID-19 is also affected by various types of determinants. In aspects of host factors, there have been reports on the different symptomatic characteristics of COVID-19 according to ethnicities.[26] The age of patients is another key factor to determine the fatality of SARS-CoV-2 infection.[27] In previous modeling study, the infection fatality of COVID-19 was estimated to be lowest in age groups of 5 to 9 years old and it increased according to age in a log-linear pattern.[27] Because the aged population is more vulnerable to the SARS-CoV-2 infection, the availability of nursing health care system and age distribution of the population are factors that could contribute to the heterogeneous mortality rates of COVID-19 among nations. In South Korea, the medical costs for diagnosis and treatment of COVID-19 have been completely covered by the national health insurance system.[28] This health care system may lead to the results of the low death rate of COVID-19 in South Korea.

4.2 Strengths and Limitations

It is notable that there are additional factors to be considered when estimating the mortality rates of COVID-19 in the future. The virulence of SARS-CoV-2 has been weakening with emergence of its novel variants. In addition, vaccinations against SARS-CoV-2 effectively attenuated the severity of COVID-19.[29] Because immunity of the disease has been maintained while the infection-blocking immunity rapidly disappeared, the immunologic features of SARS-CoV-2 are predicted to change and become endemic phase of COVID-19.[30]

In this study, we reported global, regional, and national incidence and mortality of COVID-19 in 237 countries and territories up to January 2022 through a systematic analysis for WHO COVID-19 Dashboard dataset. However, these are several limitations of this study that need to be addressed. First, every effort from WHO has been made to ensure the reliability and accuracy of the dataset, significant data errors could be detected. Second, as the data was collected by WHO, governments, international, national, and regional authorities, there is the possibility that the estimates may tend to underestimate or overestimate the levels of incidence and mortality of COVID-19.

5. Conclusions

From the start of the COVID-19 pandemic up to 31 January, 2022, 349.6 million of the worldwide population suffered symptoms of SARS-COV-2 and 5.6 million lost their lives due to it. The population in Europe and other high-income groups showed high incidence rates of COVID-19 while the death rate was high in Americas and other upper middle-income groups.

According to figures nationalities, the counties with compromised social and economic status presented higher death rate despite the relatively lower incidence of COVID-19 than the developed countries. The results of this study may provide crucially important for COVID-19 research and proper public health policies and strategies.

Capsule Summary

From the start of the COVID-19 pandemic to 31 January, 2022, 349.6 million and 5.6 million of worldwide population each suffered and died from SARS-COV-2 infection.

Ethics statements

The study's protocol has been approved by the research ethics board at the University of Washington. This dataset shall be conducted in full compliance with University of Washington policies and procedures, as well as applicable federal, state, and local laws.

Patient and public involvement

No patients were directly involved in designing the research question or in conducting the research. No patients were asked for advice on interpretation or writing up the results. There are no plans to involve patients or relevant patient community in dissemination at this moment.

Data availability statement

Data of the study are publicly available.

Transparency statement

The leading authors (Dr. SYK and AÖY) are an honest, accurate, and transparent account of the study being reported.

Acknowledgements

None

Author contribution

Drs SYK and AÖY had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. All authors approved the final version before submission. *Study concept and design*: SYK and AÖY; *Acquisition, analysis, or interpretation of data*: SYK and AÖY; *Drafting of the manuscript*: SYK and AÖY; *Critical revision of the manuscript for important intellectual content*: SYK and AÖY; *Statistical analysis*: SYK and AÖY; *Study supervision*: SYK and AÖY. SYK is guarantor. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

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Competing interests

The authors have no conflicts of interest to declare for this study.

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