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(REVIEW ARTICLE)

Global disparities in COVID-19 mortality: A regional and population-based analysis

Md Raiyan Hashar [1,*], Md Mahmudur Rahman Chowdhury [2], Md Imam Hossain [3], Ajim Uddin [4] and Md Abdul Bari [5]

[1] *Department of Public Health, World University of Bangladesh.*
[2] *Department of Respiratory Medicine, Bangladesh Medical University.*
[3] *Sylhet MAG Osmani Medical College.*
[4] *Department of Medicine, Dhaka Medical College Hospital.*
[5] *Department of Pharmacology, Ibn Sina Medical College.*

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Abstract

This study examines global disparities in COVID-19 mortality across WHO regions and countries, utilizing secondary data from the WHO COVID-19 Dashboard and World Bank population estimates. Descriptive statistical analyses reveal significant variations in mortality metrics. The African region exhibits the highest death-to-case ratio at 1.93%, driven by underreported cases and limited healthcare access, while the Western Pacific region records the lowest at 0.20%, reflecting robust public health measures. Globally, 80% of 7.78 million reported deaths are concentrated in 24 countries, with the U.S. (1.2 million deaths) and India (533,000 deaths) bearing significant burdens. Mexico and Peru show the highest case fatality rates at 4.4% and 4.9%, respectively, indicating underreporting or healthcare strain. In contrast, China and Japan report low mortality per capita due to stringent interventions. The case study of Bangladesh highlights challenges in densely populated developing nations, with a 1.44% death-to-case ratio exceeding the global average of 1%. These findings underscore the need for equitable healthcare resource allocation and strengthened surveillance systems to address disparities and enhance global pandemic preparedness.

Keywords: COVID-19 mortality; Global disparities; Case fatality rate; WHO regions; Population-adjusted analysis

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has fundamentally reshaped global health systems, exposed disparities in healthcare infrastructure, and challenged public health preparedness in both developed and developing nations (Sawicka et al., 2022). Since its emergence in late 2019, the virus has spread across virtually every country, resulting in over 778 million confirmed cases and 7.1 million reported deaths as of early 2025, according to the World Health Organization (WHO). While COVID-19 is a universal health challenge, its impact has been far from uniform across regions, countries, and demographic groups.

The global mortality burden from COVID-19 has varied significantly, driven by a complex interplay of factors including healthcare system capacity, population demographics, viral variants, vaccination coverage, public health policy, and socioeconomic inequalities. For instance, some regions have reported high infection rates but comparatively low death rates, whereas others, particularly certain countries in the Americas and Eastern Mediterranean regions, have experienced disproportionately high case fatality rates (CFRs) (Khafaie & Rahim, 2020). These disparities prompt urgent questions about the structural and systemic factors underlying COVID-19 outcomes.

* Corresponding author: Raiyan Hashar

Epidemiological comparisons between nations offer valuable insights into public health vulnerabilities and policy effectiveness. However, comparing crude death counts without adjusting for population size, testing rates, and repeat infections can be misleading. Mortality indicators such as the case fatality rate (CFR) and mortality rate per 100,000 population provide more nuanced views but are still subject to variation in testing strategies and reporting accuracy.

An additional layer of complexity arises when comparing mortality relative to population size. Countries with very large populations, such as China and India, have shown relatively low mortality rates per capita despite high absolute case numbers. Conversely, countries with smaller populations, such as Peru and Mexico, have recorded some of the highest COVID-19 death rates in relation to their population size and confirmed cases. These disparities suggest that population-adjusted analyses are essential to properly assess and interpret the global impact of COVID-19.

Further, the regional classification provided by the WHO, including the African, Eastern Mediterranean, European, Western Pacific, South-East Asian, and American regions, offers a useful framework to compare outcomes in a geographically and administratively standardized way. Notably, countries in the Western Pacific region, despite experiencing significant caseloads, have maintained relatively low mortality, prompting inquiries into regional strategies and system-level resilience. In contrast, several nations in the Americas and Eastern Mediterranean regions have consistently exhibited higher death-to-case ratios.

Despite a vast and growing body of COVID-19 literature, there remains a significant gap in comparative analyses that simultaneously account for:

- The concentration of global deaths in a small group of countries,
- The differences in death-to-case ratios across WHO regions,
- The role of population size in shaping mortality rates.

Most existing studies either focus on clinical or virological aspects of the disease or are country-specific and lack a broader comparative perspective. Moreover, while raw data is available from global sources, few descriptive studies have synthesized these data to map patterns of mortality and case burden across the globe using consistent statistical approaches.

This study aims to address these gaps through a comprehensive descriptive statistical analysis of COVID-19 cases and deaths across WHO regions and key countries. The specific objectives are:

- To identify and analyze disparities in COVID-19 mortality across different WHO regions
- To examine the concentration of global COVID-19 deaths among a small group of countries, and to assess how much of the global death burden is accounted for by them.
- To compare country-level mortality in the context of population size, highlighting the contrast between absolute and relative mortality burdens.
- To discuss potential epidemiological, demographic, and health system factors that may explain these regional and country-level disparities.

This study uses secondary data from the World Health Organization (WHO) COVID-19 Dashboard and publicly available national-level datasets. The most recent cumulative statistics on reported cases and deaths are utilized, with regional categorizations based on WHO classifications. Population data are obtained from the United Nations World Population Prospects (2022 revision) to compute population-adjusted indicators.

A descriptive statistical approach is employed to explore trends and patterns. Key metrics include:

- Case Fatality Rate (CFR): deaths as a percentage of confirmed cases,
- Mortality per 100,000 population, and
- Proportional contribution of each country to total global deaths.

Visualizations such as bar charts, heat maps, and regional comparisons are used to support the analysis.

No inferential or predictive modeling is applied in this study, as the primary objective is to describe, summarize, and compare mortality metrics across geographies in an epidemiologically meaningful manner.

Understanding where and why mortality disparities exist is critical for future pandemic preparedness and for strengthening global health equity. This research provides foundational insights for policymakers, epidemiologists, and public health stakeholders by:

- Highlighting nations and regions with disproportionately high death rates relative to case counts and population sizes,
- Informing future health resource allocation and international collaboration efforts,
- Encouraging deeper investigations into healthcare access, comorbidity patterns, testing availability, and reporting practices.

Furthermore, these findings could guide future response strategies not only for COVID-19 but also for other communicable disease outbreaks. By identifying patterns of vulnerability and resilience, this study contributes to global lessons in preparedness, surveillance, and equity.

2. Literature Review

The COVID-19 pandemic has unveiled significant disparities in mortality rates across different regions, populations, and healthcare systems. Numerous studies have explored these disparities, highlighting the multifaceted nature of COVID-19 outcomes influenced by socioeconomic, racial, and regional factors.

Racial and ethnic disparities have been a prominent feature of COVID-19 mortality statistics. A study published in JAMA Network Open analyzed age-adjusted mortality rates across various racial and ethnic groups in the United States from February 2020 to September 2023 (Albuquerque et al., 2022). The findings revealed that non-Hispanic American Indian or Alaska Native and non-Hispanic Native Hawaiian or Pacific Islander populations consistently exhibited higher mortality rates compared to non-Hispanic White individuals. These disparities were particularly pronounced during COVID-19 surges, underscoring the persistent health inequities faced by these communities.

Similarly, a study highlighted in Time magazine emphasized that people of color in the U.S., regardless of income level, disproportionately suffered higher rates of COVID-19 infection and mortality. The research indicated that structural racism extends beyond income disparities, affecting access to medical care, job types, and exposure to stressors, thereby exacerbating health outcomes during the pandemic (Chen et al, 2025).

Regional disparities also played a significant role in COVID-19 mortality (Sumibcay et al., 2024). A retrospective analysis conducted in Ontario, Canada, examined the effects of deprivation, age, and regional differences on COVID-19 mortality from 2020 to 2022. The study found that areas with higher deprivation levels experienced increased mortality rates, highlighting the intersection of socioeconomic status and health outcomes.

In the United States, nursing homes with lower proportions of white residents saw significantly higher COVID-19 death rates compared to those with predominantly white populations (Time Staff, 2020). This disparity was attributed to the more severe spread of the disease in non-white communities and the specific characteristics of the nursing homes serving these populations.

Treatment disparities have also influenced COVID-19 mortality outcomes. A Bayesian reanalysis published in JAMA Network Open assessed the mortality rates among hospitalized COVID-19 patients treated with tocilizumab and corticosteroids (Axios Staff, 2021). The study concluded that patients receiving simple oxygen or noninvasive ventilation benefited from tocilizumab treatment, while the benefit was uncertain for those requiring invasive mechanical ventilation.

While the studies primarily focus on high-income countries, the implications are relevant for countries like Bangladesh. Understanding the interplay of racial, socioeconomic, and regional factors in COVID-19 mortality can inform public health strategies to address disparities. Given Bangladesh's diverse population and varying access to healthcare resources, similar analyses are essential to identify vulnerable groups and tailor interventions accordingly.

3. Methodology

3.1. Study Design

This study adopts a retrospective, cross-sectional design using publicly available secondary data to assess global disparities in COVID-19 mortality. The analysis focuses on regional and country-level differences in COVID-19 death rates in relation to reported cases and population sizes.

3.2. Data Sources

Data were collected from reputable, open-access databases including:

- World Health Organization (WHO) COVID-19 Dashboard
- Our World in Data (OWID) COVID-19 dataset
- World Bank for population estimates and healthcare indicators

These sources offer comprehensive and regularly updated datasets on confirmed cases, deaths, testing rates, and population statistics across countries and regions.

3.3. Inclusion Criteria

- Countries and WHO regions with at least 100,000 reported COVID-19 cases.
- Availability of cumulative data for total confirmed cases, deaths, and national population.

Countries with significant underreporting or missing data were excluded to maintain analytical reliability.

3.4. Variables and Definitions

- Total Reported Cases (C): Cumulative confirmed COVID-19 cases.
- Total Reported Deaths (D): Cumulative confirmed COVID-19-related deaths.
- Population (P): Total national population as reported by the World Bank.
- Case Fatality Rate (CFR): Ratio of deaths to confirmed cases.
- Mortality per 100,000 Population (M): Deaths per capita, standardized.

3.5. Data Analysis

The analysis employed descriptive statistical techniques using Microsoft Excel and Python (pandas, seaborn, matplotlib) to explore patterns in COVID-19 mortality. Regional and country-level summaries were created based on WHO regional classifications.

The following metrics were computed:

3.5.1. Case Fatality Rate (CFR)

$$\text{CFR\%} = \frac{D}{C}\ X\ 100$$

3.5.2. Mortality Rate per 100,000 Population (MR)

$$\text{MR} = \frac{D}{P}\ X\ 100{,}000$$

3.5.3. Infection Penetration Rate (IPR):

Total reported cases as a proportion of the population

$$\text{IPR\%} = \frac{C}{P}\ X\ 100$$

3.5.4. Contribution to Global Deaths (CDG):

Proportion of global deaths attributed to each country

$$\text{CDG\%} = \frac{D_i}{D_{total}}\ X\ 100$$

Where:

D: Total deaths in the country; C: Total cases in the country; P: Total population of the country; D_i: Deaths in country *i*; D_{total}: Global total deaths.

3.6. Regional Comparison

Countries were grouped into the six WHO regions: African Region (AFR); Region of the Americas (AMR); South-East Asia Region (SEAR); European Region (EUR); Eastern Mediterranean Region (EMR); Western Pacific Region (WPR)

Descriptive comparisons of CFR and MR were conducted between regions to identify which regions experienced disproportionately high or low mortality burdens.

3.7. Visualization and Statistical Tools

Data visualizations (e.g. bar graphs, heatmaps, scatter plots) were used to illustrate regional and country-level patterns. Analysis was descriptive in nature, without inferential statistical testing, due to the ecological nature of the data and variability in national reporting standards.

3.8. Ethical Considerations

As this study uses only secondary, publicly available, and aggregated data, no ethical approval was required. No personal or confidential health information was used.

4. Results and Discussion

Table 1 shows the results for zone-wise case and death rate-

Table 1 Zone-wise case and death rate across the world

Region	Deaths	Case	Death/Case
AFRO	174426	9051672	1.93%
AMRO	3053194	192982520	1.58%
EMRO	351975	23417911	1.50%
EURO	2280007	281013542	0.81%
SEARO	808873	61332835	1.32%
WPRO	421686	208610782	0.20%
Grand Total	7090161	776409262	0.20%

According to this result, the African region shows the highest death-to-case ratio (1.93%) among all WHO regions. Many African nations may have underreported total cases due to weak surveillance systems and testing capacity. This leads to inflated death/case ratios because the denominator (case count) is underestimated.

Access to intensive care, oxygen therapy, and advanced treatments are often limited in many parts of Africa. Delayed identification of COVID-19 cases due to low testing may result in higher mortality once cases are detected.

Despite being better resourced, the Americas show a significantly high death/case ratio. The Americas have a high prevalence of obesity, diabetes, and cardiovascular diseases, all of which increase COVID-19 mortality. Countries like the USA and Brazil faced early challenges in response strategies, healthcare overload, and vaccine rollout. Marginalized populations (e.g., low-income or indigenous groups) had reduced access to care and were disproportionately affected.

Also, above the global average, EMRO includes countries like Iran, Pakistan, and Egypt. Conflict zones and fragile health systems (e.g., Syria, Yemen) likely reduced access to proper healthcare and led to underreporting of mild/moderate cases. Limited data transparency in some countries might also skew the ratio.

South-East Asia Region (SEARO) – 1.32%. Includes densely populated countries like India, Bangladesh, and Indonesia. In countries like India and Bangladesh, the sheer size of the population and resource limitations could have reduced testing coverage. Undetected mild cases reduce the official case count, making the death-to-case ratio appear higher than it truly is.

European Region (EURO) – 0.81%. Europe shows a relatively moderate death/case ratio despite high case numbers. Widespread testing increased the number of detected (including asymptomatic and mild) cases, lowering the death/case ratio. The availability of ICU beds, ventilators, and early intervention helped reduce fatality rates. High vaccine coverage played a crucial role in minimizing severe outcomes.

Lowest Death-to-Case Ratio: Western Pacific Region (WPRO) – 0.20%. Countries like China, Japan, South Korea, and Australia fall in this region. Strict lockdowns, border control, and early interventions slowed virus spread. Mask-wearing and social distancing were widely practiced. High vaccination rates and strong healthcare systems, particularly in countries like Japan and Australia. Accurate testing and reporting increased the denominator (cases), lowering the ratio.

Table 2 shows that 80% of the total death occurred only in 24 countries as reported.

Table 2 80% of the death occurred in 24 countries

Countries	Sum of New_deaths	Sum of New_cases	Population
United States of America	1222309	103436829	336998000
Brazil	702747	37715366	214326000
India	533664	45044634	1407564000
Russian Federation	404290	24901467	145103000
Mexico	334818	7622513	126705000
United Kingdom	232112	25040433	67281000
Peru	221051	4532174	33715000
Italy	198519	26968272	59240000
Germany	174979	38437863	83409000
France	168162	39037633	64531000
Indonesia	162059	6830227	273753000
Iran (Islamic Republic of)	146837	7627863	87923000
Colombia	142755	6397671	51517000
Argentina	130750	10112153	45277000
China	122398	99381761	1425894000
Spain	121852	13980340	47487000
Poland	121018	6779266	38308000
Ukraine	109925	5543240	43531000
South Africa	102595	4072955	59392000
Turkey	101419	17004713	84775000
Japan	74694	33803572	124613000
Romania	68963	3568885	19329000
Philippines	66864	4140383	113880000
Chile	62872	5410137	19493000
Grand Total	5727652	577390350	4974044000

A choropleth map can describe the scenario with enhanced clarity.

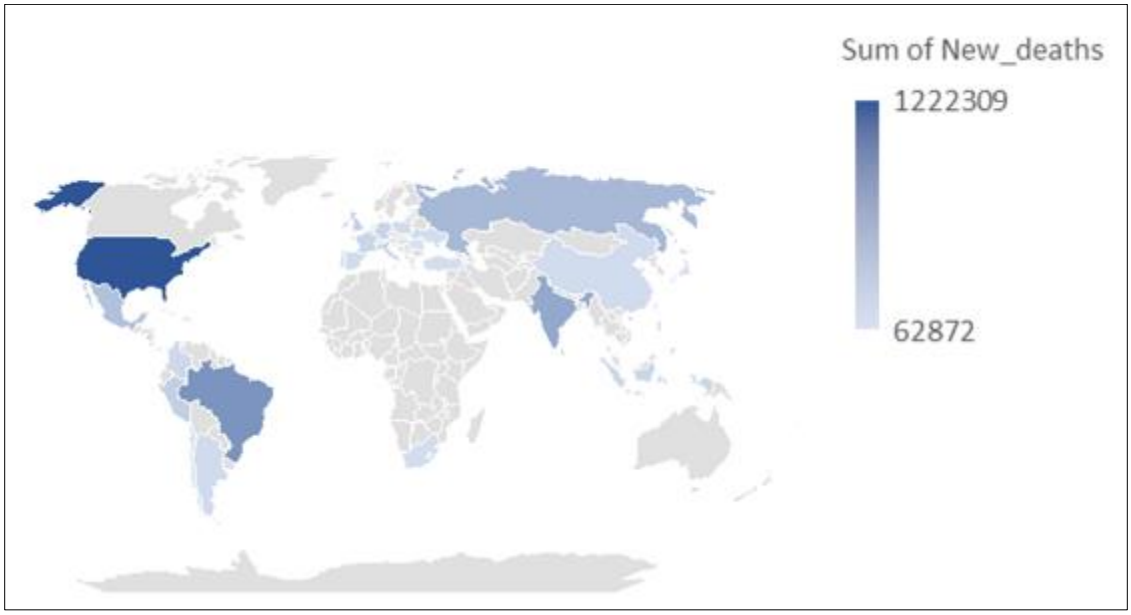

Figure 1 80% death due to Covid 19 occurred in only 24 countries

Based on the results, here are the most critical COVID-19 impact scenarios drawn from deaths, cases, and population figures:

4.1. High Death Toll with High Population – India & USA

- India: Though it had over 533,000 deaths, this is relatively low per capita due to its large population (1.4 billion). Its death rate per 100,000 population is significantly lower than most top countries.
- USA: The highest number of deaths (1.2 million) and highest cases (103 million). Even with high testing and healthcare, the death toll reflects early-stage policy gaps and widespread transmission.

4.2. Highest Case Fatality Ratio (Deaths per Case) – Mexico & Peru

- Mexico: 334,818 deaths with only 7.6 million cases → approx. 4.4% case fatality rate.
- Peru: 221,051 deaths and 4.5 million cases → approx. 4.9%, the highest globally.
- These high rates suggest underreporting of mild cases, poor testing, and/or weaker healthcare responses.

4.3. Large Case Counts but Moderate Mortality – France, Germany, UK

- These countries reported 25M–39M cases, but death rates remained comparatively lower (0.4–0.7%).
- Indicates effective public health measures, vaccinations, and healthcare capacity.

4.4. Low Deaths Relative to Population – China & Japan

- China: ~122,000 deaths with 99 million cases, but a population of 1.42 billion → very low mortality per capita.
- Japan: Despite 33.8 million cases, only 74,694 deaths → extremely low case fatality rate (~0.2%).
- Both benefitted from stringent control measures, early intervention, and public compliance.

4.5. Underrepresented Infection – Indonesia & Philippines

- Both have large populations (Indonesia: 274M, Philippines: 114M) but relatively low case counts.
- Likely due to limited testing/reporting, not necessarily lower transmission.

Over 80% of the total 7.78 million reported COVID-19 deaths are concentrated in just 24 countries, with an average global case fatality rate of around 1%. Among these, Mexico leads with an exceptionally high death-to-case ratio of approximately 4–5%, indicating either severe underreporting of cases or a strained healthcare response. Although Peru has one of the highest fatality ratios globally, it is not included among the top 24 contributors to total deaths due to its relatively lower number of reported cases. In contrast, countries like China, Japan, and South Korea demonstrate the most favorable outcomes, with very low death-to-case ratios, reflecting effective containment and healthcare strategies. Additionally, China and India report the lowest mortality rates relative to their total populations, largely due to their

massive population sizes diluting the per capita impact. In terms of case-to-population ratios, countries with more extensive testing facilities, such as those in Europe and North America, naturally show higher percentages, underscoring the role of testing capacity in reported infection data.

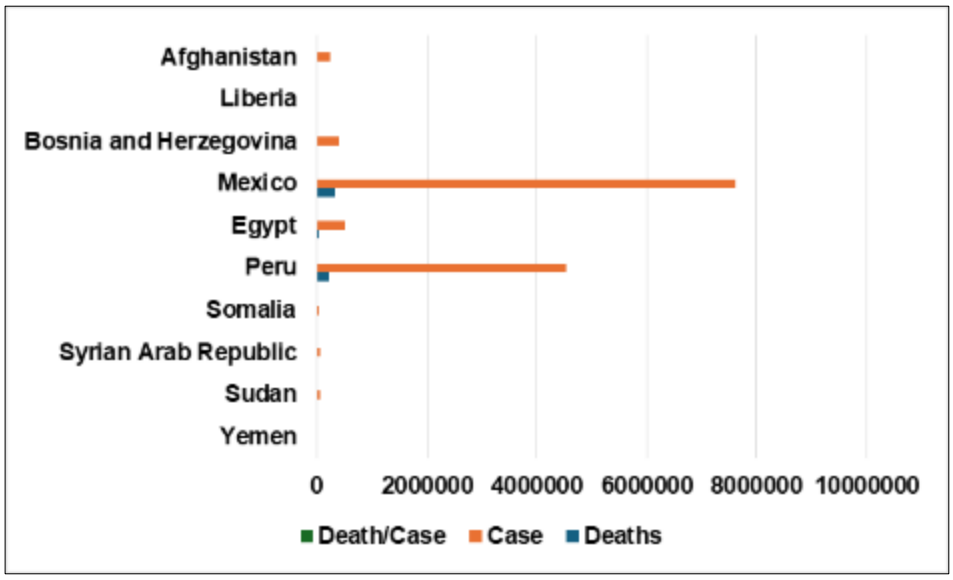

Figure 2 Top ten countries with maximum death/case

The top ten countries (Figure 2) with the highest death-to-case ratios exhibit alarmingly high fatality rates, indicating severe healthcare challenges or underreporting of cases. Yemen leads with a staggering 18.1% death-to-case ratio, suggesting an overwhelmed health system amid ongoing conflict. Sudan (7.9%), Syria (5.5%), and Somalia (5.0%) follow closely—countries similarly affected by political instability or fragile healthcare infrastructures. Peru (4.9%) and Mexico (4.4%) are notable exceptions from Latin America, likely affected by delayed testing and reporting. Egypt (4.8%) and Bosnia and Herzegovina (4.1%) reflect the struggle of middle-income countries to manage case surges. Even countries like Liberia (3.7%) and Afghanistan (3.4%) report high ratios, likely due to limited access to healthcare and testing. These high death-to-case ratios reflect the need for strengthened health systems, timely diagnosis, and equitable vaccine distribution, especially in vulnerable and conflict-affected regions.

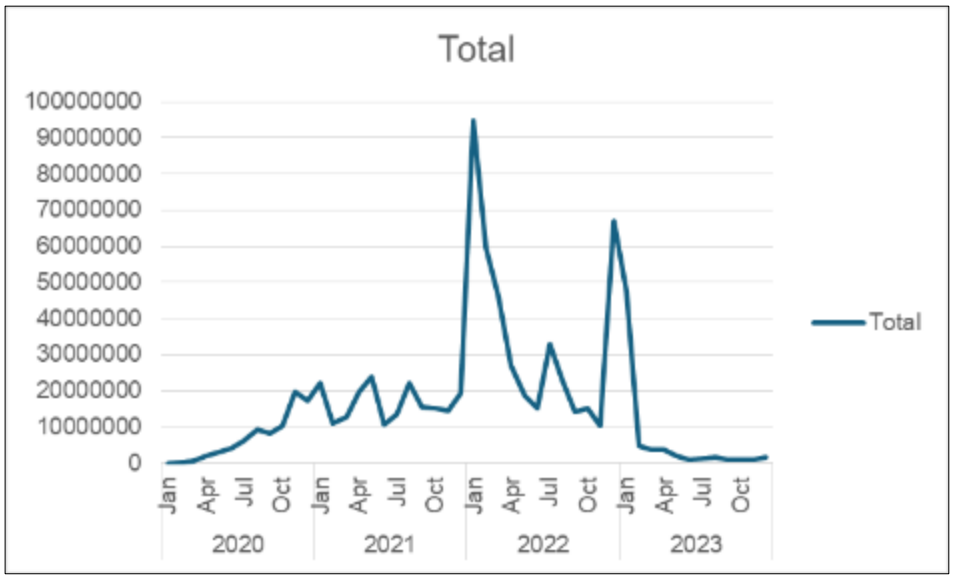

Figure 3 Covid cases and deaths over time

The peak in reported cases, which occurred from the last quarter of 2021 to February 2023, appears to coincide with a significant decline in reported deaths starting in March 2022 (Figure 3). This suggests a potential relationship between the peak in cases and the subsequent decrease in deaths. Notably, the highest number of deaths occurred during the second half of 2020 to the first half of 2021, possibly indicating a period of more severe impact. The decline in deaths after March 2022 could be attributed to improved healthcare responses, vaccination efforts, or other mitigating factors.

5. Case Study of Bangladesh: A Densely Populated Developing Economy

In Bangladesh, the death-to-case ratio of 1.44% exceeds the global average of 1%, suggesting that many COVID-19 cases may have been identified only after death or that there was a lack of testing facilities during critical periods. The case-to-population ratio of 1.21% aligns closely with countries like India, where limited healthcare infrastructure and testing availability contribute to lower detection rates. The relatively low death-to-population ratio can be attributed to the country's large population size, although population density may not be a significant factor in this context. Both cases and deaths peaked in 2021, reflecting the severity of the pandemic during that year.

The COVID-19 pandemic presented severe challenges to both the people of Bangladesh and its healthcare system, highlighting the country's vulnerabilities in handling large-scale public health crises (Debnath et al., 2024). One of the most extreme challenges faced by the Bangladeshi population was the overwhelming pressure on the healthcare infrastructure. With a dense population and limited medical resources, the healthcare system was ill-equipped to handle the surge in COVID-19 cases. Hospitals were quickly overwhelmed with patients, and there was a shortage of essential medical supplies, including personal protective equipment (PPE), ventilators, and oxygen cylinders. As the virus spread rapidly, the already strained healthcare system became even more burdened, leading to inadequate care for many patients and an increase in preventable deaths.

Compounding the situation was the lack of a robust testing infrastructure. Initially, testing capacity was extremely limited, which resulted in delayed diagnoses and made it difficult to track the true spread of the virus. Many people in Bangladesh were unaware of their COVID-19 status until they developed severe symptoms, by which time the virus had already spread within households and communities. This lack of early detection contributed to the rapid transmission of the virus and made containment efforts even more challenging. The widespread fear of the unknown also led to a sense of panic, as people sought medical help only when their conditions worsened, often too late for effective intervention.

In addition to the strain on the healthcare system, the pandemic exposed significant gaps in the social safety net, leaving many vulnerable groups without adequate support. With businesses forced to close and many workers in the informal sector losing their livelihoods, millions of Bangladeshis faced economic hardship. The sudden halt in daily wage earnings, combined with rising prices for basic goods, exacerbated poverty levels, particularly in urban slums and rural areas. Food insecurity became a growing issue as people struggled to meet their basic needs. The government and non-governmental organizations (NGOs) made efforts to provide food assistance, but the scale of the problem was too large for these initiatives to fully address the widespread economic suffering.

The pandemic also intensified the mental health crisis in Bangladesh. The fear of contracting the virus, combined with the loss of loved ones, economic strain, and isolation due to lockdowns, contributed to rising levels of stress, anxiety, and depression. Mental health services, which were already underdeveloped, became even more inaccessible due to restrictions on movement and the overwhelming demands on healthcare providers. This left many people coping with mental health issues in silence, further straining the social fabric of the country.

Moreover, the pandemic highlighted the deep-seated inequalities in the healthcare system. Rural areas, where healthcare access was already limited, were hit especially hard as people struggled to access even basic medical services. The urban-rural divide in healthcare facilities became more pronounced, with people in remote areas having to travel long distances to access hospitals or clinics, often with little success due to overcrowding and lack of resources. In the cities, while healthcare facilities were relatively better equipped, the surge in cases led to shortages in critical care services, such as ICU beds and oxygen supply, forcing hospitals to make difficult decisions about who would receive life-saving treatment.

The overall health crisis was further exacerbated by misinformation and a lack of public health awareness. In the absence of clear and accurate information, rumors and conspiracy theories spread, which undermined efforts to curb the virus. Many people were hesitant to seek medical help due to fear of being stigmatized or being turned away from hospitals. Some even resisted public health measures such as wearing masks or social distancing, further complicating the fight against the pandemic.

6. Implications in Healthcare System of a Developing Nation

The COVID-19 pandemic has starkly exposed the vulnerabilities of healthcare systems in developing nations, as illustrated by the case of Bangladesh. The country's death-to-case ratio of 1.44%, which exceeds the global average of

1%, underscores systemic challenges such as limited testing capacity and delayed diagnoses. Many cases were likely identified only after severe symptoms or death, reflecting gaps in early detection and surveillance. The overwhelmed healthcare infrastructure, compounded by shortages of critical supplies like PPE, ventilators, and oxygen, further exacerbated mortality rates. Hospitals, particularly in urban areas, struggled to accommodate the surge in patients, leading to rationed care and preventable deaths. This scenario highlights the urgent need for scalable healthcare resources and robust emergency preparedness to manage large-scale public health crises effectively.

The pandemic also revealed deep disparities in healthcare access between urban and rural areas in developing nations. Rural regions, where medical facilities are sparse and under-resourced, faced disproportionate challenges. Patients often had to travel long distances for treatment, only to encounter overcrowded hospitals with inadequate services. In contrast, urban centers, while better equipped, still grappled with shortages, illustrating the pervasive nature of resource limitations. These inequities call for targeted investments in rural healthcare infrastructure, including the expansion of primary care facilities and mobile health units, to ensure equitable access during emergencies. Additionally, the lack of a robust social safety net left vulnerable populations, such as daily wage earners and informal workers, without financial or medical support, exacerbating the health and economic toll of the pandemic.

Misinformation and low public health literacy further strained the healthcare response. Rumors and distrust in official guidance hindered compliance with preventive measures like mask-wearing and vaccination, perpetuating transmission. Strengthening health communication strategies and community engagement is critical to building public trust and ensuring adherence to life-saving interventions. Furthermore, the mental health crisis triggered by the pandemic remained largely unaddressed due to underdeveloped mental health services and competing priorities. Integrating mental health support into primary care and emergency response plans is essential to mitigate the long-term psychological impact of such crises.

The experiences of Bangladesh and similar nations underscore the importance of global collaboration in strengthening healthcare systems. International support for vaccine distribution, medical supplies, and capacity-building can help bridge gaps in preparedness. Domestically, policies must prioritize healthcare financing, workforce training, and infrastructure development to build resilience against future pandemics. By addressing these systemic weaknesses, developing nations can better protect their populations and reduce the disproportionate burden of health emergencies.

7. Conclusion

This study provides a comprehensive analysis of global disparities in COVID-19 mortality, revealing significant variations across WHO regions and countries. Unique findings include the disproportionately high death-to-case ratios in the African and Eastern Mediterranean regions, likely due to underreporting of cases and healthcare system limitations, as well as the concentration of 80% of global deaths in just 24 countries, with nations like the U.S., Brazil, and India bearing the highest absolute burdens. Strikingly, countries such as Mexico and Peru exhibited alarmingly high case fatality rates, suggesting severe underreporting or healthcare strain, while nations in the Western Pacific, including China and Japan, demonstrated remarkably low mortality due to stringent public health measures and strong healthcare infrastructure. The case study of Bangladesh further highlighted the challenges faced by densely populated developing nations, where limited testing, overwhelmed hospitals, and socioeconomic inequities exacerbated pandemic outcomes.

However, this study has several limitations. The reliance on reported case and death data may underestimate true figures, particularly in regions with weak surveillance systems. Variations in testing policies, diagnostic criteria, and death attribution across countries could skew comparisons. Additionally, the ecological nature of the analysis precludes causal inferences, and factors such as comorbidities, vaccination rates, and healthcare access were not examined in depth. Future research should incorporate granular data on healthcare capacity, socioeconomic determinants, and genomic surveillance to better explain mortality disparities. Longitudinal studies assessing the long-term impact of COVID-19 on health systems, as well as comparative analyses of pandemic preparedness strategies, would further enrich global health policy discussions.

Moving forward, the findings underscore the need for equitable resource allocation, strengthened health infrastructure, and proactive surveillance to mitigate disparities in future pandemics. Investing in resilient healthcare systems, particularly in low- and middle-income countries, must be a global priority to ensure that no nation is left vulnerable in the face of emerging health threats.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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