World Health Disparities and Inequalities under the COVID-19 Pandemic

Johnston H. C. Wong, Ghee W. Ho, and Hao Yue Zhang

Health disparities exist within and across countries. Medical facilities, in numbers and capabilities, vary greatly between countries. In March 2020, the United Nations launched the Humanitarian Response Plan for COVID-19, in which the most vulnerable countries were identified. National governments are generally held accountable to bridge gaps in internal health disparities. However, a lack of interest in cross-country health equity is evident. The distribution of masks and vaccines, for example, was left to market forces. Health gaps widened and did not bridge when global supply chains broke down. Vaccines were regarded as a profitable product instead of a necessity. This paper studied and compared health disparities between the top 20% of the "best prepared countries" and the lowest 20% of the "least prepared countries," according to the Global Health Security Index (GHSI). Qualitative and quantitative data were analyzed to illustrate global health gaps during COVID-19 and beyond. These data demonstrated that health disparities have widened in the last two years.

Keywords*: health disparities and inequalities, COVID-19, Global Health Informatics*

Introduction

Health disparities are differences in health outcomes between populations within a country or across various countries. International health disparities are evident as life expectancy is profoundly influenced by income. "In 2016, it was 18.1 years lower in low-income countries (62.7 years) than in high-income countries

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(80.8 years)", according to the World Health Statistics Report 2020 published by the World Health Organization (WHO, 2020, p. 1).

The world has been caught unprepared for the challenge posed by the outbreak of COVID-19 in 2020. On March 25, 2020, the United Nations (UN) launched a massive appeal for humanitarian aid to help countries with weak health care systems. The UN Secretary General António Guterres and the WHO Director General Tedros Adhanom Ghebreyesus expressed that a funding of US$2 billion was required to support the world's most vulnerable countries to combat COVID-19. Health experts explained that if the most vulnerable populations were not protected, the COVID-19 virus would continue to mutate and we could see no end to this pandemic.

After this appeal, the United Nations received timely donations, which made it possible to fund 80 projects in 76 countries under the UN operation. Health experts further pointed out that if these people were not protected, the COVID-19 virus would travel throughout the world and we could see no end to this pandemic. Thus, once again, public health crises exposed serious gaps of world health disparities, which could harm various populations.

The eight major donors to the COVID-19 Funding Appeal (see Figure 1) to the United Nations COVID-19 Response and Recovery Fund (hereafter referred to as the UN COVID-19 Fund) were the governments of the Netherlands, Norway,

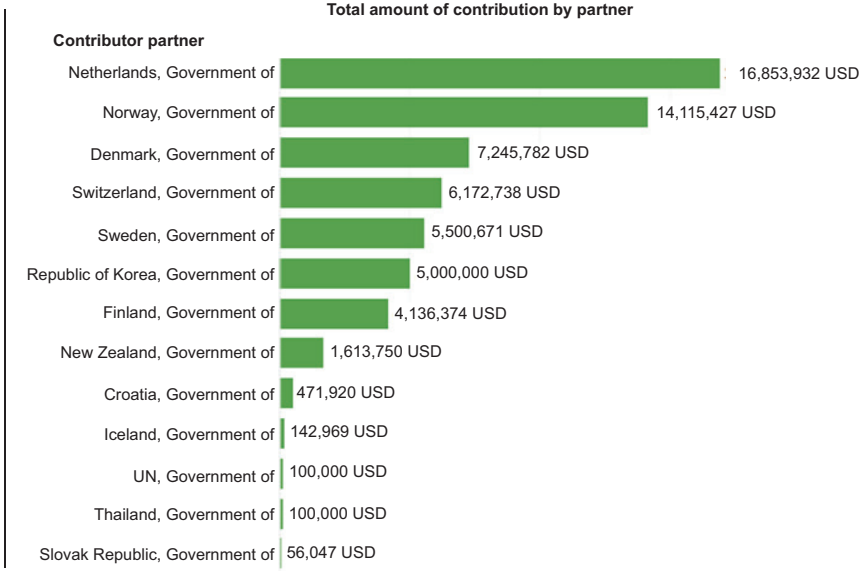

Figure 1 Major government contributors to the UN COVID-19 fund.
Source: United Nation's global interim report of the UN COVID-19 Response and Recovery Fund for the period of May to September 2020.

Denmark, Switzerland, Sweden, Republic of Korea, Finland, and New Zealand. The United Kingdom's pledge of donating US$2.408 million has not been deposited at the time of publishing of interim report.

With other donations added to the UN COVID-19 fund, the United Nations was able to provide US$75 million to 80 projects in 76 countries. The geographical locations of these countries are shown in Figure 2.

The geographical locations of the funding projects showed that needy countries were mostly situated in the southern hemisphere of the globe. The contrast between the eight donating countries and the 67 receiving countries is a vivid example of world health disparities. Not all developed countries donated to the fund. For example, the United States, one of the most "wealthy" countries in terms of "medical facilities," was absent from the list. Japan, with the highest life expectancy in the world and a very high GDP, was also not listed. Therefore, the dichotomy of donating and receiving countries is not sufficient to illustrate world health disparities.

The United Kingdom has promised equal access to health care through its National Health System, a model that many countries copied to different degrees. However, did these countries, such as Canada and Australia with health care services generously financed by their governments, survive the COVID-19 crisis? The United States, on the contrary, simply passed the health financial burden to individuals. Its hospitals and doctors mainly worked as private businesses and private practitioners, financed through private insurers. To what extent did the US health services, spending the highest percentage of GDP on health care in the world, save the US citizens? In the United States, almost 16% of the GDP is devoted to health care. The total spending of the United States in 2020 -doubled the average health budget of other developed European countries (see Figure 3). Did the

Figure 2 Countries supported by the UN COVID-19 fund for the period March–September 2020.
Source: United Nation's global interim report of the UN COVID-19 Response and Recovery Fund for the period May to September 2020.

incomparably high level of health care financing make a difference in health outcomes for the United States during the challenge of the COVID-19 pandemic?

On July 29, 2020, the Texas Academy of Medicine, Engineering, Science, and Technology (TAMEST, 2020) held a seminar on the COVID-19 health disparities. Georges C. Benjamin, MD, executive director of the American Public Health Association, pointed out that they were surprised by the magnitude of health disparities in COVID-19. People of color, mostly low-wage front-line workers, unlike their non-Hispanic white counterparts, were disproportionately impacted by structural racism and socioeconomic factors. People of color were more likely to be uninsured (TAMEST, 2020). The American Association of Family Physicians (AAFP, 2022) openly acknowledged that racism has been institutionalized as a "system disparity" in a manner that consistently penalizes and exploits people because of their race, color, culture, or ethnic origin by establishing patterns, procedures, practices, and policies within health organizations. In 2020, the average COVID-19 hospitalization cost in the United States was US$41,611, with out-of-pocket costs ranging from US$1,280 to US$1,880 (Wager, Claxton, Amin, & Cox, 2022). Hospitalization in an intensive care unit (ICU) doubled the expenses. This explained why the lower-income groups in the United States found the COVID-19 treatment unaffordable.

Andraska et al. (2020) found in a review study that health disparities that existed in vulnerable communities were "exacerbated" in the United States during the pandemic. Their study confirmed that the disadvantaged groups, in particular the black, indigenous, and people of color (BIPOC), had higher rates of infection and complications. According to the Centers for Disease Control (CDC, 2021),

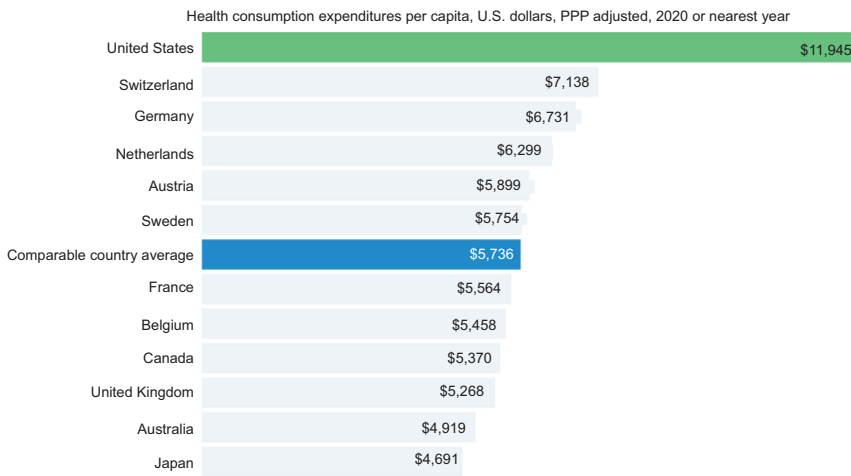

Figure 3 Comparative health spending in developed countries.
Source: Peterson Health Tracker, November 26, 2022. https://www.healthsystemtracker.org

their hospitalization rate was three times higher than that in the white people. Andraska et al. further stated that "fear of anti-Asian violence and racist attacks might also prevent individuals from seeking care."

National governments are generally held accountable to bridge gaps in national health disparities. However, there is a lack of interest in cross-country health equity.

King, Harper, and Young (2013) examined the topic "Who cares about health inequalities?" using secondary data from the World Health Survey (WHS) published by the WHO. They discovered that people in wealthier countries gave higher priority to the reduction of health inequalities. Meanwhile, people in poorer countries were more concerned about overall improvements in health services. These findings underlined the complexity of distributive justice and procedural justice.

The aim of this paper was to study the status of world health disparities before the COVID-19 outbreak in 2020, how such disparities affected a country's performance in combating the pandemic, and to find out whether such disparities were reduced or enlarged after the pandemic up to the year 2022. Even though the United Nations has emphasized the importance of sustainability in fund allocation, the pandemic response money was largely spent on emergency measures instead of capacity building (CDC, 2021).

Methodology

Differentiating Health Disparity, Inequality, and Equity

Braveman (2006) has examined thoroughly the definitions of "health disparities," "health inequalities," and "health equity." He considered the terms "disparities" and "inequalities" of health to be interchangeable, and that both refer to inter-group differences in health outcomes and access to health care. Health equity is distinct from disparity and health inequality. Whitehead (1990) defined health equity as follows:

> Equity in health implies that ideally, everyone should have a fair opportunity to attain their full health potential and, more pragmatically, that no one should be disadvantaged from achieving this potential if it can be avoided.

The primary purpose of this paper was to examine health disparities in the world related to the COVID-19 pandemic and to a lesser extent the health inequalities.

It is difficult to identify what causes health disparities, as differences in health outcomes may be the result of an individual, a provider, or an institution or a combination of these reasons. For example, deaths caused by lung cancer can be attributed to individual smoking, medical negligence, and/or the lack of early screening.

The National Institutes of Health (NIH, 2005) of the United States defined health disparities as "differences in the incidence, prevalence, mortality, and

burden of disease and other adverse health conditions that exist among specific population groups." NIH considered that these racial/ethnic disparities were related to socioeconomic status, which should also be addressed.

Conceptualizing International Health Disparities of COVID-19

In this report, international health disparities were divided into three categories: differences that existed among populations before, during, and after the COVID-19 pandemic.

Pre-existing health differences include "major medical factors for the prevention of a public health crisis, including the basic health facilities in the health system to deliver proper care." (John Hopkins University, 2019a, p7). These facilities include the number of hospital beds, physicians, nurses, and ICUs in proportion to the population of the country before the outbreak of COVID-19. These pre-existing factors are hereby referred to as health capacity (HC).

International health disparities during the pandemic refer to differences in health outcomes during the impact stage of the pandemic. In national disparities, the major concern was insufficient treatment, meaning patients who contracted the virus were not tested and treated. It was difficult to obtain information on insufficient treatment on the international scene because a lot of countries could not afford universal testing. This was a significant limitation of this paper. Similarly, there were no reliable and comprehensive data on preventable deaths. In this paper, several key indicators, including attack rate, vaccination rate, case fatality rate, and death rate, were used to reflect international differences during COVID-19, or the health impact (HI).

Finally, health disparities after the pandemic narrowed down or widened depending on government policies. Some countries scaled up their medical services during the pandemic and additional medical resources were redirected to bridge health gaps. On the contrary, in many countries the pandemic exhausted existing medical resources. For example, some medical staff chose to leave the profession or migrated to other countries that provided better renumeration packages. The disparities that developed after the pandemic are referred to as the Health Systems Change (HSC).

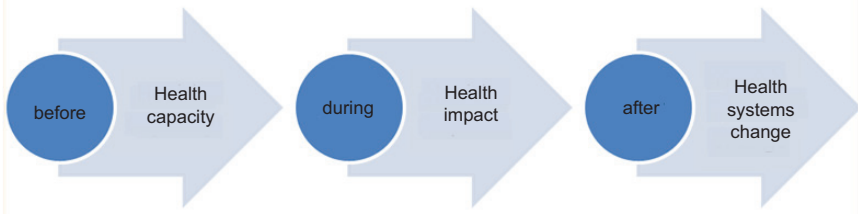

Figure 4 Conceptualization of health disparities across countries of COVID-19.
Note: this conceptual framework is developed for this paper.

Measuring International Health Disparities

This study was based on reliable secondary data. Health data were derived from the WHO COVID-19 dashboard, and the John Hopkins COVID-19 tracker. Economic and population information was derived from the country profiles provided by the World Bank. The Oxford COVID-19 government response tracker (OxCGRT; Oxford University, 2022) was a reliable and reputable source of government stringency and response measures. OxCGRT provided three sub-indices: stringency, containment, and assistance. The assistance index reflected differences in terms of financial resources that governments provided to citizens when strict social isolation was imposed and income from work stopped.

The John Hopkins University (JHU), together with the Economist Intelligence Unit (EIU) and the Nuclear Threat Institute (NTI), developed a Global Health Security Index (GHSI) (John Hopkins University, 2019b) The GHSI measured the following six components: prevention, detection and reporting, response, health capacity, norm, and risk. In 2019, the United States ranked number one according to total GHSI scores, followed by the United Kingdom, among 195 countries.

Therefore, to measure disparities existing before the COVID-19 pandemic in terms of necessary health capacities to face COVID-19, the GHSI total scores and its subscales were studied (see Table 1).

The Global Health Security Report 2019 stated that the average GHSI score of 195 countries was only 40.2 out of 100. Even among the high-income countries, 60 of them only scored an average of 51.9. Based on their low scores, more than 75% of the countries were unprepared for a global communicable disease. For the "health systems" subscale, the average score was 26.4, which was the lowest among the six subscales.

Hereafter, the countries with the top 20% GHSI 2019 scores are referred to as the "best prepared countries," while those with the lowest 20% scores are referred to as the "least prepared countries." The two categories are treated as sample countries in this study.

Ratio of the average total GHSI score of the best prepared countries to the average scores of the least prepared countries was referred to as the Health Capacity Disparity Ratio (HCDR).

In order to measure differences in the health impact between the top 20% and the lowest 20% countries, the following indicators were selected: attack rate, vaccination rate, case fatality rate, and death rate. The data, calculated from January 1, 2020 to the end of October 2022, could be obtained from the COVID-19 dashboard of the WHO. The average COVID-19 population death rate in the best prepared countries as compared to the average in the least prepared countries was used to develop a Health Impact Disparity Ratio (HIDR).

The change in scores between the GHSI reports of 2019 and 2021 was used to measure change in "health systems." The average change in the total scores of GHSI for the best prepared countries as compared to the change for the least prepared countries could then be used to calculate the Disparity Ratio of Health Systems Change (HSCDR). Using the same logic, disparities between the best

Table 1. Sub-scale categories of the Global Health Security Index (GHSI)

Categories	Contents
Prevention	Prevention of the emergence or release of pathogens
Detection and Reporting	Early detection and reporting for epidemics of potential international concern
Rapid Response	Rapid response to and mitigation of the spread of an epidemic
Health System	Sufficient and robust health system to treat the sick and protect health workers
Compliance with International Norms	Commitments to improving national capacity, financing plans to address gaps and adhering to global norms
Risk Environment	Overall risk environment and country vulnerability

Source: Relief Web. https://reliefweb.int/report/world/global-health-security-ghs-index-october-2019. Assessed November 26, 2020.

prepared countries and the least prepared countries could be calculated for the COVID-19 financial assistance and GDP growth. The former data were provided by the OxCGRT, and the latter data were from the World Bank. A list of indicators is presented for clarity in Table 2.

Findings

Degree of International Health Capacity Disparities

Considering the sample countries, 195 countries were included in the GHSI profile. In other words, 39 countries were there to occupy the top 20% position in the overall GHSI scores, and there were also 39 countries classified as the least prepared countries. The overall GHSI scores and scores of subscales of the best prepared and the least prepared countries are presented with mean scores in Tables 3 and 4, respectively.

Table 2 List of indicators of international health disparities

Health Capacity Disparity Ratio (HCDR)	Ratio of the average GHSI total score of the best prepared 20% (with the highest scores) to that of the least prepared 20% countries.
Health Impact Disparity Ratio (HIDR)	Ratio of the average COVID-19 death rate in the best prepared 20% of countries to that in the least prepared 20% countries.
Health Security Change (HSC)	Change in the GHSI total scores from 2019 to 2021. It can be positive or negative.
Relative improvement in HSC	Difference between change in the GHSI scores from 2019 to 2021 of the best prepared 20%, and the same change in the GHSI scores of the least prepared 20% countries.
GDP Disparity Ratio	Change in GDP from 2019 to 2021 of the best prepared 20% countries to that of the least prepared 20% countries.
Financial Assistance Disparity Ratio	Ratio of the average financial assistance provided by governments to needy citizens in the best prepared 20% countries to that in the least prepared 20% countries.

Health capacity of the best prepared countries

The average overall score of the 39 best prepared countries was 60.60 out of 100. The average score of risk prevention was highest among the six subscales, being 72.75 out of 100. However, the average score of prevention was lowest, recorded

Table 3 GHSI scores of the best prepared countries

Country	Overall	Prevention	Detection	Response	Health	Norms	Risk
US	76.20	78.60	75.30	72.80	75.20	81.90	73.70
Australia	73.20	68.50	79.60	68.50	66.90	76.40	79.50
Finland	72.00	61.60	65.40	81.50	64.10	77.80	81.40
Thailand	68.90	63.90	83.20	78.60	62.30	66.50	58.90
Slovenia	68.60	66.20	66.70	64.20	65.70	76.40	72.70
UK	68.30	63.30	62.50	68.10	66.00	75.00	75.00
Netherlands	67.70	60.00	61.30	70.70	67.00	67.50	79.60
Canada	67.60	69.80	64.60	50.00	65.00	75.00	81.30
Denmark	67.30	67.70	60.40	78.10	59.70	56.90	80.90
Sweden	66.40	80.60	64.60	46.10	53.60	69.40	83.80
S. Korea	65.90	53.20	67.50	74.90	58.80	66.70	74.10
Germany	65.70	49.10	70.30	68.00	53.70	70.80	82.50
Armenia	63.20	75.00	67.90	72.60	55.00	58.70	50.30
France	62.60	62.70	45.10	56.20	68.10	61.10	82.60
Belgium	61.90	57.50	52.90	57.50	64.30	60.60	78.40
Bulgaria	61.40	66.70	61.70	49.00	58.30	69.40	63.50
Norway	61.40	49.60	52.50	68.10	45.10	64.80	88.20
Spain	60.40	47.70	64.60	61.80	49.70	63.40	75.30
Switzerland	60.40	50.20	38.30	71.30	50.90	68.10	83.90
Latvia	59.80	49.30	72.90	58.50	55.90	55.00	67.30
Japan	58.80	47.20	56.10	63.10	49.30	66.70	70.30
Portugal	58.70	52.80	44.70	63.70	50.70	63.40	77.20
Austria	57.40	53.30	38.80	47.90	54.00	63.90	86.50
Argentina	56.10	41.50	54.60	52.00	64.40	64.80	59.30
New Zealand	55.80	48.40	47.60	55.30	46.60	59.70	76.90
Singapore	55.80	50.20	49.00	64.60	44.90	46.70	79.60
Estonia	55.60	42.50	41.30	62.90	46.40	66.10	74.20
Ireland	55.10	52.90	49.90	43.90	49.30	55.60	78.90
Malaysia	55.10	45.20	57.50	65.00	39.00	50.30	73.30
Mexico	55.10	41.70	50.10	61.50	52.50	68.10	56.80
Czech Republic	55.00	46.70	37.80	55.30	55.80	59.20	75.00
Hungary	55.00	52.70	38.10	56.30	57.00	57.80	68.20
Lithuania	54.90	37.00	62.20	49.00	51.80	62.50	66.80
Poland	54.30	46.80	31.00	59.90	55.10	63.40	69.80
Peru	53.80	37.70	48.90	50.20	65.70	65.10	55.30
Chile	53.00	46.60	43.50	60.80	48.20	52.60	66.40
Slovakia	52.00	51.90	33.90	36.90	59.50	58.30	71.70
Italy	51.90	47.20	49.70	49.10	40.30	59.70	65.30
Brazil	51.00	49.60	51.50	64.80	50.30	37.00	52.80
Average	**60.60**	**54.69**	**55.47**	**60.99**	**56.05**	**63.65**	**72.75**

Source: Global Health Security Index (GSHI) 2019, https://www.ghsindex.org

Table 4 GHSI scores of the least prepared countries

Country	Overall	Prevention	Detection	Response	Health	Norms	Risk
Vanuatu	27.00	16.80	4.20	31.20	10.60	43.60	55.80
Algeria	26.80	19.40	8.50	31.10	12.60	37.30	52.00
Honduras	26.30	14.70	12.50	34.30	16.50	39.40	40.20
Papua New Guinea	26.30	8.40	18.80	34.20	16.00	38.90	41.80
Togo	26.10	13.60	27.10	30.30	11.50	33.30	40.90
Democratic Republic of Congo	26.00	12.40	29.20	29.80	16.20	42.20	26.40
Grenada	25.60	1.10	5.80	27.70	11.80	45.00	62.00
Fiji	25.40	16.00	6.30	33.90	10.10	26.90	58.90
Mauritania	25.40	1.90	24.60	31.00	21.00	33.20	40.80
Angola	25.20	13.40	13.30	20.90	16.80	43.10	43.70
Comoros	25.20	8.40	15.80	31.40	11.60	47.90	36.30
Chad	24.50	18.10	18.30	29.60	10.20	41.70	29.20
Tonga	24.50	16.90	4.20	32.20	6.50	29.70	57.50
Democratic Republic Timor-Leste	24.20	9.80	18.30	29.10	9.70	31.10	47.40
Republic of the Congo (Brazzaville)	23.90	9.50	4.20	28.00	8.20	54.20	39.20
Djibouti	23.90	12.70	10.00	26.90	14.00	33.20	46.60
Iraq	23.30	17.30	15.80	26.70	15.00	29.50	35.40
Libya	23.30	15.50	22.10	21.50	13.10	29.20	38.50
Burundi	22.70	10.30	14.20	30.00	9.10	33.30	39.00
Eritrea	22.50	16.00	10.40	23.60	8.60	37.50	38.80
Solomon Islands	21.80	1.10	4.20	25.80	16.50	37.30	45.70
Niue	21.70	9.40	0.00	28.70	5.40	29.90	56.50
Kiribati	21.60	4.20	0.60	34.20	8.70	37.30	44.40
South Sudan	21.60	15.40	16.70	21.30	17.10	31.30	27.80
Venezuela	21.40	13.00	0.00	29.40	18.00	31.60	36.60
Cook Islands	21.10	9.70	1.70	31.60	13.10	22.90	47.90
São Tomé & Príncipe	20.90	0.00	5.80	29.40	10.90	34.70	44.70
Central African Republic	20.70	13.80	12.50	27.80	8.30	31.80	29.90
Tuvalu	20.20	4.20	0.00	27.10	8.30	27.10	54.50
Gabon	19.90	3.20	3.30	27.90	9.30	35.40	40.50
Palau	19.90	0.80	1.70	31.60	5.90	25.50	54.30
Yemen	19.90	9.20	8.30	24.70	12.00	37.50	27.80
Nauru	19.50	4.20	0.00	33.10	7.60	24.10	47.80
Guinea-Bissau	19.30	8.40	12.50	24.80	7.20	34.70	28.30
North Korea	18.90	16.70	4.20	17.90	7.00	27.10	40.80
Marshall Islands	18.80	0.00	1.70	29.50	5.10	28.30	48.30
Syria	18.70	9.70	8.30	24.60	13.40	24.00	32.00
Equatorial Guinea	18.00	0.00	0.00	24.90	8.30	29.20	45.40
Somalia	17.90	11.40	15.80	28.90	1.30	26.00	24.20
Average	**22.56**	**9.91**	**9.77**	**28.37**	**11.09**	**34.00**	**42.25**

Source: Global Health Security Index (GSHI) 2019, https://www.ghsindex.org

at 54.69. The range of overall scores was between 51 and 76.2, which was considerably wide. Nevertheless, the GHS experts considered that an overall score of more than 50 was considered relatively safe in facing a public health challenge; 21 developed countries scored 50 or below.

Health capacity of the least prepared countries

The average overall score of the 39 least prepared countries was only 22.56, compared to 60.60 for the best prepared countries. The average score of risk prevention was again highest among the six subscales, being 42.25, compared to 72.75 of the best prepared countries. The average score of detection was lowest at 9.77, compared to 55.47 for the best prepared countries. The range of overall scores was between 22.56 and 27, with a small deviation of 4.44.

Obviously, all least developed countries were handicapped in their abilities to detect coronavirus and identify patients. The follow-up medical care was not initiated without having the capacity to detect COVID-19.

International Health Capacity Disparity

The average overall scores of subscales were selected to measure disparities between the best prepared countries and the least prepared ones. Differences in the average scores of six subscales are shown in Table 5.

Large disparities were observed in overall scores as well as the six subscale scores between the best prepared countries and the least prepared countries. The biggest differences in the ratios were in the "detection" (5.68), "prevention" (5.52), and "health system" (5.05) subscales.

International Health Impact Disparity

The findings showed that GHSI score and death rate in the population were not related directly (Table 6). For example, the United States and the United Kingdom ranked number one and six in GHSI scores, respectively, having been hit severely

Table 5 International health capacity disparity

GHSI	Best prepared countries	Least prepared countries	Differences	Ratio
Prevention	54.69	9.91	44.78	5.52
Detection	55.47	9.77	45.71	5.68
Response	60.99	28.37	32.62	2.15
Health system	56.05	11.09	44.96	5.05
Norms	63.65	34.00	29.65	1.87
Risk	72.75	42.25	30.50	1.72
Overall	**60.60**	**22.56**	**38.04**	**2.69**

Source: Global Health Security Index (GSHI) 2019, https://www.ghsindex.org

Table 6 International health impact disparity

COVID-19 health impact (per 100,000 of population)	Best prepared countries	Least prepared countries	Differences	Ratio (MPC:LPC)
Attack rate	33,800	6,770	–27,030	4.993
Full vaccination rate	73,040	34,510	–38,530	2.116
Case fatality rate	1,030	1,780	750	0.579
Death rate	240	30	–210	8.00

Source: WHO COVID-19 dashboard.

by COVID-19. On the other hand, many least prepared countries were not hit seriously when it came to the attack and death rates. For example, Rwanda had a very low death rate of 0.022 per 10,000 population.

The COVID-19 health impact was multi-factorial. The response of governments in applying social distancing and population structure, particularly age structure, has a stronger relationship with attack rate. The number of confirmed cases in proportion to the size of the population in the least prepared countries could have been under-reported as mentioned previously because of their weak capacity of "detection." Nevertheless, there were few reports of excessive deaths in these countries compared to previous years.

Concerning the health impact disparity ratio, the number of COVID-19 deaths per 100,000 persons was 240 for the best prepared countries. On the other hand, it was only 30 per 100,000 persons for the least prepared countries. The attack rate and the number of confirmed cases per 100,000 persons for the best prepared countries was 33,800(33.8%) compared to 6,770 (6.77%) for the least prepared countries. However, both figures for the least prepared countries might have been grossly underreported as these countries had weak capacity of detection (on average, a score of 9.77 as shown in Table 4). Concerning the fatality rate, the best prepared countries achieved a lower score of 1,030 per 100,000 persons whereas the least prepared countries had a higher score of 1,780 per 100,000 persons. This was logical because the best prepared countries had much higher scores in terms of health systems (an average score of 56.05 for the best prepared countries, compared to 11.09 for the least prepared countries or a difference of 44.96 between the two categories of countries, as shown in Table 5).

The ratios of attack rate to death rate in the best prepared countries and the least prepared countries were 4.993 and 8.0, respectively. In general, it appeared that the least prepared countries outperformed the best prepared countries. This pointed to the fact that health capacity could not guarantee better health outcomes in COVID-19, as there were many factors involved in the interplay.

Change in International Health Systems

During the COVID-19 pandemic, the WHO recommended that all governments should scale up their health services. Masks, respirators, and even ICUs were in

great demand. All governments drew resources to meet these demands. For vulnerable countries, the United Nations raised the COVID-19 humanitarian fund of US$ 75 million, as mentioned earlier, to assist 67 countries. Hopefully, these additional resources were not spent completely on disposable items but used intelligently to improve capacities and enhance resilience. A comparison between the GHSI first published in 2019 and the data available in the latest GHSI report published in 2021 provides insight on this matter (see Table 7).

It was observed in Table 7 that the overall scores of GHSI for the best prepared countries dropped only slightly from 60.60 to 60.46. The most significant improvement was observed in the "detection" subscale, which changed from 55.47 to 60.16, an increase of 4.69. The most significant drop occurred in the "Response" subscale, which dropped from 60.99 to 54.26. To summarize, the scaled-up effect in health capacity advocated by the WHO was not evident. The more developed countries only improved their capacity of detection. The capacity of "Response" subscale might have decreased because most countries were exhausted by the long pandemic. There was no significant improvement in "health system" capacity on which sustainability depended.

On the other end, the least prepared countries showed a slight improvement in the overall score, getting 23.09, compared to 22.56. There was a slight increase of 1.66 in "detection" and an even slimmer increase of 1.22 in "health system."

To compare the improvements of the best prepared countries with that of the least prepared countries, relative improvements were calculated by subtracting the change in scores of the least prepared countries from similar scores of the best prepared countries. The overall score relative improvement was -0.67, with the least prepared countries showing a slightly better improvement. In the area of "detection," the best prepared countries did better, with a relative improvement of 3.03. On the contrary, the largest difference in relative change of scores was in the area of "response," recorded as -5.85.

However, no significant improvements were observed in the overall score as well as the six subscales of the best prepared and the least prepared countries from 2019 to 2021. Although governments around the world spent billions of dollars in fighting the COVID-19 pandemic, in the end a negligible improvement was discovered in GHSI or health capacities.

Conclusion

This paper examined disparities prevailing globally in the health capacities of various countries, and their implications on health outcomes during the COVID-19 pandemic. The study also explored changes required to improve health systems globally. Of the 195 countries included in the GHSI, the 39 countries with the highest scores (top 20%) and lowest scores (bottom 20%) were labelled as the best-prepared and least-prepared countries, respectively.

Table 7. International health systems change disparities

GHSI	Best prepared countries 2019	Best prepared countries 2021	Best prepared countries Change (MPCC)	Least prepared countries 2019	Least prepared countries 2021	Least prepared countries Change (LPCC)	Relative improvements (MPC-C – LPC-C)
Prevention	54.69	53.54	–1.15	9.91	9.67	–0.24	0.91
Detection	55.47	60.16	4.69	9.77	11.43	1.66	3.03
Response	60.99	54.26	–6.73	28.37	27.49	–0.88	–5.85
Health system	56.05	57.83	1.78	11.09	12.31	1.22	0.56
Norms	63.65	64.40	0.75	34.00	34.97	0.97	–0.22
Risk	72.75	72.55	–0.20	42.25	42.66	0.41	–0.61
Overall	**60.60**	**60.46**	**–0.14**	**22.56**	**23.09**	**0.53**	**–0.67**

Source: Global Health Security Index (GSHI) 2019, https://www.ghsindex.org

Results demonstrated that wide disparities existed regarding health systems between the best prepared countries and the least prepared countries in the six areas of prevention, detection, response, health systems, norms, and risks. The disparity ratio of health capacity between the best prepared countries and the least prepared countries was 2.9, with the former scoring higher than the latter.

Concerning the COVID-19 deaths, the least--prepared countries registered much lower deaths than the best-prepared ones, with a disparity ratio of 1:8. Number of deaths in the least-prepared countries was 30 per 100,000 persons, which was only 30% or one-eighth of the best prepared countries. Attack rate of the pandemic in the least-prepared countries (6,770 per 100,000 persons) was much lower than that in the best prepared countries (33,800 per 100,000 persons). These findings are congruent with the results of other studies, which indicated that GHSI was not predictive (Abbey et al., 2020; Kaiser, Chen, & Gluckman, 2021; Khalifa et al., 2021).

According to Bell and Nuzzo (2021), the GHSI is best applied to measure changes in emergency response capacities, which in the present study was referred as the health system changes. Little evidence was observed for any improvement in the health systems of countries in both categories. The "Detection" subscale showed a slight improvement in the GHSI 2021 scores compared to the GHSI 2019 scores, but the overall scores demonstrated negligible changes.

Rose, Paterra, and Isaac (2021) found with linear regression methods that COVID-19 outcomes were significantly associated with other variables, such as sociodemographic, political, and governance, but not GHSI 2019. However, it does not affect the applicability of GHSI to measure health disparities in terms of capacity. Regarding the next global health crisis, the least prepared countries remain unprepared while the best prepared countries have to consider factors beyond pure health science.

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