



Was priority setting considered in COVID-19 response planning? A global comparative analysis

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ABSTRACT

Background: The COVID-19 pandemic forced governments across the world to consider how to prioritize resource allocation. Most countries produced pandemic preparedness plans that guide and coordinate healthcare, including how to allocate scarce resources such as ventilators, human resources, and therapeutics. The objective of this study was to compare and contrast the extent to which established parameters for effective priority setting (PS) were incorporated into COVID-19 pandemic response planning in several countries around the world.

Methods: We used the Kapiriri and Martin framework for effective priority setting and performed a quantitative descriptive analysis to explore whether and how countries' type of health system, political, and economic contexts impacted the inclusion of those parameters in their COVID-19 pandemic plans. We analyzed 86 country plans across six regions of the World Health Organization.

Results: The countries sampled represent 40% of nations in AFRO, 54.5% of EMRO, 45% of EURO, 46% of PAHO, 64% of SEARO, and 41% of WPRO. They also represent 39% of all HICs in the world, 39% of Upper-Middle, 54% of Lower-Middle, and 48% of LICs. No pattern in attention to parameters of PS emerged by WHO region or country income levels. The parameters: evidence of political will, stakeholder participation, and use of scientific evidence/ adoption of WHO recommendations were each found in over 80% of plans. We identified a description of a specific PS process in 7% of the plans; explicit criteria for PS in 36.5%; inclusion of publicity strategies in 65%; mention of mechanisms for appealing decisions or implementing procedures to improve internal accountability and reduce corruption in 20%; explicit reference to public values in 15%; and a description of means for enhancing compliance with the decisions in 5%.

Conclusion: The findings provide a basis for policymakers to reflect on their prioritization plans and identify areas that need to be strengthened. Overall, there is little consideration for explicit prioritization processes and tools and restricted attention to equity considerations; this may be a starting point for policymakers interested in improving future preparedness and response planning. Although the study focused on the COVID-19 pandemic, priority setting remains one of the policymakers' most prominent challenges. Policymakers should consider integrating systematic priority setting in their routine decision-making processes.

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1. Introduction

The COVID-19 pandemic strained all health systems, shifting critical health resources from routine programs to containing the spread of the pandemic and treating those who fall seriously ill [1–3]. Policymakers regularly make decisions about the allocation of public funds in health systems [4–6]; however, in this challenging state of affairs, health policymakers from all countries have to rapidly determine how to allocate the available resources among competing interventions, populations, healthcare settings, and geographic regions [5,7–8]. In these contexts of severe resource constraints, there is a need for systematic priority setting so that urgent decisions and actions are enacted to make the best use of resources while ensuring a fair distribution of the costs and benefits [9–10].

During the COVID-19 pandemic, many countries created formal pandemic preparedness and response plans, which set out the overall governmental health policy response, defined stakeholders' functions and responsibilities, and designed mechanisms and strategies for coordinated delivery. Although these plans vary in content, they provide a rich source of information on how to understand the challenges posed by COVID-19 and the decisions made concerning allocating scarce resources such as ventilators, human resources, and therapeutics.

Priority setting can be understood as the process of ranking different programmes to provide resource allocation or preference for implementation [11]. Different approaches have been developed to support the priority setting (PS) process, including program budgeting and marginal analysis (PBMA), accountability for reasonableness (A4R), multi-criteria decision analysis (MCDA), the burden of disease & cost-effectiveness analysis (BOD/CEA), and the framework of Kapiriri & Martin for evaluating success in priority setting [12]. All these approaches use criteria of what is considered a high-quality PS, but some of them have not been successfully embedded into 'real-world' decision-making due to being too technical or misaligned with specific social values and contexts. Some of the criteria, such as those included in Kapiriri & Martin's framework, refer to stakeholder participation, the use of explicit and relevant criteria for PS, the use of evidence, the reflection of public values, and publicity of priorities [13].

Yet there is scarce theoretical and empirical literature about how priority-setting processes can be integrated during public health emergencies [3,9]. It is possible that with a deadly disease pandemic such as COVID-19, the allocation of resources may not reflect the known systematic PS processes [15], and may not benefit the groups of the population most socially vulnerable (such as immigrants, refugees, internally displaced people) or usually overlooked for public health interventions (such as ethnic groups, population in rural areas, sexual and gender minorities, homeless population and inmates) [3].

The objective of this study was to compare the extent to which established parameters for effective priority setting were incorporated into COVID-19 pandemic response planning in several countries around the world. This paper is part of a large study ("The impact of priority setting on pandemic preparedness and response: A global comparative analysis of the role of priority setting and equity during the COVID-19 pandemic") aimed at conducting a global comparative analysis of priority setting incorporated into COVID-19 pandemic response planning in countries representing all six WHO regions of the world, Africa (AFRO), Eastern Mediterranean (EMRO), European (EURO), Pan Americas (PAHO), South-East Asia (SEARO), and Western Pacific Region (WPRO).

2. Methods

2.1. Study design

This cross-sectional study quantitatively synthesizes findings from a large project based on a review of 86 countries' COVID-19 preparedness and response planning documents [16–17]. Further details of the methodology have been provided in a separate publication [18].

2.2. Sampling

We purposively sampled pandemic response and preparedness plans from each WHO region (AFRO, EMRO, EURO, PAHO, SEARO, and WPRO), aiming for maximal variation in income level (according to World Bank current 2020 fiscal year criteria); political system (i.e., presidential, parliamentary, monarchy, unitary); and the existence of universal health coverage. We aimed to reach at least 35 % of the representation of each WHO region and at least one country for each geographical subregion. For instance, Pan American Health Organization (PAHO) is the WHO region for countries within the Americas, and its geographical subregions are North America, Central America, South America, and the Caribbean.

2.3. Document selection

2.3.1. Retrieval strategy

For each WHO region, two trained research team members conducted the document search between August 2020 and September 2021. We initially searched for specific preparedness and response plans publicly available on the web pages of the ministries of health and official government websites. When these plans were unavailable, we: i) conducted additional searches in Google and Google Scholar, ii) systematically searched for other relevant documents (e.g. guidelines, pandemic response plans, multisectoral response plans), and iii) emailed contacts of the research team within the country or region for guidance in the process of identifying and retrieving documents not publicly available. After exhausting these steps, we added the label "missing plan" if a plan was not identified.

2.3.2. Eligibility criteria

We included all documents labelled as COVID-19 preparedness and response plans, and according to the country particularities we included other documents labelled as guidelines, recovery plans, or contingency plan. In most cases, this was a single, general national COVID-19 document; in other instances, details of the government response plan were dispersed over multiple documents. Two researchers conducted an initial scan of the documents to ascertain their relevance. Documents that covered information on the mobilization and allocation of resources for health services were included. When more than one version of the plan was available, we selected the earliest version to assess the initial country governmental response to the COVID-19 pandemic. Documents focussing on general government response (e.g. sustaining the economy) or other specific services (e.g. school closures) were excluded. Plans that were not written in English were either screened by native speakers for relevance, or translated to English and then screened, depending on availability of native speakers.

2.4. Data extraction and collection

Data extraction was guided by Kapiriri & Martin's framework for assessing parameters of effectiveness healthcare PS [16]. The Kapiriri & Martin framework has been validated globally and used to evaluate PS in different health programs and contexts, including during disease outbreaks [14]. The original framework is comprised of five domains with 26 quality parameters [16]; however, we used an adapted version for evaluating PS during disease outbreaks in Uganda [9], which contains 20 parameters made up of: pre-requisites (four parameters); the priority setting process (nine parameters); implementation (two parameters); and impact (five parameters) (for implementation and impact parameters, we merely assessed the expectations about them) (See additional file 1). This overall framework provided a consistent standard against which the plans were assessed.

Given how the COVID-19 pandemic has highlighted and exacerbated existing health inequities [15], we modified the extraction instrument to include equity considerations, specifically whether and how vulnerable

populations are identified and/or prioritized in the plans. Additionally, we extracted information about how plans addressed their likely impact on specific health resources at all levels (e.g., level of resource scarcity, specific resources identified, priority setting for health research, and plan for continuity of care across the health system). The revised tool was pilot tested by at least two research team members who met to compare their outputs following a review of the same two preparedness plans and ensure consistency in their interpretation and application of the revised tool.

Furthermore, for all countries (sampled and not sampled), we gathered information about WHO-regional affiliation (AFRO, EMRO, EURO, PAHO, SEARO, and WPRO), country classification by income level (according to the World Bank 2020); COVID-19 cumulative morbidity and mortality rates until February 1st, 2022 (from Oxford database); and the service coverage index (from the World Bank report for 2019). The service coverage index, presented on a scale of 0 to 100, evaluates the provision of essential health services based on tracer interventions [19]. For the countries included, we registered the pandemic milestone dates, establishing the dates for i) the first COVID-19 case within the country, ii) first one hundred cases (indicating community transmission of the virus), iii) first thousand cases, iv) first ten thousand cases, and v) date of publication of the pandemic response plan.

2.5. Data analysis

To establish the countries' representativeness, we compared sampled and not sampled countries regarding WHO-regional affiliation, country classification by income level, COVID-19 cumulative morbidity and mortality rates until February 1st, 2022, and the service coverage index. Then, to compare frequencies among categorical variables, Chi-squared tests were performed. After assessing the normal distribution, cumulative morbidity and mortality rates and the service coverage index were compared with non-parametric statistics. Based on the results of these tests, all associations with $p < 0.05$ were considered statistically significant.

The initial analysis of countries sampled was descriptive, to assess the degree to which each country's plans addressed quality parameters. We created two variables for each priority setting parameter considered: a complete variable describing whether the parameter was managed according to four categories ("extensively addressed" when rich details were provided; "addressed" when presented enough information to understand how the parameter was addressed; "addressed slightly" when some aspects of the parameter were merely mentioned; not included), and a binary variable indicating whether the parameter was addressed or not—which was one of the primary outcomes of this study. General and by domain scores were estimated using the binary variable, and then the general score was transformed to T-score ($\mu=50$, $SD=10$).

Data about the assessment of the priority setting parameters, vulnerable populations prioritized, and explicit resources prioritized were presented as absolute and relative frequencies (number and percentage). Continuous data that were not normally distributed were described as median and interquartile interval. For comparing medians, we used non-parametric statistics (Wilcoxon signed rank test); p-values of < 0.05 were considered statistically significant after Bonferroni correction for multiple comparisons.

Pearson's correlation was performed to explore the correlation of quality parameters of priority setting with other covariables, principally to explore profiles of priority setting among countries. Correlations positive or negative in the rank 0—0,10 were considered as non-existent, in the rank 0,10–0,29 as modest, between 0,30 and 0,50 as moderate, and higher than 0,50 as strong [20]. A two-side p-value of < 0.05 was considered statistically significant. All statistical analyses were performed using SPSS Statistics 21 software (IBM, NY, United States).

3. Results

From a total of 183 countries considered for sampling, we searched for the preparedness and response plans of 129 countries; after exhausting all the search and retrieval steps, we could not identify 43 country plans. Our final sample of 86 countries included around 40 % of nations in each WHO region, accounting for 72 % of the global population. There were no statistically significant differences between the 86 countries sampled and the 97 countries not sampled, according to WHO-regional affiliation, classification by income level, COVID-19 cumulative morbidity and mortality rates, and the service coverage index (Additional File Table 2).

Among the sampled countries, 14 were low-income (16,3%), 26 were lower-middle-income (30.2 %), 20 were upper-middle-income (23.3 %), and 26 were high-income countries (30.2 %) (Table 1). The sampled countries covered different forms of governments; the most common was the presidential republic (39.5 %), followed by the parliamentary republic (22 %). The form of governance was federal in 18 countries (21 %) and unitary in 68 (79 %).

Documents retrieved were categorized as COVID-19 response and/or preparedness plan (62,7%), pandemic plan (12.8 %), COVID-19 guideline (11.6 %), governmental multi-sectoral or humanitarian response (8.1 %), and series of governmental COVID-19 documents (4.6 %). The number of days between the first case of COVID-19 reported in each country and the date of publication of the plan varied from -486 days (Tonga, the first case on October 29, 2021; plan published on June 30, 2020) to + 365 days (the USA, first case on January 22, 2020; plan posted on January 21, 2021). When excluding Tonga and the USA (outliers), the number of days ranged between -79 and + 206 (Fiji and Canada, respectively) (See Fig. 1). The median of days between the first case and the date of plan publication was 19 (IQR 102). Approximately 30 % of the countries' plans were published before the first case was reported; in 20 % of the nations, the document was published around four months after the reporting of the first case; and 22 % published the response plan after having reached more than 10,000 cases (see Fig. 2).

Note: AFRO stands for the African region, EMRO for the Eastern Mediterranean region, EURO for the European region, PAHO for the Pan American region, SEARO for South-East Asia region, and WPRO for the Western Pacific region

Of the twenty parameters of effective Priority setting assessed, two of them, 'political will' and 'resources prioritized' (both from the prerequisite domain), were addressed by all the plans reviewed. In contrast, two parameters, 'impact on inequalities' and 'fair financial contributions' (both from the Priority setting impact domain), were not included in any of the reviewed plans. When comparing the parameters by country income level, three were found to have a statistically significant difference (Table 2). First, the parameter 'use of explicit priority setting criteria' was addressed in 36 % of all plans reviewed. This proportion was higher in low- and high-income countries (57.1 % and 50,0%, respectively) and lower in lower-middle and upper-middle-income countries (19.2 % and 10 %, respectively) ($p = 0.003$). Second, the parameter 'publicity of priorities' was addressed in 66.3 % of all plans reviewed, but this proportion was 37.5 % for low-income countries ($p = 0.038$). Lastly, the parameter 'allocation of resources' (including the provision of an explicit budget) was addressed in 27.9 % of all plans. However, this differed according to income level; it was less commonly addressed in upper-middle-income (15 %) and high-income (20 %) countries than in low-income (50 %) and lower-middle-income (42.3 %) countries ($p = 0.011$). When comparing assessment of the parameters by WHO region, seven showed a statistically significant difference ($p < 0.05$): 'legitimate institutions,' 'allocation of resources,' 'impact on confidence in public institutions,' and four parameters from the domain priority-setting process ('stakeholders' involvement,' 'use of evidence,' 'publicity of priorities' and 'mechanisms for appealing decisions') (Tables 4a and 4b).

All the 86 plans identified a need for different resources to manage

Table 1
Characteristics of sampled and not sampled countries.

		Sampled (n = 86)		Not sampled (n = 97)		p value
		Mean	SD	Mean	SD	
Service Coverage Index		66.08	16.5	64.03	14.4	0.374
Total cases per million		85,015.7	94,807.8	99,909.8	103,928.6	0.315
Total deaths per million		1,040.7	1,189.3	1,089.7	1,146.0	0.777
		Sampledn (%)		Not sampledn (%)		
Country income	Low (n = 28)	14	16.3 %	14	14.4 %	0.415
	Lower-Middle (n = 46)	26	30.2 %	20	20.6 %	
	Upper-Middle (n = 49)	20	23.3 %	29	29.9 %	
	High (n = 60)	26	30.2 %	34	35.1 %	
WHO- Region	AFRO (n = 46)	18	20.9 %	28	28.9 %	0.568
	EMRO (n = 22)	12	14.0 %	10	10.3 %	
	EURO (n = 52)	24	27.9 %	28	28.9 %	
	PAHO (n = 35)	16	18.6 %	19	19.6 %	
	SEARO (n = 10)	7	8.1 %	3	3.1 %	
	WPRO (n = 18)	9	10.5 %	9	9.3 %	

AFRO stands for the African region, EMRO for the Eastern Mediterranean region, EURO for the European region, PAHO for the Pan American region, SEARO for South-East Asia region, and WPRO for the Western Pacific region

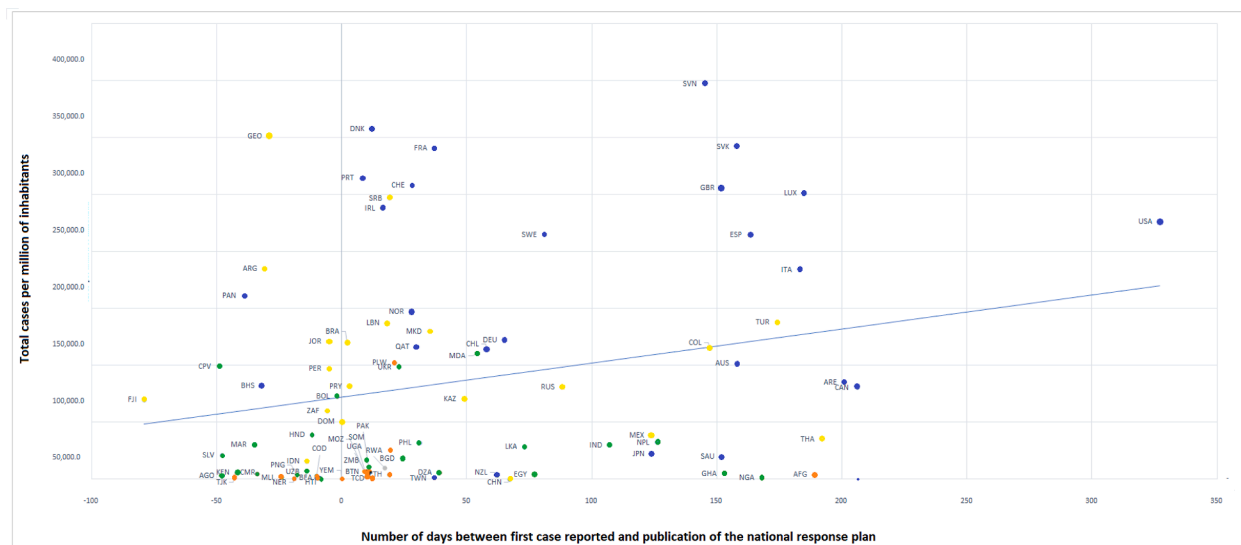


Fig. 1. Scatter plot of date of publication of the plan and rate of cases reported.

the pandemic. About 80 % of the reviewed plans articulated a need for 'human resources/training', personal protective equipment (PPE) and other Infection Prevention and Control (IPC) materials. However, only 20 % of the plans articulated a need for life support equipment and ambulances. When comparing the resources identified by country income level, two areas had a statistically significant difference: healthcare facilities were identified in 36 % of all the plans but only in 7.7 % of high-income countries ($p = 0.003$). In contrast, vaccines were identified in 15 % of all the country plans, but they were more likely to be identified in high-income countries (34.6 %) ($p = 0.007$). The resources identified also varied according to the WHO regions. Human resources and training were less frequently identified in the WPRO country plans (44.4 %) ($p = 0.013$); PPE and other IPC materials were less frequently identified in the EURO country plans (62.5 %) and PAHO country plans (68.8 %) ($p = 0.042$). Healthcare facilities were frequently identified in the AFRO country plans (61.1 %), rarely identified in the EMRO (8.3 %), and not identified in any of the EURO country plans ($p < 0.001$). Financial resources were identified in 21 % of all plans but were more commonly identified in the AFRO (44.4 %) and not identified in EURO country plans ($p = 0.017$). Only 36 % of all the plans identified medical equipment as a needed resource. While all the SEARO country plans articulated a need for medical equipment, only 16.7 % of the AFRO- and

20.8 % of the EURO identified this resource ($p = 0.002$).

Regarding vulnerable populations identified and/or prioritized, we found that the elderly (34 %) and people with pre-existing illnesses (26 %) were the most consistently identified. In contrast, Indigenous populations, people living with HIV, and sexual and gender minorities were represented in only 3.5 % of the reviewed plans. Prioritization of the elderly and indigenous populations was statistically ($p < 0.05$) different by WHO regions. Only 16.7 % of the plans from AFRO and EMRO identified the elderly as vulnerable, while in SEARO and WPRO, the frequency was 85.7 % and 55.6 %, respectively ($p = 0.014$). Only three plans considered Indigenous populations (Australia, New Zealand, and Mexico) ($p = 0.004$). Prioritization of refugees and forcibly displaced people was the only category of vulnerable populations with significant differences between countries with distinct income levels. Only five countries prioritized refugees and forcibly displaced people in their COVID-19 national response plans. Still, they were significantly more likely to be explicitly mentioned in low-income countries (28.6 % vs. 7 % for all plans) ($p = 0.006$). Table 3 describes resources prioritized, and Tables 4a and 4b presents groups of populations prioritized.

General and domain-specific results are shown in Table 5. For all the countries, the median percentage for the general score was 35 % (IQR 24 %), for the domain pre-requisites was 75 % (IQR 25 %), priority

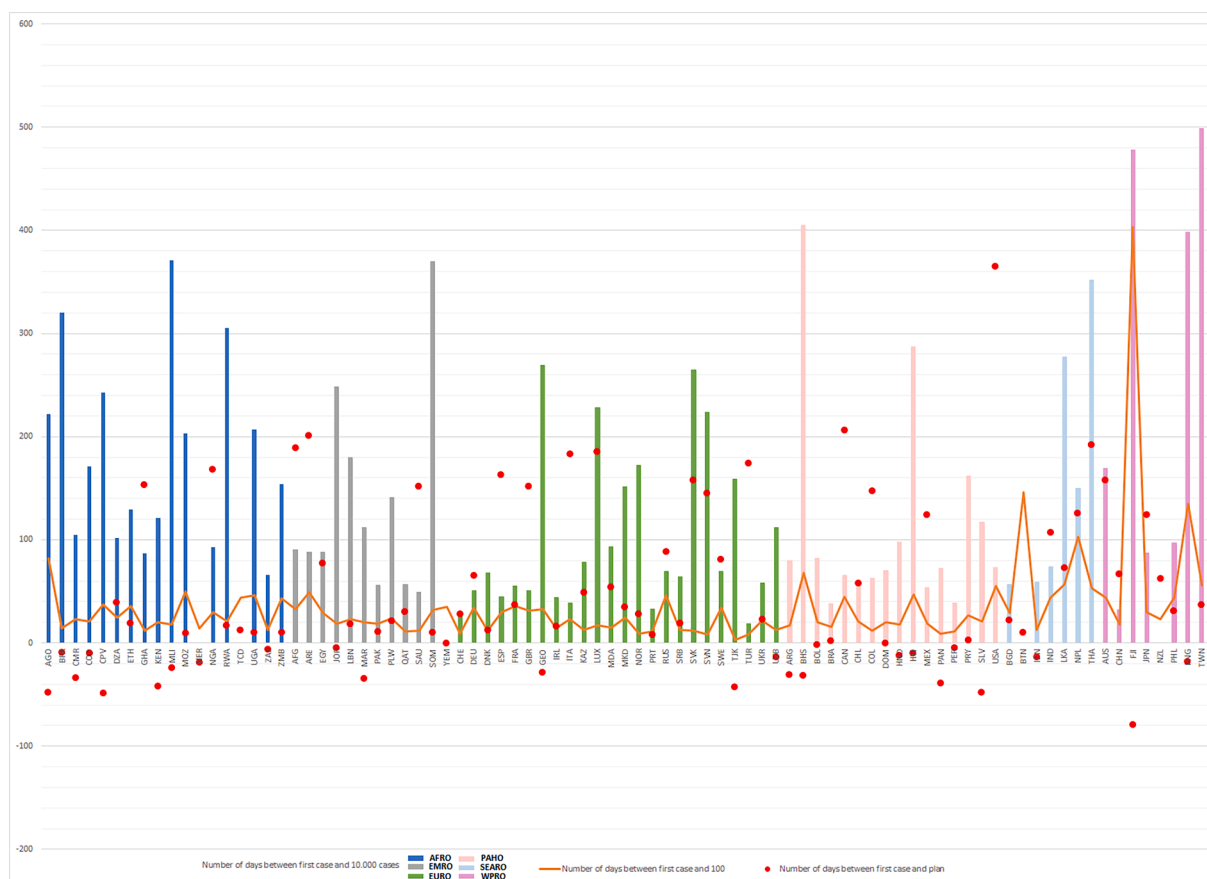


Fig. 2. Moment of publication of response plans according to different moments of the pandemic.

Table 2
Characteristics of sampled countries grouped by income level.

		Country Income Classification									
		Low (n = 14)n (%)	Lower-Middle (n = 26)n (%)	Upper-Middle (n = 20)n (%)	High (n = 26)n (%)	All countries (n = 86)n (%)					
Type of government	Parliamentary republic	2	14.3 %	6	23.1 %	6	30.0 %	5	19.2 %	19	22.1 %
	Parliamentary democracy under a constitutional monarchy	0	0.0 %	1	3.8 %	0	0.0 %	4	15.4 %	5	5.8 %
	Parliamentary constitutional monarchy	0	0.0 %	2	7.7 %	1	5.0 %	6	23.1 %	9	10.5 %
	Presidential republic	6	42.9 %	14	53.8 %	10	50.0 %	4	15.4 %	34	39.5 %
	Semi-presidential republic	4	28.6 %	2	7.7 %	0	0.0 %	3	11.5 %	9	10.5 %
	Constitutional monarchy	0	0.0 %	1	3.8 %	1	5.0 %	1	3.8 %	3	3.5 %
	Absolute Monarchy	0	0.0 %	0	0.0 %	0	0.0 %	2	7.7 %	2	2.3 %
	Unitary one-party socialist republic	0	0.0 %	0	0.0 %	1	5.0 %	0	0.0 %	1	1.2 %
	Other	2	14.3 %	0	0.0 %	1	5.0 %	1	3.8 %	4	4.7 %
Form of governance	Unitary	12	85.7 %	21	80.8 %	15	75.0 %	20	76.9 %	68	79.1 %
	Federal	2	14.3 %	5	19.2 %	5	25.0 %	6	23.1 %	18	20.9 %
WHO Region	AFRO	9	64.3 %	8	30.8 %	1	5.0 %	0	0.0 %	18	20.9 %
	EMRO	4	28.6 %	3	11.5 %	2	10.0 %	3	11.5 %	12	14.0 %
	EURO	1	7.1 %	3	11.5 %	6	30.0 %	14	53.8 %	24	27.9 %
	PAHO	0	0.0 %	4	15.4 %	7	35.0 %	5	19.2 %	16	18.6 %
	SEARO	0	0.0 %	5	19.2 %	2	10.0 %	0	0.0 %	7	8.1 %
	WPRO	0	0.0 %	3	11.5 %	2	10.0 %	4	15.4 %	9	10.5 %
Countries with universal health coverage		0	0.0 %	6	23.1 %	11	55.0 %	24	92.3 %	41	47.7 %
Service Coverage Index* (Median and IQR)		42.5	14	58.5	23	72.5	12	84.0	8	69.0	4

AFRO stands for the African region, EMRO for the Eastern Mediterranean region, EURO for the European region, PAHO for the Pan American region, SEARO for South-East Asia region, and WPRO for the Western Pacific region

*Service coverage index is measured on a scale from 0 to 100.

setting process was 44 % (IQR 32 %), and 0 % for the domain priority setting impact. The median percentage in domain implementation of set priorities was 0 % for all the countries sampled; however, a statistically significant difference was found; the score was 50 % (IQR 25 %) for low- and lower-middle-income countries, but 0 % for upper-middle- and

high-income countries (p = 0.009).

Pearson correlations between the total score and score by domains were positive and statistically significant. Correlation between total score and domain pre-requisites was fair (r = 0.223, p = 0.039), and domains implementation of set priorities and impact of the priority

Table 3
Assessment of parameters of priority setting grouped by country income level and WHO region.

Quality parameter of PS	Country Income Classification					p value	WHO Region					p value	
	All countries (n = 86)						All countries						
	Low (n = 14)n (%)	Lower-Middle (n = 26)n (%)	Upper-Middle (n = 20)n (%)	High (n = 26)n (%)			AFRO (n = 18)n (%)	EMRO (n = 12)n (%)	EURO (n = 24)n (%)	PAHO (n = 16)n (%)	SEARO (n = 7)n (%)		WPRO (n = 9)n (%)
Political Will	86	100	All countries	-	-	-	-	-	-	-	-	-	
Resources	81	94.2	14	100	24	92.3	18	90.0	25	96.2	0.258	88.9	0.452
Legitimate institutions	52	60.5	7	50.0	19	73.1	11	55.0	15	57.7	0.439	7	<0.001
Mechanisms for compliance	5	5.8	1	7.1	2	7.7	1	5.0	1	3.8	0.936	0	0.067
Continuity of services	33	38.4	6	42.9	10	38.5	4	20.0	13	50.0	0.216	6	0.418
Stakeholders' involvement	69	80.2	13	92.9	22	84.6	16	80.0	18	69.2	0.295	8	<0.001
Priority setting process	7	8.1	1	7.1	1	3.8	0	0.0	5	19.2	0.082	2	0.382
Explicit priority setting criteria	28	32.6	8	57.1	5	19.2	2	10.0	13	50.0	0.003	3	0.12
Use of evidence	70	81.4	12	85.7	21	80.8	15	75.0	22	84.6	0.826	5	0.013
Public values	14	16.3	2	14.3	2	7.7	2	10.0	8	30.8	0.11	1	0.181
Publicity of priorities	57	66.3	5	35.7	17	65.4	14	70.0	21	80.8	0.038	9	<0.001
Mechanisms for appealing	19	22.1	6	42.9	7	26.9	3	15.0	3	11.5	0.106	0	0.004
Mechanisms for enforcement	20	23.3	2	14.3	5	19.2	8	40.0	5	19.2	0.236	1	0.294
Allocation of resources	24	27.9	7	50.0	11	42.3	3	15.0	3	11.5	0.011	0	0.002
Accountability	17	19.8	3	21.4	8	30.8	2	10.0	4	15.4	0.317	3	0.213
Swiftiness	31	36.0	5	35.7	7	26.9	8	40.0	11	42.3	0.678	3	0.174
Impact on population	5	5.8	0	0.0	1	3.8	0	0.0	4	15.4	0.085	2	0.113
Impact on inequalities	No country												
Fair financial contributions	No country												
Impact on confidence	5	5.8	0	0.0	1	3.8	2	10.0	2	7.7	0.603	0	0.018

Table 4a
Resources prioritized in each country grouped by income level and WHO region.

Resources prioritized	Country Income Classification					p value	WHO Region					p value	
	All countries (n = 80)n (%)						All countries						
	Low (n = 14)n (%)	Lower-Middle (n = 26)n (%)	Upper-Middle (n = 20)n (%)	High (n = 26)n (%)			AFRO (n = 18)n (%)	EMRO (n = 12)n (%)	EURO (n = 24)n (%)	PAHO (n = 16)n (%)	SEARO (n = 7)n (%)		WPRO (n = 9)n (%)
Human resources and training	70	81.4	13	92.9	22	84.6	15	75.0	20	76.9	0.517	4	0.013
PPE and other IPC materials	69	80.2	13	92.9	24	92.3	13	65.0	19	73.1	0.056	8	0.042
Healthcare facilities	31	36.0	6	42.9	12	46.2	11	55.0	2	7.7	0.003	3	<0.001
Medical equipment	31	36.0	4	28.6	10	38.5	7	35.0	10	38.5	0.923	4	0.002
Essential medicines	41	47.7	7	50.0	11	42.3	9	45.0	14	53.8	0.853	5	0.994
ICU beds	39	45.3	8	57.1	9	34.6	8	40.0	14	53.8	0.394	6	0.282
Life support equipment	17	19.8	4	28.6	6	23.1	1	5.0	6	23.1	0.285	3	0.672
Lab equipment	59	68.6	9	64.3	22	84.6	13	65.0	15	57.7	0.189	7	0.128
Testing kits	50	58.1	4	28.6	16	61.5	13	65.0	17	65.4	0.107	7	0.069
Ambulances	17	19.8	4	28.6	5	19.2	3	15.0	5	19.2	0.806	3	0.101
Financial resources	18	20.9	5	35.7	8	30.8	3	15.0	2	7.7	0.088	2	0.017
Vaccines	13	15.1	1	7.1	3	11.5	0	0.0	9	34.6	0.007	1	0.749

AFRO stands for the African region, EMRO for the Eastern Mediterranean region, EURO for the European region, PAHO for the Pan American region, SEARO for South-East Asia region, and WPRO for the Western Pacific region. PPE: Personal Protective Equipment, IPC: Infection Prevention and Control, ICU: Intensive Care Unit.

Table 4b
Groups of population prioritized in each country grouped by income level and WHO region.

Populations prioritized	All countries (n=86) n (%)		Country Income Classification								WHO Region														
			Low (n=14) n (%)	Lower-Middle (n=26) n (%)	Upper-Middle (n=20) n (%)	High (n=26) n (%)	p value	AFRO (n=18) n (%)	EMRO (n=12) n (%)	EURO (n=24) n (%)	PAHO (n=16) n (%)	SEARO (n=7) n (%)	WPRO (n=9) n (%)	p value											
Elderly	29	33.7	3	21.4	9	34.6	5	25.0	12	46.2	0.329	3	16.7	2	16.7	8	33.3	5	31.3	6	85.7	5	55.6	0.014	
People immune-compromised	9	10.5	2	14.3	1	3.8	3	15.0	3	11.5	0.592	1	5.6	1	8.3	2	8.3	2	12.5	2	28.6	1	11.1	0.675	
People with comorbidities or predisposing conditions	22	25.6	3	21.4	5	19.2	4	20.0	10	38.5	0.352	3	16.7	2	16.7	8	33.3	3	18.8	2	28.6	4	44.4	0.533	
Healthcare workers	14	16.3	3	21.4	3	11.5	2	10.0	6	23.1	0.54	5	27.8	1	8.3	3	12.5	3	18.8	2	28.6	0	0.0	0.398	
Travellers	13	15.1	4	28.6	3	11.5	2	10.0	4	15.4	0.45	6	33.3	2	16.7	0	0.0	2	12.5	2	28.6	1	11.1	0.071	
People living in institutions	4	4.7	0		0		1	5.0	3	11.5	0.192	0		0		1	4.2	2	12.5	0	0	1	11.1	0.43	
Pregnant women	15	17.4	3	21.4	7	26.9	2	10.0	3	11.5	0.365	5	27.8	1	8.3	5	20.8	1	6.3	2	28.6	1	11.1	0.485	
Young infants- Children	17	19.8	3	21.4	4	15.4	3	15.0	7	26.9	0.7	3	16.7	1	8.3	8	33.3	1	6.3	1	14.3	3	33.3	0.228	
People in need of sexual and reproductive services	1	1.2	1	7.1	0		0		0		0.157	1	5.6	0		0		0		0		0		0.575	
People living with HIV	2	2.3	1	7.1	1	3.8	0		0		0.425	2	11.1	0		0		0		0		0		0.171	
People who need mental health services	6	7.0	1	7.1	2	7.7	0		3	11.5	0.502	0		1	8.3	2	8.3	0	0.0	1	14.3	2	22.2	0.265	
Racial and ethnic minorities	5	5.8	1	7.1	0		0		4	15.4	0.065	1	5.6	0		0		2	12.5	0		2	22.2	0.136	
Religious minorities																									
Migrants	6	7.0	0		4	15.4	1	5.0	1	3.8	0.222	2	11.1	0		1	4.2	1	6.3	2	28.6	0		0.194	
Refugees/ Internal Displaced Persons	6	7.0	4	28.6	1	3.8	0		1	3.8	0.006	2	11.1	3	25.0	1	4.2	0		0		0		0.102	
Indigenous populations	2	2.3	0		0		0		3	11.5	0.193	0		0		0		1	6.3	0		2	22.2	0.004	
Persons with disabilities	14	16.3	0		4	15.4	2	10.0	8	30.8	0.062	1	5.6	0		3	12.5	5	31.3	2	28.6	3	33.3	0.093	
Prisoners, detainees, and those deprived of their liberty	4	4.7	1	7.1	1	3.8	0		2	7.7	0.625	1	5.6	1	8.3	0		1	6.3	0		1	11.1	0.723	
LGBTIQ+ people and gender minorities	3	3.5	0		1	3.8	1	5.0	1	3.8	0.882	1	5.6	0		0		2	12.5	0		0		0.309	
People who use illicit substances	3	3.5	1	7.1	0		0		2	7.7	0.31	0		1	8.3	2	8.3	0		0		0		0.505	
People with lower socio-economic status											-														-
Population in rural areas	3	3.5	1	7.1	1	3.8	0	0.0	1	3.8	0.73	2	11.1	0	0.0	0	0.0	1	6.3	0	0.0	0	0.0	0.0	0.375
Homeless population	4	4.7	0	0.0	1	3.8	0	0.0	3	11.5	0.214	1	5.6	0	0.0	1	4.2	2	12.5	0	0.0	0	0.0	0.0	0.603

AFRO stands for the African region, EMRO for the Eastern Mediterranean region, EURO for the European region, PAHO for the Pan American region, SEARO for South-East Asia region, and WPRO for the Western Pacific region

In blue: populations prioritized in WHO documents; in green: populations prioritized for continuity of services, in gray: prioritized in International Human Rights Committees.

setting were moderate ($r = 0.333, p = 0.002$, and $r = 0.326, p = 0.002$; respectively), and strong with domain priority-setting process ($r = 0.590, p < 0.001$). Only two parameters showed a fair negative correlation with the rate of cases: 'legitimate institutions' ($r = -0.266, p = 0.013$) and 'mechanisms for the enforcement of decisions' ($r = -0.215, p = 0.047$). A modest negative correlation was found between the parameter 'legitimate institutions' and the rate of deaths ($r = -0.262, p = 0.015$).

Note: AFRO stands for the African region, EMRO for the Eastern Mediterranean region, EURO for the European region, PAHO for Pan American region, SEARO for the South-East Asia region, and WPRO for Western Pacific region

4. Discussion

The present study offers a global, critical analysis of how parameters of priority setting were incorporated into COVID-19 pandemic response planning in a sample of 86 countries from the six WHO Regions. Our findings showed strengths and weaknesses in priority setting plans in all the reviewed plans. There is room for incorporating lessons learnt in the planning for future public health emergencies.

The median percentage for the general score of priority setting was 35 %, indicating that most countries' plans missed more than one quality parameter of priority setting. The domain pre-requisites had a higher median score (75 %), given that virtually all the plans addressed parameters of political will and resources prioritized. In contrast, the implementation of set priorities and priority setting impact domains had median scores of 0 %, indicating how uncommon it was that plans considered implementation phases or evaluated the effects of decisions made. This result may have been influenced by our selection of the earliest versions of published preparedness and response plans; later

plans may have expanded in those domains [21]. In fact, 30 % of the plans were published before the first case was reported, and only 22 % were published after the country reached more than 10,000 cases, principally in European high-income countries, which faced the pandemic earlier than other countries in the world. Still, priority setting plans need to address implementation and impact to ensure practicality and accountability; for the future, preparedness requires content in those domains to face a public health emergency [22].

Use of evidence, publicity and stakeholder involvement were strengths in the PS process domain. Explicit criteria for priority setting, mechanisms for appealing and enforcement were identified in a minority of plans. The attention to evidence is not surprising in a document about how to respond to a public health emergency. "Follow the science" was a frequent phrase articulated by policymakers and medical and public health stakeholders. Explicit criteria, appeals and enforcement could be more politically sensitive [23]. However, explicitness, enforcement and accountability could strengthen trust in legitimate institutions, a trust which has been shown to influence vaccine hesitancy and uptake [24].

We identified some patterns of priority setting; for instance, the use of explicit priority setting criteria was less likely to be identified in lower-middle- and upper-middle-income countries. This pattern may not be surprising since more high-income countries have a longer history of implementing explicit, systematic priority setting than other countries [25–27]. The articulation of explicit priority setting criteria in low-income countries may reflect the transfer of policies and conditions inherent to donor support- often from high-income countries [27–29]. Publicity (of priorities and criteria) was less addressed in low-income countries, which may reflect the routine priority setting. Prior case studies on priority setting in LICs have documented a lack of publicity of the priority setting processes and the criteria [30,31].

Table 5
General and by dominions scores ordered by country income level and WHO region.

Parameter	WHO Region										p-value	p-value
	Country Income Classification					WHO Region						
	All countries (median; IQR)	Low	Lower- Middle (median; IQR)	Upper- Middle	High	AFRO	EMRO	EURO	PAHO	SEARO		
Pre-requisites	75 %; 25	50 %; 25	75 %; 25	62 %; 25	50 %; 25	75 %; 25	50 %; 25	20 %; 25	75 %; 0	75 %; 25	75 %; 25	0.605
The priority setting process	44 %; 23	44 %; 37	44 %; 11	44 %; 31	44 %; 23	44 %; 34	44 %; 23	33 %; 42	44 %; 8	44 %; 0	44 %; 23	0.139
Implementation of the set priorities	0; 50	50 %; 50	50 %; 50	0; 13	0; 13	50 %; 63	44 %; 23	0; 50	25 %; 50	0; 100	0; 50	0.009
Priority setting impact	0; 20	0; 20	0; 20	20 %; 20	10 %; 20	0; 20	20 %; 20	0; 20	20 %; 20	63 %; 38	20 %; 20	0.444
Total score	35 %; 15	35 %; 11	35 %; 11	35 %; 24	37 %; 15	75; 38	69 %; 38	50 %; 35	69 %; 25	53.5; 8.4	63 %; 25	0.859
T-Score	49.3; 12.6	49.3; 9.5	49.3; 9.5	49.3; 19.9	51.4; 12.6	49.3; 16.8	49.3; 11.5	45.1; 19.9	53.5; 8.4	53.5; 8.4	53.5; 10.5	0.859
Number of days between first case and plan	19; 102	9.50; 30	10; 93	10.5; 89	73; 131	1.5; 44	19.5; 131	43; 134	1; 134	73; 116	37; 144	<0.001
Rate cases	44,874;	1,705;	8,783;	89,368;	172,623;	4,118;	24,984.9;	214,855.5;	81,887.9;	28,483;	4,087.1;	<0.001
Rate deaths	119,246	4,021	110,587	82,266	172,612	6,511	108,623.8	149,653	76,716.0	21,373	50,448.2	<0.001
	119.6;	64.1;	189.0;	1,789;	1,480.5;	64.9;	222.9; 692.0	1,956.2;	1,973.8;	357.4;	65.5; 312.3	<0.001
	1,821.0	966.0	562.8	1,745.3	1,773.3	101.8		1,375.6	1,722.8	351.3		

AFRO stands for the African region, EMRO for the Eastern Mediterranean region, EURO for the European region, PAHO for the Pan American region, SEARO for South-East Asia region, and WPRO for the Western Pacific region

In contrast to earlier pandemic plans, personal protective equipment was commonly considered and vaccines less often [32]. The latter was undoubtedly influenced by a pandemic with a novel virus rather than an influenza virus, for which we could reasonably expect a vaccine would be available within a relatively short time [33,34]. Most countries also prioritized human resources; however, life support equipment –necessary in intensive care units- and ambulances- were only prioritized in one-fifth of the plans. From the perspective of income level, high-income countries were five times more inclined to prioritize healthcare facilities and two times more prone to prioritize vaccines than other countries. This situation has been a reflection of the realistic assessment of countries about what is possible. Many LICs, lacking the capacity to produce their own vaccines, were the least likely to identify vaccines [35,36]. Again, the realistic assessment of the countries’ capacities was demonstrated in the differences based on their WHO groupings, whereby the AFRO region prioritized resources such as healthcare facilities, financial resources, and PPE and other IPC materials, but these same resources were less likely to be prioritized in the EURO region.

Regarding vulnerable populations, we found that the elderly and people with pre-existing illnesses were the most prioritized (by 34 % and 26 % of countries, respectively), while Indigenous populations, people living with HIV, and sexual and gender minorities were only explicitly recognized in less than 3.5 % of the plans reviewed. Prioritization of refugees and internally displaced persons varied among countries with different income levels; they were significantly more likely to be prioritized in low-income countries (28.6 %) than in other countries (7 % of all plans). Only five (of the 86) nations prioritized forcibly displaced people in their COVID-19 national response plans. Among the top ten forcibly displaced people hosting countries [37], Uganda’s plan was the only one which explicitly prioritized this vulnerable group. Although Turkey, Colombia, and Germany account for nearly one-fifth (6.6 million) of forcibly displaced people [37], none of their COVID-19 response plans prioritized these populations. Most of these populations were recommended to be prioritized during the COVID-19 pandemic by the WHO and the International Human Rights Committees [38,39]. The findings that only a few countries identified these populations as vulnerable in their COVID-19 plans demonstrate limited consideration at the national level of this critical aspect recommended in global level guidance documents [40]. This is contradictory since many countries reported using global-level guidance documents and recommendations when developing their national COVID-19 plans.

We explored quality parameters of priority setting correlated to COVID-19 cases and death rates. We found that legitimate institutions and mechanisms for enforcing decisions were the only ones with a modest statistically significant correlation. These findings are consistent with Bollyky et al.’s analysis [41], who, in their analysis of a relationship between the infection and fatality rates and contextual factors in 177 countries, found statistically significant associations between trust in the government, interpersonal trust, less government corruption and low standardized infection rates. No other features of political systems and government capacity had a statistically significant association with fewer COVID-19 infections [41]. As in Bollyky et al., our findings indicate that society responds well to trustworthy institutions that demonstrate knowledge, expertise, and capacity and are accountable in decision-making [41].

The scope of this study (covering 86 countries representing all the WHO regions) makes the findings potentially beneficial to other countries that were not included in the sample. Furthermore, the systematic and consistent assessment of the inclusion of priority setting using quality priority setting parameters in Kapiriri & Martin’s framework (which is informed by extensive empirical review and validated for use in various contexts [15,16,42]), makes the findings relevant to the health policy and priority setting literature. However, because only one framework was chosen, it is possible that other approaches, domains and criteria of priority setting were not taking into consideration in this

analysis. Other limitations of this study include, first, that the analysis draws from documentary analysis of COVID-19 preparedness and response plans issued at the early stages of the pandemic, it is possible the latter plans included priority setting. Second, the plans are likely to diverge from the reality of priority setting; it is expected that documents prescribe policies and activities that were not implemented in practice and that some activities which were not stipulated in the documents were implemented. Third, since we depended on accessing the publicly available plans, we may have missed some of the critical planning documents which were not available in the public domain.

4.1. Implications for policy and practice

The study presents a global comparative analysis relevant to all countries. The findings provide a basis for individual policymakers to reflect on their prioritization plans and implementation (although this was beyond the scope of the study), and identify areas that need to be strengthened. Overall, little consideration for explicit prioritization processes and tools and restricted attention to equity considerations may be a start for policymakers interested in enhancing their processes. Although the study focused on the COVID-19 pandemic, priority setting remains one of the policymakers' most prominent challenges. They should consider integrating systematic priority setting in their routine decision-making processes.

Since it was beyond the scope of this study to assess actual practice, there is a need for policymakers to reflect on if and how they integrated (or can integrate) priority setting and equity considerations into their decision-making and implementation. Future research could also focus on evaluating the integration of priority setting in actual policy implementation in each country.

5. Conclusion

This study offers a global, critical analysis of how parameters of priority setting were incorporated into COVID-19 pandemic response planning in 86 countries. Most countries' plans missed more than one quality parameter of priority setting, indicating that there is room for incorporating lessons learnt in the planning for future public health emergencies. We found that legitimate institutions and mechanisms for the enforcement of decisions were the only ones with a modest correlation with a better performance in the COVID-19 response, indicating that society responds well to trustworthy institutions, which

Appendix

Additional File 1. Criteria of Kaporiri & Martin's Priority Setting Framework.

Dimension	Factor included	Short definition
Contextual Factors	Conducive Political, Economic, Social and cultural context	¹ Relevant contextual factors that may impact priority setting
Pre-requisites	Political will	Degree to which the politicians manifested the support to tackle the pandemic
	Resources	Availability of a budget in the COVID plan, and clear description of resources available or required (including human resources, ICU beds and equipment, PPE, and other resources)
	Legitimate and credible institutions	Degree to which the priority setting institutions can set priorities, public confidence in the institution
The Priority setting process	Incentives for compliance	Explicit description of material and financial incentives to comply with the pandemic plan
	Planning for continuity of care across the health systems	² Explicit mentions of the continuity of healthcare services during the pandemic
	Stakeholder participation	Description of stakeholders participating in the development and implementation of the COVID plan
	Use of clear priority setting process/tool/methods	Documented priority setting process and/or use of priority setting framework
	Use of explicit relevant priority setting criteria	Documented/articulated criteria for the priority setting in the COVID plan

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demonstrate knowledge, expertise, and capacity and are accountable in decision-making. The findings of this study provide a basis for policymakers to reflect on their prioritization plans and identify areas that need to be strengthened. Overall, there is little consideration for explicit prioritization processes and tools and restricted attention to equity considerations; this may be a start point for policymakers interested in improving future preparedness and response planning. Although the study focused on the COVID-19 pandemic, priority setting continues to be one of the biggest challenges faced by policymakers, who should consider integrating systematic priority setting in their routine decision-making processes.

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CRediT authorship contribution statement

Claudia-Marcela Vélez: Writing – review & editing, Writing – original draft, Software, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Lydia Kaporiri:** Writing – review & editing, Resources, Project administration, Funding acquisition, Conceptualization. **Susan Goold:** Writing – review & editing, Formal analysis. **Marion Danis:** Writing – review & editing, Formal analysis. **Iestyn Williams:** Writing – review & editing, Formal analysis. **Bernardo Aguilera:** Writing – review & editing. **Beverley M. Essue:** Writing – review & editing. **Elysee Nouvet:** Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Dimension	Factor included	Short definition
	Use of evidence	Explicit mention of the use of evidence to understand the context, the epidemiological situation, or to identify and assess possible interventions to be implemented
	Reflection of public values	Explicit mention that the public is represented, or that public values have been considered for the development or implementation of the plan
	Publicity of priorities and criteria	Evidence that the plan and criteria for priority-setting have been publicized and documents are openly accessible
	Functional mechanisms for appealing the decision	Description of mechanisms for appealing decisions related to the COVID plan, or evidence that the plan has been revised
	Functional mechanisms for enforcement the decision	Description of mechanisms for enforcing decisions related to the COVID plan
	Efficiency of the priority-setting process	³ Proportion of meeting time spent on priority setting; number of decisions made on time
Implementation	Decreased dissensions	³ Number of complaints from Stakeholder
	Allocation of resources according to priorities	Degree of alignment of resource allocation and agreed upon priorities
	Decreased resource wastage / misallocation	³ Proportion of budget unused, drug stock-outs
	Improved internal accountability/reduced corruption	Description of mechanisms for improving the internal accountability or reduce corruption
	Increased stakeholder understanding, satisfaction and compliance with the Priority setting process	³ Number of SH attending meetings, number of complaints from stakeholder, % stakeholder that can articulate the concepts used in priority setting and appreciate the need for priority setting
	Strengthening of the PS institution	³ Indicators relating to increased efficiency, use of data, quality of decisions and appropriate resource allocation, % stakeholders with the capacity to set priorities
Outcome/ Impact	Impact on institutional goals and objectives	³ % of institutional objectives met that are attributed to the priority setting process
	Impact on health policy and practice	Changes in health policy to reflect identified priorities, and swiftness of the pandemic response
	Impact on population health	Description of the expected impact of the COVID plan on the population health
	Impact on reducing inequalities	Description of the expected impact of the COVID plan on reducing inequalities
	Fair financial contribution	Description of the expected impact of the COVID plan on fair financial contributions
	Increased public confidence in the health sector	Description of the expected impact of the COVID plan for increasing public confidence in the response to the COVID-19 pandemic
	-responsive health care system	³ % reduction in DALYs, % reduction of the gap between the lower and upper quintiles, % of poor populations spending more than 50 % of their income on health care, % users who report satisfaction with the healthcare system
	Improved financial and political accountability	³ Number of publicized financial resource allocation decisions, number of corruption instances reported, % of the public reporting satisfaction with the process
	Increased investment in the health sector and strengthening of the health care system	³ Proportion increase in the health budget, proportion increase in the retention of health workers, % of the public reporting satisfaction with the health care system

1 This parameter was not assessed in the national COVID plans, but the information about the political, economic, social and cultural context was obtained from different sources and provided in this study to identify similarities and differences among countries in the same region.

2 This parameter was added to the framework for the specific context of the COVID-19 pandemic.

3 This parameter was not possible to be assessed in the national COVID plans.

Additional File 2. General description of countries sampled.

	Country		Context			Score					Number of days between first case and			Rate per million*	
	Name	Code	Region	Service Coverage	Type of governance	Pre-requisites	PS Process	Implementation	PS Impact	Overall	100 cases	10.000 cases	Publication of plan	Cases	Deaths
Low-income countries	Afghanistan	AFG	EMRO	37	Unitary	50%	56%	0%	0%	35%	33	90	189	4,105.8	186.2
	Burkina Faso	BFA	AFRO	43	Unitary	75%	22%	0%	0%	25%	14	320	-9	960.5	17.3
	Chad	TCD	AFRO	28	Unitary	75%	22%	100%	0%	35%	44		12	423.0	11.2
	Democratic Republic of the Congo	COD	AFRO	39	Unitary	75%	22%	100%	0%	35%	21	171	-10	924.2	13.8
	Ethiopia	ETH	AFRO	38	Federal	75%	56%	0%	0%	40%	36	129	19	3,948.9	62.3
	Mali	MLI	AFRO	42	Unitary	25%	44%	50%	0%	30%	18	371	-24	1,443.3	34.3
	Mozambique	MOZ	AFRO	47	Unitary	50%	44%	50%	20%	40%	50	203	9	6,962.9	67.6
	Niger	NER	AFRO	37	Unitary	50%	22%	50%	0%	25%	14		-19	344.4	12.0
	Palestine	PLW	EMRO	61	Unitary	50%	33%	0%	20%	30%	24	141	21	102,467.0	977.3
	Rwanda	RWA	AFRO	54	Unitary	50%	33%	50%	0%	30%	21	305	17	9,711.4	108.8
	Somalia	SOM	EMRO	27	Federal	50%	44%	0%	20%	35%	32	370	10	1,593.4	81.6
	Tajikistan	TJK	EURO	66	Unitary	50%	67%	50%	0%	45%	3	159	-43	1,817.1	12.8
Uganda	UGA	AFRO	50	Unitary	75%	67%	50%	20%	55%	46	207	10	3,436.3	75.1	
Yemen	YEM	EMRO	44	Unitary	75%	78%	0%	20%	55%	35		0	362.8	66.0	
Lower-middle income countries	Algeria	DZA	AFRO	75	Unitary	75%	33%	0%	0%	30%	25	102	39	5,682.2	147.8
	Angola	AGO	AFRO	39	Unitary	75%	67%	100%	20%	60%	82	222	-48	2,894.7	55.8
	Bangladesh	BGD	SEARO	51	Unitary	50%	44%	100%	0%	40%	29	57	22	10,895.7	170.9
	Bhutan	BTN	SEARO	62	Unitary	75%	33%	0%	0%	30%	146		10	6,671.4	5.1
	Bolivia	BOL	PAHO	67	Unitary	75%	44%	0%	0%	35%	20	82	-2	72,638.8	1,775.6

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	Country		Context			Score					Number of days between first case and			Rate per million*	
	Name	Code	Region	Service Coverage Index	Type of governance	Pre-requisites	PS Process	Implementation	PS Impact	Overall	100 cases	10.000 cases	Publication of plan	Cases	Deaths
	Cameroon	CMR	AFRO	44	Unitary	75%	22%	0%	0%	25%	23	105	-34	4,287.3	69.1
	Cape Verde	CPV	AFRO	69	Unitary	75%	44%	0%	20%	40%	37	243	-49	99,165.2	704.8
	Egypt	EGY	EMRO	70	Unitary	50%	22%	0%	0%	20%	29	88	77	4,107.1	217.6
	El Salvador	SLV	PAHO	76	Unitary	75%	44%	50%	20%	45%	21	117	-48	20,727.0	599.5
	Ghana	GHA	AFRO	45	Unitary	75%	56%	100%	20%	55%	12	87	153	4,945.1	44.0
	Haiti	HTI	PAHO	47	Unitary	25%	33%	50%	0%	25%	47	287	-10	2,540.6	75.9
	Honduras	HND	PAHO	63	Unitary	75%	33%	50%	0%	35%	18	98	-12	38,942.1	1,044.6
	India	IND	SEARO	61	Federal	75%	44%	0%	0%	35%	44	74	107	29,877.0	357.4
	Kenya	KEN	AFRO	56	Unitary	50%	33%	50%	0%	30%	20	121	-42	5,847.9	101.6
	Moldova	MDA	EURO	67	Unitary	75%	22%	50%	20%	35%	15	93	54	110,597.2	2,650.6
	Morocco	MAR	EMRO	73	Unitary	50%	33%	0%	0%	25%	20	112	-35	30,413.8	413.3
	Nepal	NPL	SEARO	53	Federal	75%	44%	100%	0%	45%	103	150	126	32,268.7	396.0
	Nigeria	NGA	AFRO	44	Federal	75%	56%	50%	20%	50%	30	93	168	1,198.4	14.8
	Pakistan	PAK	EMRO	45	Federal	75%	44%	0%	20%	40%	19	56	11	6,378.4	130.2
	Papua New Guinea	PNG	WPRO	33	Federal	75%	44%	50%	20%	45%	135	398	-18	4,087.1	65.5
	Philippines	PHL	WPRO	55	Unitary	75%	33%	50%	20%	40%	44	97	31	32,145.6	486.8
	Sri Lanka	LKA	SEARO	67	Unitary	75%	44%	50%	0%	40%	57	277	73	28,483.7	719.8
	Ukraine	UKR	EURO	73	Unitary	75%	33%	50%	0%	35%	22	58	23	98,629.6	2,463.6
	Uzbekistan	UZB	EURO	71	Unitary	50%	0%	0%	0%	10%	13	112	-14	6,601.4	46.2
	Zambia	ZMB	AFRO	55	Unitary	50%	44%	0%	0%	30%	43	154	10	16,149.4	207.2
	Tonga	TON	WPRO	56	Unitary	75%	44%	50%	0%	40%	No	No	-486	9.4	No
Upper-middle income countries	Argentina	ARG	PAHO	73	Federal	75%	33%	0%	20%	35%	17	80	-31	184,796.1	2,664.4
	Brazil	BRA	PAHO	75	Federal	75%	44%	0%	20%	40%	16	38	2	119,792.4	2,936.3
	China	CHN	WPRO	82	Unitary	50%	22%	0%	0%	20%	18	32	67	73.5	3.2
	Colombia	COL	PAHO	78	Unitary	75%	44%	50%	0%	40%	12	63	147	115,119.8	2,624.6
	Dominican Republic	DOM	PAHO	66	Unitary	100%	33%	50%	20%	45%	20	70	0	50,806.5	393.5
	Fiji	FJI	WPRO	61	Unitary	75%	56%	0%	0%	40%	403	478	-79	69,614.7	887.1
	Georgia	GEO	EURO	65	Unitary	50%	11%	0%	0%	15%	33	269	-29	301,555.9	3,773.1
	Indonesia	IDN	SEARO	59	Unitary	50%	44%	0%	0%	30%	13	59	-14	15,752.4	522.2
	Jordan	JOR	EMRO	60	Unitary	50%	33%	0%	20%	30%	19	248	-5	121,052.4	1,288.8
	Kazakhstan	KAZ	EURO	76	Unitary	50%	22%	0%	0%	20%	13	78	49	70,157.7	975.4
	Lebanon	LBN	EMRO	72	Unitary	75%	56%	0%	20%	45%	23	180	18	137,169.6	1,421.3
	Mexico	MEX	PAHO	74	Federal	75%	56%	0%	20%	45%	19	54	124	38,274.3	2,356.2
	North Macedonia	MKD	EURO	68	Unitary	50%	44%	0%	0%	30%	25	151	35	130,072.5	4,054.4
	Paraguay	PRY	PAHO	61	Unitary	50%	44%	0%	20%	35%	27	162	3	81,627.1	2,408.2
	Peru	PER	PAHO	78	Unitary	75%	56%	100%	20%	55%	11	39	-5	97,110.2	6,170.2
	Russia	RUS	EURO	75	Federal	50%	11%	0%	20%	20%	46	69	88	80,836.8	2,229.6
	Serbia	SRB	EURO	71	Unitary	50%	0%	0%	0%	10%	13	64	19	246,962.1	1,991.8
	South Africa	ZAF	AFRO	67	Federal	75%	56%	50%	20%	50%	13	66	-6	60,096.4	1,587.0
	Thailand	THA	SEARO	83	Unitary	75%	44%	0%	20%	40%	53	352	192	35,118.2	317.5
	Turkey	TUR	EURO	79	Unitary	25%	0%	0%	0%	5%	8	19	174	137,842.3	1,030.2
High-income countries	Australia	AUS	WPRO	87	Federal	75%	56%	0%	20%	45%	44	169	158	101,617.4	151.4
	Bahamas	BHS	PAHO	70	Unitary	75%	44%	0%	0%	35%	68	405	-32	82,148.8	1,879.5
	Canada	CAN	PAHO	89	Federal	50%	89%	50%	60%	70%	45	66	206	80,547.6	894.0
	Chile	CHL	PAHO	80	Unitary	75%	44%	0%	40%	45%	21	55	58	114,018.3	2,068.1
	Denmark	DNK	EURO	85	Unitary	75%	33%	0%	0%	30%	12	68	12	307,559.3	648.5
	France	FRA	EURO	84	Unitary	75%	56%	50%	20%	50%	36	55	37	290,848.3	1,948.6
	Germany	DEU	EURO	86	Federal	50%	33%	50%	20%	35%	34	51	65	122,010.5	1,408.5
	Ireland	IRL	EURO	83	Unitary	50%	78%	0%	0%	45%	14	44	16	238,257.9	1,231.4
	Italy	ITA	EURO	83	Unitary	50%	33%	0%	20%	30%	23	39	183	184,145.9	2,433.8
	Japan	JPN	WPRO	85	Unitary	75%	44%	0%	20%	40%	30	87	124	22,372.4	149.8
	Luxembourg	LUX	EURO	86	Unitary	50%	11%	0%	0%	15%	17	228	185	251,157.0	1,501.2
	New Zealand	NZL	WPRO	86	Unitary	25%	56%	0%	20%	35%	23	62	62	3,280.5	10.3
	Norway	NOR	EURO	86	Unitary	50%	22%	0%	0%	20%	9	172	28	147,153.4	263.5
	Panama	PAN	PAHO	77	Unitary	75%	44%	50%	0%	40%	9	72	-39	161,101.6	1,769.2
	Portugal	PRT	EURO	84	Unitary	50%	56%	0%	0%	35%	11	33	8	264,625.3	1,963.8
	Qatar	QAT	EMRO	74	Unitary	25%	67%	0%	20%	40%	11	57	30	116,150.9	220.8
	Saudi Arabia	SAU	EMRO	73	Unitary	50%	56%	0%	40%	45%	12	49	152	19,556.1	253.0
	Slovakia	SVK	EURO	77	Unitary	50%	11%	0%	0%	15%	12	265	158	292,332.9	3,275.7
	Slovenia	SVN	EURO	80	Unitary	50%	78%	0%	20%	50%	8	224	145	347,640.4	2,828.7
	Spain	ESP	EURO	86	Unitary	75%	67%	100%	20%	60%	30	45	163	214,762.7	2,003.1
	Sweden	SWE	EURO	87	Unitary	75%	44%	0%	20%	40%	34	69	81	214,948.4	1,570.9
	Switzerland	CHE	EURO	87	Federal	50%	22%	0%	0%	20%	9	29	28	258,538.2	1,459.8
	Taiwan*	TWN	WPRO		Unitary	50%	33%	0%	0%	25%	56	499	37	790.2	35.7

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Country		Context			Score					Number of days between first case and			Rate per million*	
Name	Code	Region	Service Coverage Index	Type of governance	Pre-requisites	PS Process	Implementation	PS Impact	Overall	100 cases	10.000 cases	Publication of plan	Cases	Deaths
United Arab Emirates	ARE	EMRO	78	Federal	100%	33%	0%	0%	35%	49	88	201	84,789.8	225.0
United Kingdom	GBR	EURO	88	Unitary	75%	44%	50%	0%	40%	31	51	152	256,143.5	2,301.9
United States	USA	PAHO	83	Federal	75%	44%	0%	0%	35%	55	73	365	226,335.1	2,675.7

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.hpopen.2024.100125>.

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