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COVID-19 water, sanitation, and hygiene response: Review of measures and initiatives adopted by governments, regulators, utilities, and other stakeholders in 84 countries

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HIGHLIGHTS
- WASH response measures to COVID-19 in 84 countries are examined and discussed.
- Hygiene promotion and IPC has been promoted in 94% of mapped countries.
- Secure access to services to vulnerable groups at scale has been weak or implemented locally.
- Support to service providers needs to be enhanced to ensure continuity of services.
- More focus going forward needs to be given to promote a resilient enabling environment for WASH.

ABSTRACT
The COVID-19 pandemic has shone a light on handwashing as an inexpensive, widely applicable response measure. In consequence, most governments have taken action to promote access to water and sanitation services for all. This paper documents an overview of initiatives and interventions that countries have implemented during the first months of the COVID-19 response. Initiatives have been identified across 84 countries worldwide, and categorized into those that aimed at securing water, sanitation, and hygiene (WASH) for all, and those that sought to provide technical and financial support to service providers. The pandemic has not hit countries in the same way. Accordingly, results show disparities in the response between and within regions, with the level of activity found in the countries varying largely in terms of ambition and scope. Hygiene promotion and infection prevention and control (IPC) has been widely adopted – at least one response measure found in 94% of mapped countries – although not always matched in ambition with the assured availability of soap, water, and handwashing facilities. Support to vulnerable households to promote basic access to WASH services at large scale has been weak or implemented locally.
1. Introduction

In 2020, the world has been afflicted by the coronavirus disease (COVID-19) and its causative virus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). First reported in China in late 2019, the COVID-19 outbreak was declared a Public Health Emergency of International Concern by the World Health Organization (WHO) on 30 January 2020 (World Health Organization, 2020a). As of April 20, 2021, more than 142 million cases of COVID-19 have been reported, resulting in more than 3 million deaths (Johns Hopkins Coronavirus Resource Center, 2020).

Combatting this virus has forced countries to recognize the importance of foundational measures of disease control (Howard et al., 2020). Partial or total "lockdowns" and "physical distancing" accompanied by handwashing and other infection prevention and control (IPC) measures, are among the suite of measures that have been largely implemented across the world to contain the pandemic (Ekumah et al., 2020). The contribution of water supply, sanitation and hygiene (WASH) to the COVID-19 response has therefore been central, primarily by promoting good hygiene, and particularly, by ensuring frequent and proper handwashing (World Health Organization, 2020b; World Health Organization and United Nations Children's Fund, 2020a).

Adequate and effective hand hygiene requires sufficient water from reliable sources, preferably accessible on premises, and access to handwashing facilities (with water and soap) that enable hygiene behaviours (Howard et al., 2020). Yet, access to the levels of water supply that support good hand hygiene and access to soap are deficient, particularly in low- and middle-income countries (Howard et al., 2020; Joint Monitoring Programme, 2020, 2019). UNICEF/WHO Joint Monitoring Programme (JMP) estimates that only 71% of the global population (5.3 billion people) use a safely managed drinking-water service – that is, one located on premises, available when needed, and free from contamination (Joint Monitoring Programme, 2019). The same data however shows that over one-quarter of the global population still uses water collected from off-premises water sources that are often shared between households, including 144 million people who are dependent on untreated surface water (Joint Monitoring Programme, 2019). Reliance on such sources poses two challenges to the pandemic response. First, water for handwashing may not be available: the amount of water typically collected by households from such sources is around 20 l per person per day (Howard et al., 2020; Howard and Bartram, 2003), and scarce water is often prioritized for other tasks (Stoler et al., 2020). Second, physical distancing may be impractical for those who rely on fetching or sharing water, increasing the risk of transmission due to interhousehold contact (Howard et al., 2020; Stoler et al., 2020). For instance, the process of fetching often involves queuing in close proximity, since water fetching in groups contributes to building social capital among women and children, while offering a mechanism of protection from physical dangers (Stoler et al., 2020). With physical distancing measures in place, vulnerable groups (especially women and girls) may experience greater risks by having to fetch water alone (Geere et al., 2018). Beyond risks associated with drinking-water collection, sharing the sanitation facility, with a few households or through public, pay-per-use facilities, may also serve as a transmission pathway for COVID-19 (Caruso and Freeman, 2020; Parikh et al., 2020), especially in the absence of adequate water and soap for hygiene purposes. An estimated 8% (627 million) of the global population use a shared sanitation facility as their primary sanitation location (Joint Monitoring Programme, 2019), and once again, women might be at increased risk due to more frequent use, both for meeting their own needs, including menstruation, and assisting dependent family members (Caruso and Freeman, 2020).

It seems, however, that availability of basic water services is not the only limiting factor for having a hand washing facility with soap and water at home (Joint Monitoring Programme, 2020). According to UNICEF/WHO data, only 60% of the world’s population has at least a basic handwashing facility in the household, defined as a location where both soap and water are available that is either fixed (i.e., a sink) or mobile (jugs or basins). In least developed countries, this percentage drops to 28% (Joint Monitoring Programme, 2020). Jiwan and Antiporta (2020) also report, in sub-Saharan Africa, wide within country disparities in the percentage of households with an observed handwashing place with water and soap, disproportionately affecting the poorest households and rural residents.

In consequence, the poorest segments of the population have received the COVID-19 shock on top of existing WASH services gaps, all pointing towards an increased risk of water-related diseases outbreak. Large cities face risks stemming from population density, with a large share of city residents in Africa and Asia living in slums and informal settlements (Lall and Wahba, 2020). In addition, the cramped living conditions and inadequate public services, especially inadequate waste management and sanitation, can exacerbate contagion of the virus - COVID-19 is impacting more heavily urbanized regions (Groupe URD, 2020). But rural areas cannot be left behind. A recent assessment of service provider perspectives on the effects of COVID-19 on WASH access found no consistency as to whether urban or rural dwellers were impacted more (US Agency for International Development, 2020). However, inequalities in access to services between urban and rural populations have been largely reported (Joint Monitoring Programme, 2019), and many response measures (e.g., various forms of free-water initiatives) were not applicable in off-grid communities (Amanlowaa and Ampratwum, 2020; Cooper, 2020). It has also been emphasized that the likelihood of a household without an in-house sanitation facility violating the lockdown regulations is higher than a household without other basic needs covered (e.g., refrigerator to store food), since one cannot cope with living in a house without a sanitation facility for a day or two under a total lockdown situation (Ekumah et al., 2020). This is particularly important in informal settlements, since settlers frequently rely on communal toilets, where it is difficult to apply physical distancing and to follow strict hygiene procedures (Parikh et al., 2020).

Despite the unquestionable importance of handwashing and WASH services to COVID-19 pandemic mitigation, and the urgency for policy and response interventions, four other major issues have captured much of the attention of water-related COVID-19 scientific literature (Antwi et al., 2021; Ekumah et al., 2020; Sharifi and Khavarian-Garmsir, 2020): first, improvements observed in the quality of water...
resources during lockdown periods due to reduced anthropogenic activities; second, tracing the presence of COVID-19 in public waterways, particularly relating to wastewater and sewage systems, to predict diffusion patterns and take effective response measures; third, concerns regarding the possibility of increased water pollution caused by drugs used for treatment of COVID-19 patients; and fourth, the need for enhanced wastewater treatment to reduce the likelihood of COVID-19 transmission through faecal matter. To date, with a few exceptions (Anankwaa and Ampatratum, 2020), academic studies on COVID-19 policy response from the WASH sector in low-income countries have not received adequate attention.

Since the start of the outbreak, stakeholders working in the WASH sector – e.g., governments and decision makers, regulators, utilities, external support agencies, and civil society – have actively employed a variety of emergency measures to secure access to WASH services for all, particularly because clean water is central in promoting hygienic practices towards mitigating COVID-19s spread. This study, therefore, maps and reviews WASH sector government and non-government interventions in response to COVID-19, and provides a baseline understanding of the nature of these interventions, which subsequently can influence development of future policies and response plans. The focus is on three questions:

1) Which areas of intervention have been prioritized by WASH stakeholders in their COVID-19 responses?

2) How do these priorities vary between countries and regions?

3) What have been the main response gaps?

To answer these questions, the paper first develops an analytical framework to structure and assess the WASH COVID-19 responses. It is based on two different blocks and five target intervention areas, as shown in Table 1 (Stockholm International Water Institute, 2020).

Second, the paper provides an overview of measures and initiatives that WASH stakeholders have launched or are implementing in the response to COVID-19 in 84 countries, and points out key remarks and main findings for each region. Third, we discuss the need for looking forward, by identifying the overarching aspects that might contribute to enhanced WASH services resilience in the face of a future pandemic. By documenting and presenting specific measures and concrete initiatives, this paper gains a better understanding of the nature of the WASH response interventions. It ultimately aims to support the preparation of response strategies in countries in the face of COVID-19 and future pandemics.

2. Methods

This paper is based on a comprehensive mapping and compilation of measures and initiatives implemented in 84 countries, purposively selected from different world regions (see Fig. 1). It was conducted between end of February and June 2020 - the mapping cut-off date varied between different regions - and included 26 countries from Latin America and the Caribbean (LAC, last mapping update conducted in June 15), 21 countries from Middle East and North Africa (MENA, last update in May 31), 4 countries from East Asia and Pacific (EAP, last update in May 8), 5 countries from South Asia (SA, last update in May 8), 12 countries from Eastern and Southern Africa (ESA, last update in May 4), and 16 countries from West and Central Africa (WCA, last update in May 8).

Relevant works of literature from a series of searches using Google, Google scholar and PubMed, as well as policy documents from multinational organizations, agencies, and accessible databases of various governments, were considered. Peer-reviewed works from a wide range of sources were therefore included together with grey literature from websites of service providers, government portals and other regulatory bodies (and social media), humanitarian and development organization websites, including Global WASH cluster and WASH and Health clusters at country level (e.g., UNICEF Situation Reports). The latter complemented published studies on COVID-19, since the body of knowledge on the virus and its impact on the environment, economies and other facets of society are still emerging.

Search queries consisted of combinations of keywords around two key areas with a geographic focus: (“COVID-19” OR “Coronavirus” OR “SARS-CoV-2”) AND (“Water” OR “Sanitation” OR “Hygiene” OR “WASH”) AND (“response” OR “measure” OR “initiative”) AND (“Country” OR “Region”). Search languages, depending on the region, included English, French, Portuguese, Spanish, and Arabic. In the mapping, responses from all actors were considered, including national and local governments, utilities, regulators, international organizations, civil society organizations, and the private sector.

Initially, the literature review contributed to the development of a framework that allowed a structured analysis of the response. As mentioned above (Table 1), it is based on five target areas, classified in two key response blocks. The framework was guided by UNICEF COVID-19 programming documents (United Nations Children’s Fund, 2020a; World Health Organization and United Nations Children’s Fund, 2020a, 2020b, 2020c), and subsequently validated by selected WASH experts and stakeholders – mainly from UNICEF –, through different rounds of consultations. Feedback received in various webinars and workshops, where the framework was presented and discussed, was also used to fine-tune the response blocks and target areas.

Using the framework as a basis, all measures and initiatives found were then classified in target areas, and also based on the administrative level: i) Initiative/measure led by national/central level state institution or national emergency taskforce; or ii) Initiative/measure led by sub-national/local level state institution, sub-national emergency taskforce, or non-state actor.

Table 1

| Key response blocks | Target intervention areas |
|---------------------|---------------------------|
| Measures and approaches to ensure access to a minimum daily volume of drinking water, basic sanitation and enhance safe hygiene behaviour for all – with a focus on the consumer (people and institutions). | 1. Intensify behaviour change population-wide initiatives and awareness-raising campaigns for hand washing at the household level. |
| Measures to secure the continuity and affordability of WASH services and products – with a focus on the service providers. | 2. Strengthen infection prevention and control (IPC) at the household and in institutions. |
|                      | 3. Preserve the ability of all people, including the most vulnerable, to meet their basic needs in relation to water and sanitation during the crisis. |
|                      | 4. Secure the continuity, affordability and quality of water and sanitation services as well as proper waste management practices. |
|                      | 5. Ensure technical and financial support to service providers. |
Finally, the web-based search was complemented and found information validated with relevant stakeholders from mapped countries wherever possible, albeit to a different extent and in different ways: i) interviews and/or emails with UNICEF WASH experts or government officials; or ii) multistakeholder dialogues at the national level, including regulators, service providers, and WASH practitioners. In total, validation processes were conducted in eleven countries, namely Bolivia, Brazil, Colombia, Ecuador, and Venezuela from LAC, and Egypt, Iran, Iraq, Jordan, Libya, and State of Palestine from MENA.

There were limitations in the scope and methodology used for the data collection. Whilst the contents and findings of the paper are based on a systematic and comprehensive mapping of publicly available secondary information, validated through interviews wherever possible, it should not be assumed to provide a fully complete picture of the responses in the countries. Limitations include i) the lack of publicly available information on the internet in some cases, ii) the dynamic and rapidly evolving situation, iii) the scale of the measures and level of ambition (e.g., one country supporting a few, some, versus all utilities were categorized in the same way), and iv) the representativity (number of countries mapped) and the regularity of updates and periods reported, which differ from one region to another. Another limitation relates to the difficulty to assess the level and quality of the implemented measures launched by countries. In some cases, information about the implementation status was available, but for most initiatives, it was not. Therefore, the paper only provides an overview of the COVID-19 WASH responses announced and published by countries, without discussing about their degree, quality, or effectiveness of implementation.

3. The analytical framework

The proposed framework to map the COVID-19 response from WASH stakeholders is briefly outlined below. Each target area consists of a number of recommended actions and measures that countries could adopt in achieving the target. For instance, the framework includes “moratoriums on cutting off the water supply” or “the immediate reconnection of previously disconnected households because of their inability to pay”, as two different initiatives aimed at improving access to drinking-water for all (Target Area 3). The full list of preidentified and recommended measures, which were used to map countries’ responses, is detailed in Annex 1 of Supplementary Material.

3.1. Ensuring access to safe water, adequate sanitation, and hygiene services for all

3.1.1. Target 1. Intensify behaviour change population-wide initiatives and awareness-raising campaigns for hand washing at the household and in institutions

Handwashing with clean water and soap is a key preventive measure against the COVID-19 (World Health Organization, 2020c; World Health Organization and United Nations Children’s Fund, 2020c). But doing it requires access to clean and reliable water, a handwashing facility with soap, and handwashing knowledge and practice (Howard et al., 2020). To promote more frequent and regular hand hygiene, the framework identifies 3 emergency measures around the following two topics (Annex 1 of Supplementary Material):

- Launch population-wide handwashing campaigns and enhance risk communication and community engagement (RCCE) to improve the continuity of preventive practices among children, at-risk groups, and the general public. Develop hygiene messages tailored to the country context and improve the communication of accurate information, using multiple delivery channels and including targeted messaging.
- Fight disinformation campaigns and fake news, ensuring people are able to access reliable information. Promote an efficient use of water, as well as proper handling and storage of treated water in households with no piped connection.

3.1.2. Target 2. Strengthen infection prevention and control (IPC) at the household and in institutions

IPC measures are essential both at household level and in institutions, in particular in health care facilities and in schools. They are aimed at limiting human to human transmission and protect individuals from exposure to COVID-19 by breaking infection transmission pathways, including through water, sanitation, and good hygiene. To improve IPC, a total of nine key interventions have been preidentified in relation to the following matters (Annex 1 of Supplementary Material):

- Promote IPC measures at the household, such as isolating people with symptoms and people at a higher risk, and not sharing personal items such as glasses, cutlery, towels, etc. with special attention to confined households and most vulnerable groups. The efficacy of
other largely implemented measures have however been recently disputed, such as cleaning and disinfecting surfaces (Goldman, 2020; Lewis, 2021).

- Ensure that handwashing infrastructure is available, safe, accessible, and functional where and when needed, including the rehabilitation and construction of new handwashing stations in exposed collective sites and public spaces, such as schools, healthcare facilities, markets, prisons, transport locations, etc. The quantity and usability of the hand hygiene stations should be adapted to the type (e.g., young children, elderly, women, those with limited mobility) and number of users to better encourage use, reduce waiting time and guarantee physical distancing (World Health Organization, 2020c).

- Ensure the availability (e.g., by promoting local production) and affordability of hygiene products (soap, domestic bleach, menstrual hygiene materials, etc.) and household-based water treatment products (chlorine tablets, filters, etc.), through direct distribution, cash-based interventions, or market control mechanisms (United Nations Children’s Fund, 2020b); with specific focus on confined households and areas of high incidence with vulnerable groups, slums, exposed collective sites and public spaces.

- Secure the continuity of water and sanitation services in health care facilities (HCF), including key IPC practices such as hand hygiene, environmental cleanliness, medical equipment processing, and healthcare waste management (World Health Organization, 2019).

- Secure water and sanitation services in schools following the reopening of education centres, including i) enforcing regular handwashing with soap and clean water at age-appropriate hand washing stations (or hand sanitizers dispensers), ii) managing excreta (faeces and urine) safely, and iii) implementing regular cleaning and disinfection of school facilities, especially bathrooms and toilet facilities (Inter-Agency Standing Committee, 2020).

3.1.3. Target 3. Preserve the ability of all people, including the most vulnerable, to meet their basic needs in relation to water and sanitation

A combination of policies, regulations and field interventions are needed to maintain - and where possible, increase - coverage of basic services and protect the needs of the most vulnerable groups. Despite lack of evidence on the relevance of the faecal-oral transmission of the virus, interventions related to the provision of WASH services should be added to the current strategies for COVID-19 pandemic control, on top of the already recognized key role of water for hand washing (Heller et al., 2020). This, at the same time, will respond to the call of Agenda 2030 to “ensure availability and sustainable management of water and sanitation for all” (SDG 6), and reinforce the urgent need for realizing the human rights to safe drinking water and sanitation. Therefore, priority must be given to those measures that guarantee that all people have access to these basic services, either through centralized solutions or other conventional and non-conventional alternatives. The framework identifies a total number of twelve measures that could be implemented by countries to address these situations (Annex 1 of Supplementary Material), and particularly to:

- Provide basic sanitation to all households without toilet facilities, preventing them from sharing toilets or practicing open defecation. In addition, ensuring availability and free access to public toilets for key workers - people whose jobs are vital to public health and safety during the coronavirus lockdown -, and homeless people.

- Implement existing and/or innovative financing mechanisms and instruments to assist vulnerable families in paying their water bills, through e.g., subsidy systems, bill cancellation, debts rescheduling and remission, exemption of reconnection charges to distribution networks, or others.

- Establish and guarantee a minimum daily amount of water for all, ensuring that the Minimum Standards for both water quantity and quality are met (Sphere Association, 2018), and taking into account an increase in consumption due to improved hygiene and the confinement situation of many people in their homes.

3.2. Securing the continuity and affordability of water, sanitation, and hygiene services, while ensuring the financial sustainability of service providers

3.2.1. Target 4. Secure the continuity, affordability, and quality of water and sanitation services as well as proper waste management practices

In the pandemic situation, keeping water supplies safe and safely managing wastewater and faecal waste need to be secured by setting minimum standards for accessibility, availability, quality, continuity, and equity. Governments have been asked to promote public policy measures in the WASH sector to ensure the continuity of services, with special attention to poorest and vulnerable segments of population (United Nations Children’s Fund, 2020b). Sector partners have been urged to support governments to prepare budgets and implementation plans for priority response and recovery measures, and to periodically monitor WASH services access and prices, and propose corrective actions when needed. Equally important, governments have had to ensure adequate waste management and treatment, including of medical, household, and other hazardous waste, as an essential public service. In total, eleven measures are recommended in the framework to address these risks (Annex 1 of Supplementary Material), and particularly to:

- Secure the continuity of services, by keeping water supplies safe (protection from source to consumer), and managing wastewater and faecal waste safely (at every point of the sanitation chain) (World Health Organization, 2018). This might include e.g., i) regular and preventive maintenance on all critical equipment, avoiding deterioration or collapse of these essential services as a secondary effect of outbreak; or ii) testing and monitoring of residual chlorine at strategic points in the distribution network and specifically for key users, such as health care facilities, nursing homes and schools. In addition, water and sanitation systems should be able to meet an increase in demand, and infrastructure extension to non-connected areas should be planned for, if possible.

- Ensure a secure and reliable electricity supply to utilities.

- Advocate for, sustain, strengthen, and diversify supply chains (e.g., by promoting local production) for essential water and wastewater treatment products, chemicals, spare parts and consumables, to ensure increased availability and continuity of supply.

- Provide appropriate personal protective equipment (PPE, such as gloves, safety goggles, face shields or masks) to utility workers (including informal workers) (World Bank et al., 2019) and to cleaning agents in health care facilities, while promoting increased hand hygiene.

3.2.2. Target 5. Provide technical and financial support to service providers

Water and sanitation services cannot be secured at the cost of technical and financial sustainability of service providers. Indeed, water utilities, small service providers and rural water community-based
organizations need technical and financial assistance to manage services safely and sustainably in an increasingly complex environment. The proposed framework predefines a set of eight response initiatives (Annex 1 of Supplementary Material) that, to a greater or lesser extent, have been taken by countries to:

- Ensure that service providers (urban and rural) receive continuous support and technical advice in relation to the issues of administration, planning, operation, and maintenance, etc. Launch and/or promote networking and collaborative platforms between local authorities and service providers for the exchange of information, the sharing of good practices, cross-learning processes, etc.
- Ensure that service providers (urban and rural) receive financial assistance to secure services’ continuity and proper operation and maintenance. Support utilities to managing and monitoring liquidity risk, preventing them from suffering cash flow crisis due to delays or non-payment of bills, increased operation, and maintenance costs, etc. Promote a digital transformation (e.g., digital payments), blended finance mechanisms, etc., since they might emerge as appropriate solutions for the short and mid-term. Develop business plans to analyse economic viability of the utility in the short and mid-term.
- Create and implement new funding instruments to improve, rehabilitate and expand water and sanitation infrastructure, covering specific needs caused by the pandemic. These mechanisms can come from government financial funds or with the support from multilateral organizations.
- Establishment of coordination mechanisms for stakeholders (across sectors Health, WASH Education, etc.) working in emergency preparedness and response.

4. Results and discussion

4.1. A snapshot view of the global response

The WASH response to mitigate the impacts of COVID-19 took different forms, in terms of the timing and the nature of adopted policies and interventions. There were, however, commonalities among regions and countries. This section reviews and discusses WASH sector government and non-government interventions in response to COVID-19, identifying trends and gaps for all target areas, and provides a baseline understanding of the nature of these responses, which may help current response development and, subsequently, influence future emergency policies and plans.

To start with, a snapshot view of the global response shows in Fig. 2 that the focus in all regions was on handwashing and hygiene promotion (target 1), followed by WASH & Infection Prevention and Control (target 2), with targets 3 (ensuring basic WASH needs), 4 (WASH service continuity) and 5 (support to WASH service providers) having significantly lower activity.

A more detailed picture of the level of response, for all recommended measures in each target area, is shown in Fig. 3, and briefly discussed below:

Population-wide initiatives and awareness-raising campaigns for hand washing (Target 1) | Almost all mapped countries (94%) opted for promoting handwashing with soap at scale, targeting households and institutions, often with the support of community and religious leaders. Many (74%) were particularly active in implementing Risk Communication and Community Engagement (RCCE) - i.e., processes and approaches to systematically consult, engage, and communicate with communities and other vulnerable groups who are at risk -, by developing, translating, and disseminating messaging and materials on COVID-19 prevention and risk reduction practices. Some countries (70%) were also proactively tracking and combating misinformation and fake news.

Infection prevention and control (IPC) at the household and in institutions (Target 2) | In more than half of surveyed countries, handwashing efforts were matched with other measures directed to ensure hygiene supplies - e.g., soap and hand sanitizer - (54%), and handwashing infrastructure, such as the immediate rehabilitation and construction of handwashing stations (58%). They were, however, largely implemented at the local level, with limited scale. In parallel, various countries were found to be proactively improving IPC at essential institutions. In this regard, measures were found in some countries (58%) to ensure continuity of WASH services in health care facilities, in the form of rapid assessments and diagnostics and providing tailored responses. On the contrary, since schools in most countries were closed, measures to prepare for schools’ reopening were found in a limited number of cases (29%). As countries began to lift lockdown measures, awareness raising initiatives shifted the focus to maintaining the physical distance in public and crowded settings. Other countries implemented measures for areas where people were likely to gather, such as the formulation and implementation of protocols for the disinfection of public spaces (61%)

Access to water and sanitation for all people, including the most vulnerable (Target 3) | A significant number of countries (73%) were found to be taking proactive steps to guarantee access to water for all, with different measures put in place at the national level. For instance, half of the countries (51%) issued policies prohibiting the disconnection of water supply to users, whilst enforcement initiatives to reconnect previously disconnected users did not receive the same level of attention. Some countries (63%) were also found to be taking complementary measures to ensure basic drinking water requirements for vulnerable and not connected households, through infrastructure expansion or alternative solutions such as emergency water systems or by water trucks. However, roughly half of these initiatives were implemented with limited scale. In MENA, a focus was also seen at local levels to promote WASH services in isolation centres and refugee and IDP camps. In addition, an increasing number of countries (48%) realized the economic hardship of customers and put in place measures to alleviate the cost of bills - e.g., direct economic financial transfers to households to maintain their water consumption levels. However, not always these mechanisms included WASH-related products, and they are likely to be insufficient and non-sustainable in the mid-term, as they were rarely accompanied with appropriate targeting mechanisms to ensure that they were reaching those most in need – who might not even be connected to the system.

In terms of access to, and management of, sanitation, a general lack of response was observed, particularly for those vulnerable households not connected to the sewerage network. Very few examples (10% of countries) were found to support decentralized sanitation solutions, and almost no measures were identified to ensure availability, safety,
cleanliness, and affordability of public or community toilets (6%). This may be particularly relevant for displaced and confined people who do not have access to sanitation and need to use shared or public toilets, as well as for essential workers, if public infrastructures are not available or properly maintained.

Finally, although there were some positive examples of considering the specific needs of women and girls in the response, measures found were scarce and implemented locally (32% of countries, with only 13% implementing national-scale measures). They were often limited to distribution of dignity kits including menstrual hygiene products.

**Continuity, affordability and quality of water and sanitation services (Target 4)** A number of measures were found in some countries to ensure correct operation of piped water supplies. Among others, by strengthening and diversifying the supply chains of all products and materials needed to operate the systems (26% of countries), increasing water and sanitation infrastructure maintenance (36% and 19%, respectively), enhancing disinfection and water quality monitoring, and securing alternative and emergency power supplies (13%), all of them ensuring business continuity. Some countries were also found to be protecting the safety and security of water and sewerage utility workers (56%), but with little measures taken to distribute personal protective equipment among informal workers (only 6% of countries). By and large, however, these measures did not receive enough attention, and mostly covered only the bigger service providers. In addition, rural operators in some countries are not formally registered, making them ineligible to request assistance from the central government.

**Technical and financial capacities to utilities (Target 5)** A significant number of emergency measures employed by governments to cope with the pandemic have challenged the technical capacities and financial viability of utilities (International Finance Corporation, 2020; US Agency for International Development, 2020), e.g., bill cancellation, debts rescheduling and remission, and exemption of reconnection charges to distribution networks. Yet, government initiatives to provide support to service providers and operators were shown to be limited. Little evidence was found on extending technical support to service providers (27% of mapped countries), including for the repair and rehabilitation of non-functional water points, chlorination of water systems and networks, and the construction of new water infrastructure; and only very few service providers were found to receive funds to guarantee operation of services – a higher focus was observed on urban utilities and (23% of countries) than on rural operators (15%). Measures regarding specific support to rural and community service providers were identified in Latin America and the Caribbean, albeit with very limited scope. As utilities potentially find themselves delivering services in an increasingly challenging context on one hand and the inability to fully cost recover on the other, their financial viability might be threatened in the medium to longer term, ultimately impacting the overall quality and sustainability of the services.

**4.2. A regional snapshot of the response**

The response showed large disparities between and within regions. In part, they might be explained by the heterogeneity among countries in terms of the preparedness of their healthcare systems, their population demography, the proportion of persons employed in the informal sector, and the adoption of other policy measures motivated by the need for “physical distancing” – e.g., school closures, travel restrictions, curfews, and quarantines (Sebhatu et al., 2020). Conversely, the epidemiological situation and the degree to which the pandemic has taken hold in each country seems to have had little impact on the number of measures implemented by WASH stakeholders, at least during the first months of the pandemic, as shown in Annex 2 of Supplementary Material. This suggests that the WASH response was not driven by epidemiological evidence but by other factors – e.g., readiness of the sector to respond to COVID-19, available resources, etc. This section briefly
discusses regional trends in the response, with a focus on the three regions where the number of mapped countries allows a more in-depth analysis: Latin America and the Caribbean, the Middle East and North Africa, and sub-Saharan Africa.

Overall, despite the methodological limitations cited above, mainly the number of countries mapped in each region and the mapping cut-off date - which varied between different regions - Figs. 4 to 9 suggest that more active responses were found in LAC region. At the national level, it is observed that most countries showed a high level of activity (e.g., El Salvador, Ecuador, Morocco, Lebanon, Zimbabwe, Ghana), although there are few in all regions that were lagging behind (e.g., Suriname, Uganda, Sierra Leone).

In LAC, mapped countries were by and large active in their response, with only a few showing low levels of measures put in place. However, regional disparities exist, with countries from South America showing a more intensive response than countries from Central America or the Caribbean. In terms of response target areas, a significant number of measures sought to promote population-wide initiatives and awareness-raising campaigns for hand washing (target 1), with all countries implementing measures in this regard. In contrast, few examples were found to secure continuity and affordability of services (target 4) and to provide technical and financial assistance to service providers (target 5).

In MENA, since the beginning of the pandemic, some countries showed high levels of activity in relation to their response, with significant difference between countries from North Africa (more active in the response) and those from the Middle East. Those target areas included in the first response block (targets 1 and 2) - which focus on hand hygiene and IPC - were found to have higher levels of activity; while targets of the second block (i.e., 3, 4 and 5) - related to continuity and affordability of WASH services - showed significantly lower levels of activity. Particularly in target area 5, for a large number of countries no evidence of technical support to utilities was found, which had the potential to directly impact on the quality and sustainability of water and sanitation services.

Finally, a closer look at response target areas in sub-Saharan Africa first illustrates a similar level of response in both WCA and ESA regions. As in other regions, hygiene promotion and other IPC were prioritized in most countries (target areas 1 and 2), both at the household and in health care facilities. More of a focus was also seen at local levels in terms of ensuring availability of hygiene supplies such as soap, and infrastructure such as temporary handwashing facilities. In contrast, very few measures aiming at providing technical and financial assistance to utilities and rural service providers were observed, together with few good examples found aiming to secure continuity and affordability of water and sanitation services (targets 4 and 5). The full summary of measures mapped for each country is presented in Annex 3 of Supplementary Material, and links to all documents found are available from the authors upon request.

4.3. Looking forward: from the first response to recovery while working towards resilience

During first phases of the pandemic, with no effective vaccines and other medical alternatives to treat the disease, governments took
measures to promote handwashing with water and soap, IPC, and to implement quarantine and physical distancing, such as school closure, suspension of public transportation services, and temporary prohibition of public gatherings and non-essential economic activities. At that stage, it was critical for essential businesses such as the delivery of water and sanitation services to continue their routine operations, in order to reduce the transmission and spread of COVID-19 (Gude and Muire, 2021). As time passed, countries managed the crisis in different ways, taking various approaches to gradually open essential and non-essential activities, and reinstating restrictions following relapses. Today, inadequate prevention and control of COVID-19 is still hampering economic growth and social development in most countries.

This evolving situation has also impacted the WASH sector. In consequence, we have conceptualized the response in three phases, moving from the initial "emergency response" to "recovery" and beyond, when "working towards resilience". Each phase requires a set of policies, norms, and measures (Fig. 10), which coexist with dynamic, changing, and often fragile, socio-economic, and environmental factors. Besides, there is not a linear, progressive, and standard evolution between phases. Crises often re-emerge and relapses can occur (e.g., in case of new waves of infections with Virus variants), with countries progressing at different speeds. It is possible for a country to be in multiple phases at the same time (e.g., different parts of the country might have different epidemiological situation), and of course, for different countries to be in completely different phases than one another.

The first phase contains the "emergency response" and includes two interrelated phases: the "confinement", where mobility restrictions at home are implemented, followed by a "de-escalation" of measures, where countries gradually reopen their economies and lift coronavirus movement restrictions. In this transition, countries opt for instance for promoting physical distancing, face masks, etc., together with improved hygiene and cleaning in public places (e.g., introduction of public handwashing stations). As mentioned above, the pandemic urged governments and WASH stakeholders to implement several response measures to increase access to water and sanitation, including free water for all initiatives. The sector needed to review the services delivery models accordingly (e.g., adopting emergency solutions such as water trucks), particularly in institutions and public spaces, while seeking to minimize COVID-19 transmission through e.g., use of community waterpoints or shared sanitation facilities. In addition, the socio-economic impacts of the pandemic have posed a significant risk to services continuity, from a dual perspective: the user has faced affordability issues to pay for water and secure access to a minimum level of service, while utilities have delivered services in an increasingly complex context and a drastic drop of revenues. All these factors have put the service operators on a risky situation (Global WASH Cluster et al., 2020; International Finance Corporation, 2020; IRG, 2010), since external technical and financial support has not scaled up.

The "recovery" phase is mainly dependent on the immunization rate and, in turn, on the development and effective implementation of strategies and plans for the deployment of COVID-19 vaccines. From the WASH perspective, it encompasses the restoration of services to pre-disaster conditions, while ensuring that they are managed and operated better than before the pandemic. It is equally important to renew the spotlight on disparities in services with a view to galvanizing more political and financial support for accelerating equitable and affordable WASH service expansion and improvements for the most vulnerable - paying special attention to the needs of the affected community members who have experienced the hardships of financial, emotional, or physical impacts. The focus is therefore on transitioning...
from an emergency context to the creation of an enabling environment for the expansion and sustainable delivery of higher levels of services. This will require a combination of new technologies with innovative models of service delivery to close the existing gaps and reduce inequalities, particularly to deliver services to informal settlements and for unconnected users. In parallel, a variety of financing approaches will be needed to attain WASH sector financial sustainability, while securing external funding where and when needed. The great effort seen during the response and de-escalation phases in hygiene promotion and handwashing would need to be sustained over time during the recovery phase and beyond to achieve a permanent change of hygiene habits.

In the last phase, namely “working towards resilience”, the sector learns from both failures and successes of previous phases, in a bid to “build forward better” and increase resilience to future pandemics at the same time. It is essential, however, to consider recovery and resilience phases simultaneously, thus avoiding recovering without considering building resilience considerations. This phase mainly entails the need to build a collective awareness of the importance to turn the potential adaptive capacity of WASH stakeholders into actual resilience to future shocks and threats. It might include e.g., innovative technologies and approaches to establish “early warning systems” to monitor and promote preventive action to avert a water crisis; simple tools for rapid assessment of the vulnerability of water utilities; green infrastructure to improve storage and supply, low carbon energy solutions and circular approaches, enhance system performance and better protect communities; and the development of multiple use water schemes to build community resilience, using WASH systems as an opportunity for improved water demand management. It also means a fundamental shift in attitudes, and behaviours, so that hand hygiene and other IPC measures become normalized and habitual.

Throughout all the phases, more focus will also need to be given to overarching aspects of the enabling environment of the response and resilience building. For instance: strengthening WASH-Health-Education inter-sectoral coordination (including revisiting the role of the international cooperation active in-country); the development or adjustments in emergency strategies and contingency plans; building capacities of stakeholders for better preparedness ensuring flexible emergency financing mechanisms for utilities, operators and users; strengthening information systems for more evidence-based decision-making, at all levels; and ensuring minimum information exchange between regulators and service providers, while simplifying regulatory procedures to integrate in service delivery non-formal providers. These areas of the enabling environment for the response are crucial for creating a stronger sector, better prepared for future shocks and working towards resilience - they will be needed to accelerate access for all people to water, sanitation, and hygiene infrastructure at the household and beyond the household.

5. Conclusions

Shortly after the COVID-19 outbreak, most countries took active measures in response to the emergency. This paper presents findings from a mapping activity of measures and initiatives that WASH stakeholders implemented worldwide to ensure WASH services for all. Despite methodological issues in collecting comprehensive or representative data, this study provides a good level of detail about the responses...
taken in each country, which can be useful to have as a snapshot of how the sector performed during the emergency response and how the situation progressed over time.

The paper first introduces a framework to guide WASH stakeholders in the identification of initiatives and interventions than can be taken to improve WASH services delivery in the COVID-19 situation. The list of recommended measures is meant to be informative rather than exhaustive, but it helps structure and map the COVID-19 responses from the WASH sector. It also provides decision-makers, practitioners, and operators with a good starting point to prepare policies, plans and strategies for implementing the WASH response.

Second, the paper provides an overview of the WASH response to the pandemic in 84 countries worldwide. Despite large regional and national disparities, there are also some commonalities. Initiatives that relate to the intensification of behaviour change and awareness-raising campaigns for the promotion of handwashing and other IPC measures are widespread and have been widely adopted. Many countries have also implemented a combination of technical and financial measures to ensure basic WASH needs for vulnerable groups and in key institutions, but they will not suffice to reach all population in need. With few exceptions, the rural areas and informal settlements received less attention. In addition, sanitation has been rarely included in the response plans, placing certain groups of society at high risk of infection. Likewise, a general lack of support to service providers is challenging the capacity of both urban and rural operators to continue delivering services. They might face serious problems, even in the short to medium-term, if technical and financial support is not scaled up soon.

As the pandemic continued to evolve, the focus has shifted to monitoring the actual level of implementation of the response, and particularly, on assessing and understanding the immediate and secondary effects of the pandemic on WASH systems and services, including socioeconomic, technical, managerial, and financial issues. An illustrative example of these monitoring efforts can be found in UNICEF’s “tracking of the situation of children in COVID-19”, which regularly collects information on a number of indicators (including WASH services) in over 120 countries (United Nations Children’s Fund, 2021). These tracking systems are aimed at gaining better understanding of the level of disruption to vital services, as well as government adaptations and responses. They for instance show the level of COVID-19 related change in coverage of WASH services and supplies nationally, whether due to change in availability, access and/or use of services.

Looking forward, as the vaccination campaigns are gradually rolling out and the immunization rate increases, the nature of the response to the pandemic needs to evolve accordingly, towards more resilient services. Hygiene promotion and IPC will need to continue at scale with a focus on public spaces and will need to be matched in ambition with the assured availability of soap, water, and handwashing facilities at scale, including in schools and health centre facilities. Support to vulnerable groups including those in rural communities, small towns, and informal settings to access WASH services needs additional focus. More political and financial support, together with innovative service delivery modalities, will be needed for accelerating equitable and affordable WASH service expansion for the most vulnerable and close the existing gaps. In addition, parallel support needs to be extended both technically and financially to service providers in order to ensure the viability of utilities and the provision of those critical services. More focus going forward will also need to be given to overarching aspects that support a resilient enabling environment in the face of a pandemic.

The critical importance of WASH services for society has been demonstrated once again. It is time to use the learnings of this crises to be better prepared for the future.

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CRediT authorship contribution statement

Ricard Giné-Garriga: Conceptualisation, methodology, literature review, mapping the response among countries, analysis of results and discussion, validation, writing—original draft, writing—review and editing; Antoine Delepiere: Conceptualisation, literature review, mapping the response among countries, analysis of results and discussion, elaboration of maps, validation, writing—review and editing; Robin Ward: Literature review, mapping the response among countries, analysis of results and discussion, validation, writing—review and editing; Jorge Álvarez-Sala: Conceptualisation, methodology, validation, writing—review and editing; Isabel Álvarez Murillo: Mapping the response...
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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