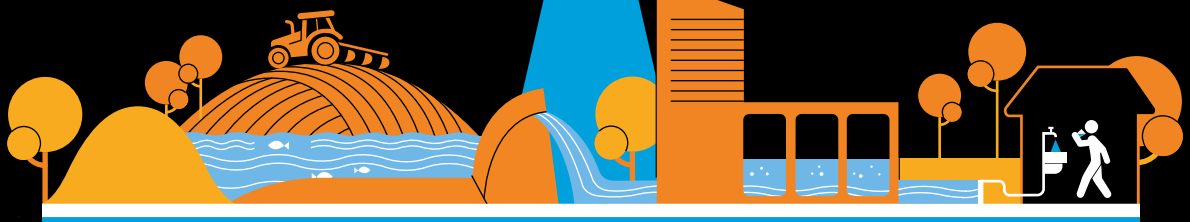

State of the World's DRINKING WATER

An urgent call to action to accelerate progress on ensuring safe drinking water for all

World Health Organization

WORLD BANK GROUP

unicef
for every child

State of the world's drinking water: an urgent call to action to accelerate progress on ensuring safe drinking water for all

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Foreword

Every day, millions of women and school-age children - almost always girls - spend hours walking long distances to fetch water, which may be of poor quality, limited quantity or unaffordable.

For hundreds of years, efforts to improve the delivery of safe drinking water have led to gains in public health and huge reductions in child mortality. In the last two decades, two billion people gained access to safe drinking water. The returns on investment for health, productivity and other factors are estimated at more than three times the cost in urban areas, and more than six times the cost in rural areas.

So why do we need another report urging action?

The first reason is that we face a crisis. Despite our understanding of the benefits of safe drinking water and the progress we have made, an estimated two billion people, one quarter of the world's population, still go without. Unsafe drinking water is a driving factor behind the more than 1.5 million people who die every year from diarrhoea, most of them infants and small children. Every one of these preventable deaths is a tragedy. Meeting the Sustainable Development Goal target of universal access to safe drinking water by 2030 will require countries and multilateral organizations to quadruple their investment - a small price to pay for the millions of lives saved.

The second reason is that the progress we have made on increasing access to drinking water is fragile. Safe water is not a one-time investment. It requires monitoring and upkeep. At the same time, external factors threaten to roll back the gains we have made. Climate change is driving water scarcity and droughts, while flooding disrupts supplies and devastates communities. Pollutants threaten both human health and entire ecosystems. Urbanization and population growth are limiting the ability of cities to deliver water to the millions of people living in informal communities and slums, while in rural areas, low quality services, waterpoint breakdown, and distant, contaminated water sources are a daily reality.

The third reason is that there is an opportunity. In 2023, for the first time in 50 years, the global community—through the United Nations—will review progress and make

firm commitments to renew action on water. We must leverage this moment to catalyse new action.

This report is the first of its kind: a comprehensive survey of the links between water, health and development, with actionable recommendations.

We hope that it will inform preparations for the 2023 review and catalyze follow-up action in the second half of the SDG period.

We call on governments and development partners to dramatically increase investment to extend access to safely managed drinking water services to all by 2030, beginning with the most vulnerable. Our organizations remain committed to supporting countries to provide safe drinking water for all.

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Acronyms and abbreviations

ESAWAS	East and Southern African Water and Sanitation Regulators Association
GLAAS	Global Analysis and Assessment of Sanitation and Drinking Water
IPCC	Intergovernmental Panel on Climate Change
JMP	Joint Monitoring Programme (for Water Supply, Sanitation and Hygiene)
LDC	least developed country
NAP	National Adaptation Plan
NDC	Nationally Determined Contribution
NGO	non-governmental organization
OECD	Organisation for Economic Co-operation and Development
ODA	official development assistance
PFAS	per- and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonic acid
PUB	Public Utilities Board (Singapore)
SDG	Sustainable Development Goal
SWA	Sanitation and Water for All
UNICEF	United Nations Children's Fund
WASH	water, sanitation and hygiene
WHO	World Health Organization

Executive Summary

The first target under Sustainable Development Goal (SDG) 6, Target 6.1, is, "By 2030, achieve universal and equitable access to safe and affordable drinking water for all". In the last two decades investment in drinking water services has led to considerable increases in access. Two billion people globally gained access to safely managed drinking water services. In 2020, 74% of the world's population used safely managed drinking water, up from 62% in 2000. Despite this progress, there are wide geographical disparities, and 2 billion people still do not use safely managed drinking water. The world is not even close to being on track to meet the SDGs by 2030. Continued progress on SDG Target 6.1, and the additional acceleration needed to achieve universal access, is threatened by the ever-increasing impacts and uncertainty of climate change, competing agricultural and ecological water needs, competing financial priorities and the challenges of existing and emerging threats to water quality.

This report presents the state of drinking water in the world today, the progress being made towards achieving SDG Target 6.1, and the challenges that remain. The SDG 6 Global Acceleration Framework calls on governments to make progress on governance, financing, capacity development, data and information and innovation. Using this framework, recommendations are presented, illustrated by examples of how countries have addressed the challenge of providing safely managed drinking water.

As a service that provides immeasurable economic and health benefits, and essential gender equality outcomes, **the need to dramatically increase political commitment to drinking water is clear**, as is the need to strengthen governance and institutions and significantly increase the financial resources available. Drinking water services must reach everyone, including the poor, vulnerable and marginalized, consistent with the promise to leave no one behind.

This report includes a comprehensive set of recommendations structured around governance, financing, capacity development, data and information and innovation. The list of potential actions is wide-ranging and some changes will take sustained action by multiple stakeholders over many years. However, there are many ways in which committed governments can make significant steps to start the process, even with limited budgets and while capacity is developing.

Overarching recommendation on GOVERNANCE

Governments should progressively strengthen existing institutions, fill institutional gaps and facilitate coordination. They should establish a stable regulatory environment supported by legislation and clear policies, including standards for service quality, and ensure enforcement.

- Governments should establish simple and transparent regulation that protects all consumers, allows and encourages continuous improvement, innovation and cost recovery, and facilitates service provision for the poor and vulnerable, consistent with the commitment to "leave no one behind".
- Regulators must be as independent as possible, have authority for and conduct enforcement, and be mandated to publish results.
- Governments should create an enabling policy environment that supports higher service levels in households, health care facilities and schools, so that safe, abundant, on-premises drinking water becomes the norm.
- Government policy should support improvement in the operational performance of service providers, and the establishment of management models that ensure sustainable, professionalized service delivery in both large and small systems.
- Drinking water quality should be regulated using risk-based approaches, for instance, through water safety plans undertaken by service providers and supported by surveillance.
- Governments should consider the impact of climate change and take action to increase the resilience of water infrastructure and services, and mitigate their climate impact.
- Governments should promote coordination between mandate-holders in the water sector, and encourage collaboration across drinking water service provision and water resources management, between rural and urban authorities, and across ministries.
- Governments should review policies, regulatory arrangements, strategies and implementation models to ensure they are inclusive and gender sensitive.

Overarching recommendation on FINANCING

To achieve the quadrupling of progress needed, funding and financing from the public sector, private sector and donors must increase dramatically, water service providers must improve efficiency and performance to ensure funds are used optimally, and governments should provide a stable and transparent administrative, regulatory and policy environment that encourages investment.

- Governments should develop clear policy objectives to guide funding and financing decisions, fully understand all the costs of drinking water service provision,

and make informed, evidence-based decisions on the allocation of funds and the setting of tariffs and user charges.

- Governments should invest in drinking water services, using allocations from the public sector budget catalytically and strategically, creating incentives for efficient, sustainable service provision and prioritizing reaching the unserved.
- Governments should encourage and support improvements in water service providers' financial performance.
- Governments should ensure they achieve an appropriate balance between investing in new infrastructure and supporting the maintenance of existing infrastructure.
- Governments should budget for the costs associated with a supportive regulatory environment.
- Governments should seek to establish a conducive environment for the use of commercial repayable finance, both domestic and international, bearing in mind the complexities and the time and expertise involved. Governments should also develop the expertise and understanding to comply with the requirements of climate finance and access it.
- Governments should work with agencies and institutions that support and provide microfinance to households for water supply investments.

Overarching recommendation on CAPACITY DEVELOPMENT

Governments should build robust and competent institutions and a capable and motivated workforce through a range of capacity-development approaches based on innovation, partnership and collaboration.

- Capacity should be built in technical areas specific to water supply services and also to create a conducive enabling environment for sustainable water supply services, including competence in long-term planning and budgeting, improved cost recovery, revenue generation and financial sustainability.
- The growth of professionalized service delivery must be supported by capacity development, particularly in small and rural systems.
- Governments should seek to build their own capacity, and that of partners in the sector, by establishing fully institutionalized training programmes.
- Governments should strengthen their capacity to integrate climate resilience and mitigation into planning, designing and delivering drinking water services, including protection of source water. Capacity should be built among regulatory agencies, service providers and users to ensure they have the knowledge and instruments to address climate change impacts.
- Governments should foster inclusion in the sector, and seek to achieve gender, ethnic and cultural balance among the staff of sector institutions.

Overarching recommendation on DATA AND INFORMATION

Governments should ensure they have relevant data and information to be better informed, understand gaps and inequalities in drinking water services, and make evidence-based decisions.

- Governments should support the institutionalization of data collection and monitoring within national systems and at all levels (community, utilities, subnational and national), the use of consistent methodologies, including standardized terms and questions, and the use of the data collected.
- Governments should identify gaps in data collection and analysis, and prioritize those areas in which missing data are a constraint, with particular emphasis on the identification of communities and individuals at risk of being left behind in service provision.
- Governments and other stakeholders should encourage and fund research in the water sector, work with academic institutions, and disseminate results to inform decision-making.
- Disseminating data on service provider performance should be prioritized by governments to drive improvements and promote accountability to users.

Overarching recommendation on INNOVATION

Governments should encourage innovation and experimentation through supportive government policy and regulation, accompanied by rigorous monitoring and evaluation.

- Governments should create a policy vision and foster the political leadership required to identify innovative approaches and bring them to scale.
- Governments should create a flexible regulatory environment to encourage innovation, and regulations should be regularly updated to reflect changes in the evidence base and the availability of better technologies.
- Innovation should be encouraged in methodologies and approaches, as well as in technologies.

As highlighted in this report, there are key opportunities in the years up to 2030 to strengthen government leadership, show political will, deepen partnerships and make strategic and catalytic public investments in drinking water. Governments have many opportunities to advance progress on the provision of reliable, safe and sustainable drinking water services, and working across all the SDG 6 accelerators will result in sustainable results and greater impact. Member States, the United Nations system, and other sector stakeholders must rise to the challenge, learn from one another and work together to achieve universal and equitable access to safe and affordable drinking water for all by 2030.

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Why is this report necessary?

1 of 1

Defining the challenge

The first target under Sustainable Development Goal (SDG) 6, Target 6.1, is, "By 2030, achieve universal and equitable access to safe and affordable drinking water for all". In the last two decades, investment in drinking water services has led to considerable increases in access. Two billion people globally gained access to safely managed drinking water services. In 2020, 74% of the world's population (5.8 billion people) used safely managed drinking water, up from 62% (3.8 billion) in 2000.[1]

Despite the progress, there are wide geographical disparities, and 2 billion people still did not use safely managed drinking water in 2020. The world is not even close to being on track to meet the 2030 SDG goals. For example, at current rates, just 37% of the population of sub-Saharan Africa will be using safely managed drinking water by 2030.[2] **Continued progress on SDG Target 6.1 and the additional acceleration needed to achieve universal access is threatened** by the ever-increasing impacts and uncertainty of climate change, competing agricultural and ecological water needs, competing financial priorities and the challenges of existing and emerging threats to water quality.

There are many countries that, through strong political leadership, well-targeted resources and a 'whole-of-government', multi-stakeholder approach, have successfully addressed these issues and have made rapid progress in the provision of safely managed drinking water, while also building the local economy and responding to emerging threats, such as climate change. This report presents the state of drinking water in the world today, progress made towards achieving SDG Target 6.1, and the challenges that remain.

The United Nations, coordinated by UN-Water, has developed the SDG 6 Global Acceleration Framework, which identifies five accelerators to support the achievement of SDG 6: governance, financing, capacity development, data and innovation.[3] Using this framework, **this report presents ways to address challenges, and identifies emerging best practices and successes.** It calls on Member States, the United Nations system, and other stakeholders to rise to the challenge, learn from one another and work together to achieve universal and equitable access to safe and affordable drinking water for all by 2030.

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1.2

Things you need to know before reading this report

Two monitoring platforms have been mandated to monitor progress towards the achievement of the drinking water target of SDG 6.

The **WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply, Sanitation and Hygiene** produces internationally comparable estimates of progress on drinking water, sanitation and hygiene, using globally agreed-upon definitions and methods. Since the establishment of the SDGs, the JMP has published global baseline reports on water, sanitation and hygiene (WASH) in households, schools and health care facilities, which are updated with progress reports every two years.[4] The data compiled by the JMP not only reveal progress, but shine a light on persistent inequalities.

The **UN-Water Global Analysis and Assessment of Sanitation and Drinking Water (GLAAS)** is implemented by the World Health Organization (WHO) on behalf of UN-Water. It monitors components of WASH systems, including governance, monitoring, finance and human resources necessary to sustain and extend WASH services to all, especially the most vulnerable population groups. WHO, through GLAAS, also monitors the 'Means of Implementation' targets for SDG 6 (Means of Implementation are defined as the interdependent mix of financial resources, technology development and transfer, capacity-building, inclusive and equitable globalization and trade, regional integration, as well as the creation of a national enabling environment required to implement the sustainable development agenda). GLAAS monitors elements of national WASH systems, including policies and plans, national targets, budgets and expenditures. Additionally, GLAAS supports countries to monitor WASH expenditures in greater detail by developing WASH accounts using the TrackFin methodology. GLAAS data are available on the GLAAS data portal.[5]

This report has also drawn on other sources of data. For instance, the East and Southern African Water and Sanitation Regulators Association (ESAWAS) initiated a landscape assessment of regulatory and monitoring frameworks for water supply and sanitation services across the African region.[6] The assessment, published in 2022, is a source of data from 54 African countries, and outlines gaps and good practices.

The SDG 'service ladders' for water in households, schools and health care facilities are shown in Table 1. The service ladders are used by the JMP to benchmark and compare service levels across countries. The ladders used for SDG monitoring build on the established 'improved/unimproved' facility type classification (used for the Millennium Development Goals between 1990 and 2015), thereby providing continuity with past monitoring and introducing additional rungs and criteria relating to service levels.

Improved drinking water sources are those that, by nature of their design and construction, have the potential to deliver safe water. The JMP subdivides households using improved sources into three groups according to the level of service provided. To meet the criteria for a safely managed drinking water service, households must use an improved source that is, "accessible on premises, available when needed, and free from contamination", corresponding to requirements articulated in the United Nations recognition of the human right to water (see Table 1). If the improved source does not meet all these criteria, but a round trip to collect water takes 30 minutes or less, then it is classified as a basic drinking water service. If water collection from an improved source exceeds 30 minutes, it is categorized as a limited service. The JMP also differentiates populations using unimproved sources, such as unprotected wells or springs, and populations drinking surface water collected directly from a river, dam, lake, stream or irrigation canal.

TABLE 1 JMP drinking water service ladders for households, schools and health care facilities

HOUSEHOLDS	SCHOOLS	HEALTH CARE FACILITIES
Safely managed: Drinking water from an improved source that is accessible on premises, available when needed and free from faecal and priority chemical contamination.		
Basic service: Drinking water from an improved source, provided collection time is not more than 30 minutes for a round trip, including queuing.	**Basic service:** Drinking water from an improved source and water is available at the school at the time of the survey.	**Basic service:** Water is available from an improved source on premises.
Limited service: Drinking water from an improved source, for which collection time exceeds 30 minutes for a round trip, including queuing.	**Limited service:** Drinking water from an improved source, but water is unavailable at the school at the time of the survey.	**Limited service:** An improved water source is within 500 metres of the premises, but not all requirements for basic service are met.
Unimproved: Drinking water from an unprotected dug well or unprotected spring.	**No service:** Drinking water from an unimproved source or no water source at the school.	**No service:** Water is taken from unprotected dug wells or springs, or surface water sources; or an improved source that is more than 500 metres from the premises, or there is no water source.
Surface water: Drinking water directly from a river, dam, lake, pond, stream, canal or irrigation canal.		

Similar definitions are used for water services in schools and health care facilities. It should be noted that there are fewer ladder rungs for schools and health care facilities than for households. These ladders have been developed more recently, and the approach to monitoring progress in these institutions is still being developed. Additional rungs may be added in the future.

It should be noted that the global SDG indicators are, of necessity, simplifications, and do not capture all aspects of safe water services that can and should be monitored at national and subnational levels. For example, although the SDG definition does not specify that a minimum quantity of water must be available, the definition of the safely managed drinking water services indicator requires water to be "available when needed". For global reporting, households are considered to have water available when needed if they report having "sufficient water" or that water is available "most of the time" (that is, at least 12 hours per day or four days per week). However, although this metric is used for global monitoring, it does not imply that this level of continuity is sufficient to realize public health gains, or that it represents a normative target. WHO's *Guidelines for drinking-water quality*[7] provide global authoritative normative guidance on drinking water and health. This includes taking a proactive risk management approach to water safety, which is not captured in the existing global SDG indicators.

Governments are expected to localize the global SDG targets related to drinking water, and set their own national targets for progressively improving services and reducing inequalities, taking into account different national realities, capacities and levels of development, and respecting national policies and priorities. Ideally, national target setting should progressively incorporate the elements of safely managed drinking water services, and additional indicators, such as whether proactive risk assessment and risk management approaches, such as water safety plans, have been implemented as recommended in WHO's *Guidelines for drinking-water quality*.

BOX 1 Definitions

Drinking water: The main source used by households for drinking, cooking, personal hygiene and other domestic uses.

Climate change adaptation: In human systems, the process of adjustment to actual or expected climate change and its effects to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate change and its effects; human intervention may facilitate adjustment to expected change climate and its effects.[8]

Climate change resilience: The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation.[9]

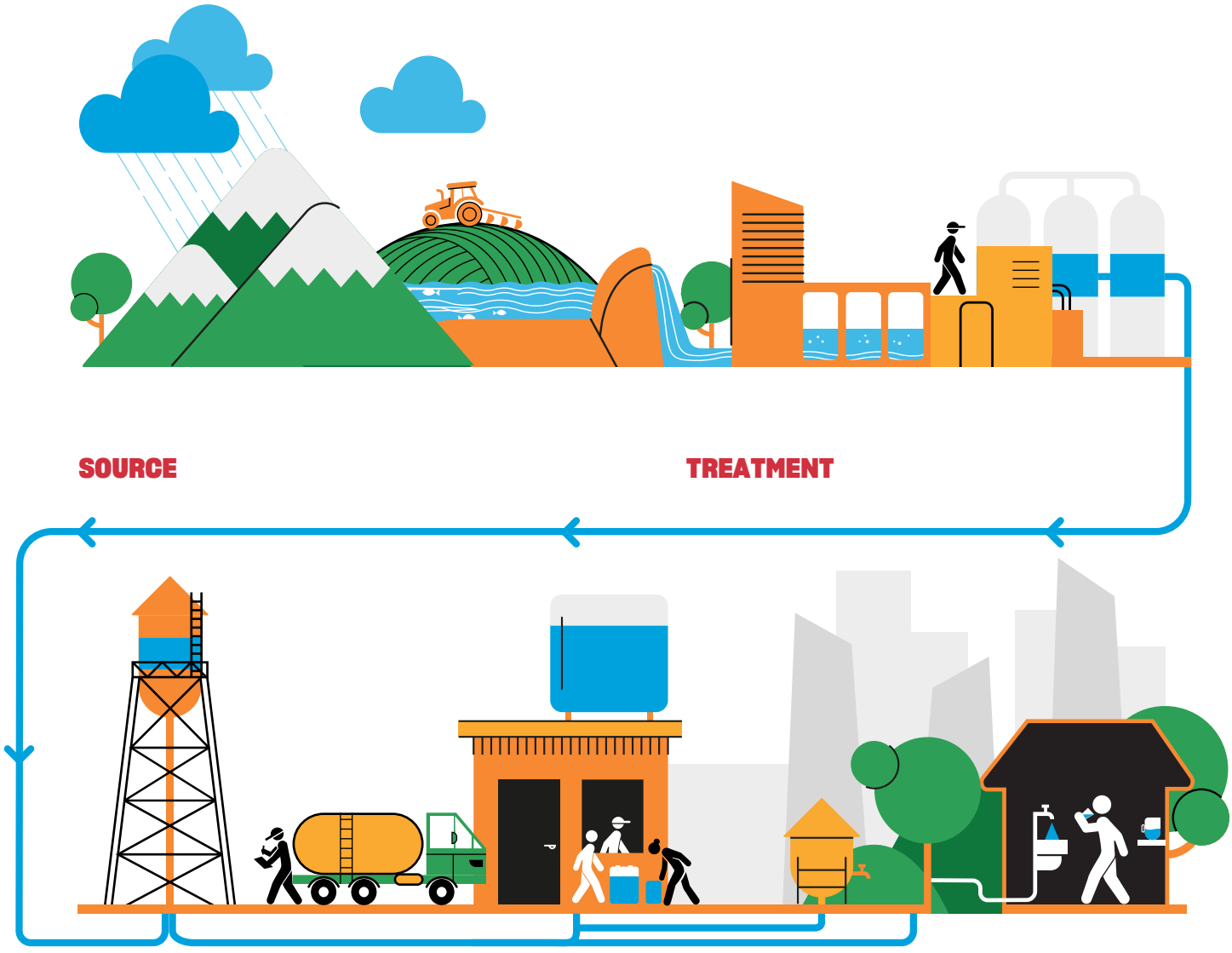
Climate change mitigation: Achieved by limiting or preventing greenhouse gas emissions and by activities that remove these gases from the atmosphere.[10]

Nature-based solutions: Approaches that use nature and natural processes to deliver infrastructure, services and integrative solutions to meet the rising challenge of urban resilience. These interventions usually go beyond sectoral boundaries and require cross-sectoral partnerships. Nature-based solutions can provide multiple benefits to cities and address different societal challenges, including reducing disaster risk and building climate resilience, while also contributing to restoring biodiversity, creating opportunities for recreation, improving human health, water and food security, and supporting community well-being and livelihoods. Examples include forests, wetlands, mangroves, terracing, green corridors and bio-retention areas.[11]

BOX 2 Water safety plans

A water safety plan is a comprehensive risk assessment and risk management approach that encompasses all steps in water supply, from catchment to consumer, with the aim of consistently ensuring the safety and acceptability of a drinking water supply.[12] Water safety plans should be carried out by water service providers. The process addresses all risks to the safety and adequacy of drinking water services, including those presented by climate variability and change. Water safety plans can also ensure equitable outcomes through inclusive participation in the process and explicit consideration of risks faced by diverse water user groups. To facilitate the systematic integration of considerations related to climate and equity into the water safety planning process, WHO has developed the guidance documents, *Climate Resilient Water Safety Plans*,[13] and, *A Guide to Equitable Water Safety Planning*.[14]

Water safety planning manages risks throughout the entire water supply chain



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Why invest in safely managed drinking water?

2.1

Safely managed drinking water protects health

The provision of safe, accessible water, available when needed in homes, schools and health care facilities in sufficient quantities, whether used for drinking or other domestic uses, directly promotes human health in myriad ways.

Diarrhoeal diseases, which are largely attributable to unsafe drinking water, together with poor sanitation, cause a significant disease burden. For example, diarrhoeal diseases, killed an estimated 1.5 million people in 2019.[15] These can range from mild, self-limiting illness, to severe diseases, such as **typhoid fever** and **cholera**, which is endemic in 69 countries, resulting in an estimated 2.9 million cases per year, killing in hours if untreated.[16] Diarrhoea can leave the body without the water and salts necessary for survival. The diarrhoeal disease burden is disproportionately felt by children; diarrhoea is the fourth-leading cause of death among children under 5 years of age globally.[17] Each episode of diarrhoea can contribute to reducing the nutrient and protein uptake of children, worsening underlying malnutrition. Repeated bouts of diarrhoea can contribute to a reduction in the nutrient and protein uptake of children, worsening underlying malnutrition and resulting in low height-for-age, or stunting.[18,19] **Stunting** affected nearly one quarter of children under 5 years of age globally in 2020, and has impacts on cognitive as well as physical development.[20]

Diarrhoea is caused by a multitude of disease-causing organisms that can be transmitted through drinking water, with vaccines having been developed for only a few. Effective treatment of drinking water, however, can kill or inactivate the more than 20 waterborne pathogens, including bacteria such as pathogenic *E. coli, Shigella, Campylobacter*, viruses, including those that cause hepatitis A and E, norovirus and rotavirus, and parasites like *Giardia* and *Cryptosporidium*. Several of these pathogens have become resistant to antibiotics and have been placed on the WHO global priority pathogen list. Safe water is, therefore, the first line of defence against certain illnesses that are fast becoming untreatable. Safe water also reduces the need to treat infectious diseases with antibiotics, extending the lifespan of last-line-of-defence antimicrobials.

A study published in 2022 found that drinking water interventions significantly reduced the risk of childhood diarrhoea. Compared with an unimproved source, the provision of water supply on premises with higher water quality reduced diarrhoea by 52%.[21] Water treated at the point-of-use through filtration, solar treatment or chlorination, reduced diarrhoea by up to 50% compared with untreated water from an unimproved source.

Safe water in sufficient quantities is vital for managing morbidity associated with **neglected tropical diseases** such as trachoma, schistosomiasis and soil-transmitted infections. These diseases require safe water to reduce or interrupt transmission and prevent infection rebounding. Provision of safe drinking water is a key component of the campaign to eradicate Guinea-worm disease, which is caused by a waterborne parasite. Safe and sufficient water for facial cleaning is part of the strategy to eliminate trachoma, which is spread by flies that have come into contact with the eyes or nose of an infected person and is the cause of blindness or visual impairment in 1.9 million people globally.[22,23] Safe water is also needed to prevent diseases that can arise from inhaling contaminated water droplets, or aerosols, associated with air conditioning systems, spas and devices or systems that produce mists or sprays. These include outbreaks caused by the bacteria **Legionella**, which can be the most significant waterborne pathogen in high-income countries.[24,25] Safe and sufficient drinking water is also key to maintaining the health of people who are vulnerable to opportunistic infections (e.g., people living with HIV/AIDS).[26,27]

Chemical contamination of drinking water is also a cause of disease, and WHO lists guideline values or 'safe maximum concentrations' for more than 100 chemicals. Those with public health significance that people are exposed to through drinking water include arsenic and fluoride (naturally present in groundwater in many places), lead (from household plumbing materials and handpumps) and nitrate (from sewage contamination or agricultural runoff).[28]

In contrast to the acute and immediate nature of waterborne microbial disease, most chemical contaminants only have an effect after a long period of exposure. For instance, long-term exposure to high levels of arsenic in drinking water, and food irrigated with contaminated water, can cause skin lesions and cancer, and has also been associated with cardiovascular disease and diabetes.[29] In utero and early childhood exposure to arsenic has been linked to impaired cognitive development and increased deaths in young adults. It is estimated that between 94 million and 220 million people are potentially exposed to drinking water containing elevated concentrations of arsenic.[30]

Drinking water contaminants of emerging concern include pharmaceuticals, pesticides, per- and polyfluoroalkyl sub-

stances (PFAS) and microplastics. Key concerns include endocrine-disrupting compounds, such as steroid oestrogens from human contraceptive pills and antibiotics that may contribute to bacterial antimicrobial resistance. Many pesticides also have endocrine-disrupting effects, with potential health consequences that are poorly understood and characterized.[31] The science is still not clear on the concentrations at which these contaminants pose a risk to human health.

Other chemical contaminants may not be of health concern at levels normally in drinking water, but may cause taste and colour issues, which may lead users to reject improved water sources and use more aesthetically acceptable but unsafe water sources, including surface water. One example is iron, which is often present in drinking water as a result of the corrosion of steel and cast-iron pipes.

Public health gains are achieved not only from better quality water, but from using greater quantities of water. For instance, when water is reliably available on premises, especially running water, there are sufficient water quantities for **personal hygiene**, including handwashing, face-washing, menstrual hygiene management, bathing and laundry. When water becomes available within the home as running water through multiple taps, this level of service is sufficient to cover all needs associated with drinking, cooking, personal hygiene and food hygiene, and to ensure there is adequate water quantities for enhanced personal hygiene practices during disease outbreaks.[32]

Water available within or closer to home also reduces the **burden of water collection** and the risk of damage to the skeleton and muscular system from carrying water. Numerous studies have documented this damage.[33,34] For instance, a large-scale study in 2018[35] found that people who carried water, particularly those who carried water by head-loading, had an increased relative risk of reporting pain in the head, chest or ribs, upper back and hands. Other research shows that, in Africa in particular, regular head-loading has been linked to a condition known as cervical spondylosis and very heavy cervical loading to severe trauma and death. People with cervical spondylosis have been shown to be at higher risk of serious spinal cord injury. These injuries are more likely to be suffered by women and girls due to their disproportionate role in water carriage[36] (see Section 2.4 for more details on the impact of water on the lives of girls and women).

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2.2

Smart investment in safe drinking water mitigates and builds resilience to climate change

Climate change presents increasing risks to water sources, such as changing rainfall patterns, rising sea levels, increased water temperatures, extreme droughts, floods, wildfires and violent storms. These impacts threaten to undermine the investments made in the provision of safe drinking water since 1990 and the progress made towards the achievement of SDG 6.[37,38,39]

BOX 3 Key impacts of climate change on drinking water

Droughts mean less, more contaminated water, is available. Drought can lead to an increased concentration of pollutants in drinking water. Reduced water availability creates enormous stresses on communities, especially the most vulnerable. Less water means children and women often must walk further distances to collect water, reducing time for schooling and other productive activities. A lack of access to adequate water can lead to migration and conflict; it is estimated that water deficits are linked to 10% of the rise in global migration.[40]

Floods damage infrastructure and can lead to water contamination. Floods can destroy or damage infrastructure, such as water distribution points and toilets. When latrines and toilets are flooded, they can contaminate water sources, making drinking water potentially deadly. Floods and increased precipitation can also increase sediment and pathogens in surface water, overwhelming treatment capabilities.[41]

Increased ice melt is causing water sources to become unsustainable for many millions. According to the Intergovernmental Panel on Climate Change (IPCC), ice and snow cover are decreasing significantly in most regions. Melting snow, glaciers and sea ice pose a huge threat to water sources. As ice melts faster than it is created, it not only contributes to rising sea levels, but also depletes stored freshwater sources that currently serve millions of people. This depletion results not only in less water available, but also in declines in water quality.[42,43]

Sea-level rise leads to freshwater salinization in coastal areas. Rising sea levels can lead to saltwater infiltrating freshwater sources, rendering the water undrinkable. Rising sea levels are already having a major impact, particularly in low-lying coastal areas and Small Island Developing States. These regions depend on groundwater sources that are highly vulnerable to the impacts of salinization.[44]

Infrastructure and service disruptions cause huge economic costs. The impacts of climate change on water services result in massive economic costs every year for many countries. Extreme weather events often disrupt water and sanitation services to the point that they can often no longer function safely, with repairs and the restoration of services costing billions of dollars annually.

Climate-smart, targeted investments can help build resilience to these impacts and help contribute to climate change mitigation.

Climate change adaptation and resilience

There is an increasing focus among governments, banks and donors to ensure that the substantial investments made in providing safely managed drinking water are safeguarded against climate risks by building climate adaptation and resilience. For the provision of safely managed drinking water, adaption and resilience-building require a focus on ensuring that water infrastructure and services are sustainable, safe and resilient to climate-related risks, and ensuring that water systems contribute to helping build community resilience to the impacts of climate change.[45]

To achieve climate resilience, a range of aspects must be considered, including:

- Historical trends of weather variability and extreme events, such as floods and droughts, and their relationship with water quality and source reliability; and,
- Projected climatic conditions and water resource demands, such as catchment development, land use and population growth.

UNICEF and other agencies have established criteria for determining whether the design of drinking water systems

meets the requirements for climate resilience, which include:

- Risk-based assessments of the capacity to provide a safe and adequate drinking water supply under the most likely future scenarios, including ensuring that water sources are reliable at all times, both during the year and during extreme weather events;

- Inclusion of appropriate remedial measures to mitigate priority risks (such as the provision of alternative water sources, elevated infrastructure in flood-prone areas, additional storage capacity, and water conservation measures); and

- Establishment of management and service delivery models that are sufficiently robust to cope with crises and ensure longer-term sustainability of the infrastructure.[46,47]

In the medium- and longer-term, drinking water services that are adapted and resilient to climate change cost less for both governments and users.[48] A recent World Bank study found that the additional cost of investing in more climate-resilient infrastructure, which is small compared with the cost of the assets, is also cost-effective over the long term. The additional cost of protecting new exposed water and sanitation assets, which would reduce the risk of damage to new infrastructure by 50%, would be between US$ 0.9 billion and US$ 2.3 billion a year. While this would be a significant expenditure, it represents only around 1% of the global baseline infrastructure investment required to achieve the SDGs between 2020 and 2030. The study also found that the cost of resilience can be reduced by making infrastructure standards and codes location-specific so that additional resilience investments are targeted to areas where exposure to natural disasters is high.[49]

Other studies have come to similar conclusions. A life-cycle analysis of rural water supply technologies in Ethiopia concluded that a climate-resilient water system was 35 times less expensive over 10 years, compared to a non-resilient technology, which forced users to switch to expensive water-trucking for an average of 60 months during that 10-year period, when water sources dried up.[50]

A major benefit of investing in climate resilience, whether infrastructure or systems, is that they are often 'no regrets' investments that represent improvements in the level of service, quality of construction, operation and maintenance and have considerable financial and coverage benefits notwithstanding climate change challenges.[51,52]

Building climate resilience into broader risk management approaches such as water safety plans appears to offer one of the most cost-effective approaches to managing climate risks.[53] Informed planning regarding the choice of water sources and technology type are critical in building climate change resilience of drinking water services. Resilience also relies on an ability to monitor the changing nature of hazards and risks and adjust management of water services, taking into account new threats (referred to as "adaptive management"). This is consistent with a water safety planning approach of continuous review and

improvement, including regular hazard assessment and review of the effectiveness of control measures.

Climate change mitigation

Considerable reduction in greenhouse gas emissions can be achieved through utilizing renewable energy and improving efficiency in water treatment and pumping, including reducing waste through leaks. It is estimated that globally almost 350 million cubic metres of water are lost through distribution networks each day, resulting in considerable avoidable emissions from the additional treatment and pumping of wasted water.[54]

Improvements to the production, treatment, distribution and collection of potable water can make important contributions to achieving the mitigation targets set by countries, known as their Nationally Determined Contributions. The water sector is currently estimated to contribute up to 5% of global greenhouse gas emissions.[55] With demand for water expected to increase by as much as 30% over current levels by 2050, opportunities must not be missed to reduce the sector's impact on the climate.[56]

There are multiple ways that smart investment in the drinking water sector can contribute to climate change mitigation while also reducing costs and building resilience.[57] These include eliminating water leaks in piped systems, reducing water waste with water-saving technologies (such as water meters and water-efficient taps and appliances), promoting the use of greywater for things such as toilet flushing to reduce the use of treated and pumped water, and improving the energy efficiency of water conveyance and treatment processes, including using renewable energy sources, such as solar power. Nature-based solutions, such as wetlands, can improve water quality and reduce the need for energy-intensive water treatment.[58]

BOX 4 Working with nature protects water availability and quality for the city of Beijing

The Miyun Reservoir is the largest reservoir in North China and serves as the primary water source for Beijing, providing up to 80% of the city's drinking water. With increased development and urbanization, much of the original forest in the watershed disappeared due to logging, undermining water conservation, and agricultural and other activities compromised water quality. By the early 2000s, Beijing was facing a progressively worsening water crisis. The water available per person was one eighth of the national average and less than one thirtieth of the global average. Water shortages were becoming frequent, and the city's future water security was threatened. The government instituted a strict resource management regime in the Miyun watershed, including a logging ban. However, the forest was not actively managed, and the system undermined biodiversity, livelihoods and watershed protection. It needed to be replaced with a forest development and management strategy that would better protect the watershed, maintain and improve forest health and ensure livelihood security for the surrounding population.

The Miyun District government initiated several improvements to the management of the reservoir. A water conservation system was established between district, town and village levels so they could work together on conservation and catchment protection initiatives. Coordination was improved, as was enforcement of water-related laws. The district implemented major water source protection projects to improve the environment in the reservoir area and protect water quality, including restricting mining, agriculture, aquaculture and livestock breeding, planting 850,000 hectares of forest (resulting in a forest coverage rate of 90%), removing sewage outfalls, and fencing the entire watershed. Local communities were directly involved in forest planning and management, which empowered and benefited them. As a result, biodiversity has increased, the water quality in the reservoir consistently meets relevant national water quality standards, and, in 2021, the storage capacity of the reservoir reached its highest-ever level.[59,60]

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2.3

Safely managed drinking water has positive economic impacts

The economic benefits of safely managed drinking water are realized in both the short- and long-term. For instance, when water comes from more accessible sources, people spend less time and effort physically collecting it, meaning they can be productive in other ways. Time saved in collecting, storing and treating water benefits women and girls disproportionately, given that the burden of water collection falls heavily on them.[61] Economic benefits also include reduced health care costs for individuals and society, gains from averted premature mortality, and greater productivity and involvement in the workplace.[62] The water sector also positively impacts employment in making possible a variety of income generation activities, in supporting other productive sectors, and as an employer itself.

For children, access to safely managed water services can result in better health and, therefore, fewer interruptions in school attendance, with positive long-term economic consequences.

A study in 2018 estimated benefit-cost ratios of 3.4 in urban areas and 6.8 in rural areas for achieving access to basic levels of water (defined as a protected community borehole/tubewell or a protected dug well).[63] The estimated benefit-cost ratios varied by region, with a high of 15.9 for rural water supply in Eastern Asia, and a low of 2.2 for urban water in South Asia.

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2.4

Safely managed drinking water is good for society as a whole

Water is a basic human need, required for drinking, supporting sanitation and hygiene, and sustaining life and health. Water is a human right, recognized by the UN General Assembly,[64] which also acknowledged that clean drinking water is essential to the realization of all human rights.

Access to water not only improves educational opportunities and workforce productivity, but also contributes to dignity and equality. Water supply contributes to an upward spiral of prosperity and well-being and is essential to a route out of poverty for individuals and communities. Increasing the proportion of people with access to drinking water will require, and result in, corresponding increases in empowerment, participation and social mobilization.[65]

Elimination of inequalities

Universal access to water will help reduce inequalities between rich and poor, marginalized groups and the rest of the population, and rural and urban dwellers. Historically, there have been significant differences in water access rates in rural and urban areas. The JMP reports that in 2020, global coverage of safely managed drinking water services was 26 percentage points lower in rural areas than in urban, and eight out of ten people who lacked even basic water services lived in rural areas.[66] Achieving universal safely managed water will help bridge the rural-urban divide, and allow rural dwellers to benefit from the same convenience, time savings and health benefits as urban dwellers.

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National, regional and global averages often mask significant inequalities in service levels between and within countries. While three out of four people worldwide used safely managed drinking water services in 2020, regional coverage ranged from 96% in Europe and North America to just 30% in sub-Saharan Africa. Inequalities were even more pronounced among the 21 countries in sub-Saharan Africa, with national estimates for coverage of safely managed services ranging from 94% in Réunion to just 6% in Chad. There are significant inequalities between rural and urban areas within countries, and between subnational regions (see Section 3.2).

Other types of inequalities also affect access to drinking water. For example, a 2015 report analysing data from six countries in Latin America and the Caribbean shows a 19% gap in access to piped water between Indigenous and non-Indigenous people.[67] Indigenous people also tend to live in areas more affected by climate change.[68] Physical barriers to accessing drinking water are often present for those living with disabilities, estimated to be 15% of the global population.[69]

A focus on universal access to higher levels of water supply service is imperative to eliminate these inequalities. Universal access to at least basic services remains the first priority. This step makes significant public health gains possible and is key to progressing towards safely managed services. Nevertheless, service levels beyond the basic level, providing continuous, reliable, accessible, safe water, are vital to ensure time savings and full public health gains are realized for all.

Positive impact on the lives of women and girls

Safely managed water entails water available on premises, which contributes significantly to gender equality. When water must be collected from a source distant from the home, and carried home, the burden falls disproportionately on women and girls, exposing them to fatigue, injury and risks to their personal safety, including sexual assault. In the case of girls, it affects school attendance and completion. Globally, it is estimated that women and girls are responsible for water collection in eight out of ten households without water on premises.[70]

An assessment of gender implications of water carriage in Nigeria, based on a survey carried out in the dry season between November 2013 and February 2014, found that almost all of the 800 girls studied reported experiencing neck and back pain from carrying water.[71] In addition, collecting water from shared water points has other negative impacts: 90% of girls interviewed in the Nigeria study said they had experienced some form of violence or injury while carrying water; one fifth of them reporting injuries from physical fights at water points.

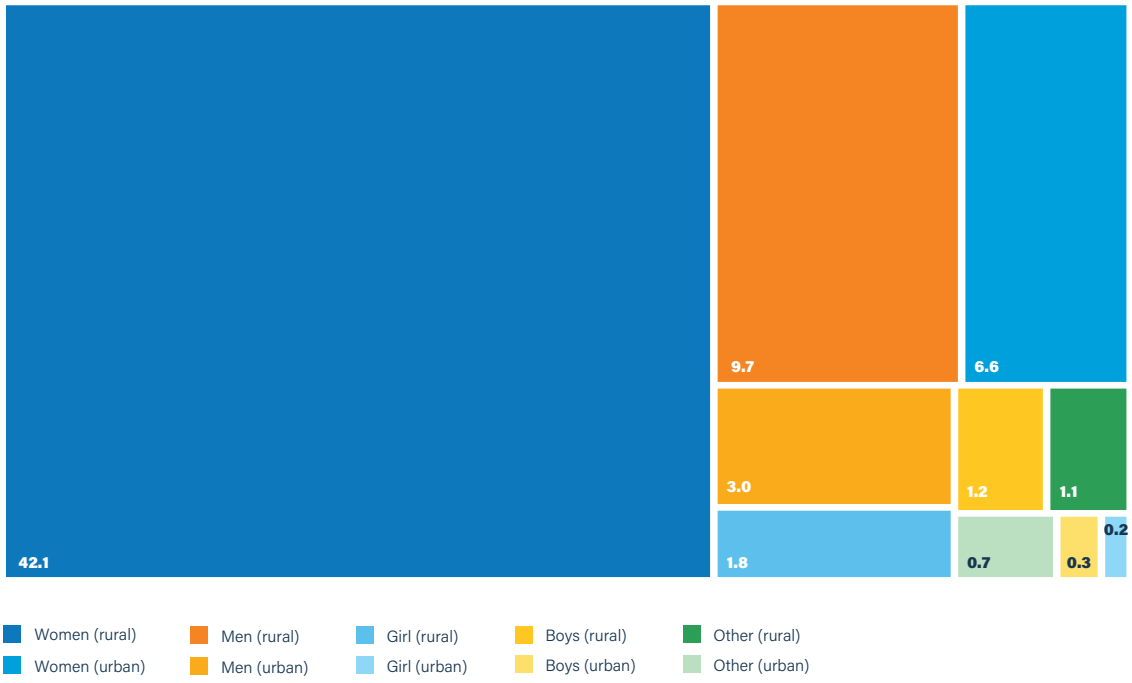
Safely managed water services also empower women and girls in other ways, allowing them to manage their menstrual cycles hygienically and with dignity, enabling them to attend school and take time for learning and literacy, and providing them with opportunities for small business activities that require water, such as market gardening.

BOX 5 Water carriage and gender in India

In 2018, a national survey in India found that about 40% of rural and 20% of urban households collected water from off-premises sources. Nearly three quarters of this work is done by women. In households with off-premises water, most households reported making two to four water collection trips per day in rural areas, and one to three trips per day in urban areas. In one quarter of rural households with off-premises water sources, women and girls spent more than 50 minutes per day collecting water. By comparison, this figure was four minutes per day for men.

In the 64 million households in which women collected water from off-premises sources, nearly 50 million person-hours were spent by women on water collection each day, with almost 90% of this burden falling on rural women.

Burden of off-premises water collection in India (millions of hours per day)



Source: Drinking water, sanitation, hygiene and household conditions in India: National sample survey (76th round). Delhi: Government of India, Ministry of Statistics & Programme Implementation and National Statistical Office; 2018.

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Contribution to peace and nation-building

Water is a strategic resource that, when not managed properly, can be a source of conflict and, in extreme cases, even threaten national and regional security. Conflict can occur if the availability and distribution of water, as a shared resource, does not meet the needs and expectations of users. If water is provided inequitably, this can lead to tensions between users, governing authorities and communities. Water scarcity, increasingly exacerbated by climate change, can be a driver and a result of conflict as communities and entire populations compete for shrinking water resources.[72] Incidents of water-related violence have more than doubled in the past 10 years,[73] and water scarcity is predicted to remain a primary cause of displacement in the future.[74] Water deficits are linked to the rise in global migration.[75]

However, while water can be a source of conflict, it can also be a positive driver of social cohesion and contribute to peacebuilding.[76] Countries that are actively engaged in water cooperation generally do not engage in conflict.[77] Investment in safely managed, climate-resilient drinking water services can reduce the likelihood of water-related conflict and reduce the pressure on services resulting from migration to urban areas. There are encouraging examples where cooperation between communities is reducing inter-community violence, and building trust and social cohesion to address other issues beyond water supply. As shown in the example from Lebanon in Box 6, the need for safely managed drinking water, while potentially a trigger for conflict, can also be an opportunity to bring people together.

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BOX 6 Water sector interventions contribute to urban peacebuilding in Tripoli, Lebanon

In 2014, Tripoli's government water services provider began the massive task of rehabilitating WASH infrastructure and services destroyed by conflict and prolonged neglect. A newly rehabilitated water network in the predominantly Sunni neighbourhood of Quobbe was to be connected to the Jabal Mohsen neighbourhood, which is predominantly Alawite. Unfortunately, the Quobbe residents – motivated by simmering tensions and a history of conflict between the Sunni and Alawite Muslim factions – filled in the trenches dug by the contractor and drove out the government water service provider.

Local groups and non-governmental organizations (NGOs) brought the communities together to address gaps in water service, encourage behaviour change and build social cohesion. This included a fair organized by youth from the Alawite and Sunni communities to raise awareness of the poor WASH conditions and their impact on community health and well-being. They also organized a theatrical performance to communicate key WASH messages and address the everyday experiences of Tripoli residents. UNICEF worked with community leaders and government service providers to discuss water and sanitation infrastructure and improving services for all. Youth from the Alawite and Sunni communities were provided with skills training and employment opportunities, and many went on to assist with the water infrastructure improvements.

The changes not only brought social cohesion and trust, but also made the water services more financially sustainable, with residents of these communities paying affordable fees for safe water supply for the first time in decades.[78]

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What is the status of progress in drinking water?

This chapter highlights the current state of drinking water supply in terms of coverage and service levels, including water quality.

The focus is on services to households, schools and health care facilities. Although representative data are scarce for other settings, such as public places, workplaces, prisons and markets, progress in ensuring that safe drinking water is available in these settings is also needed.

Unless otherwise indicated, the data presented here come from the most recent progress update on household drinking water prepared by the JMP, based on 2020 data.[79]

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3.1 Monitoring drinking water services

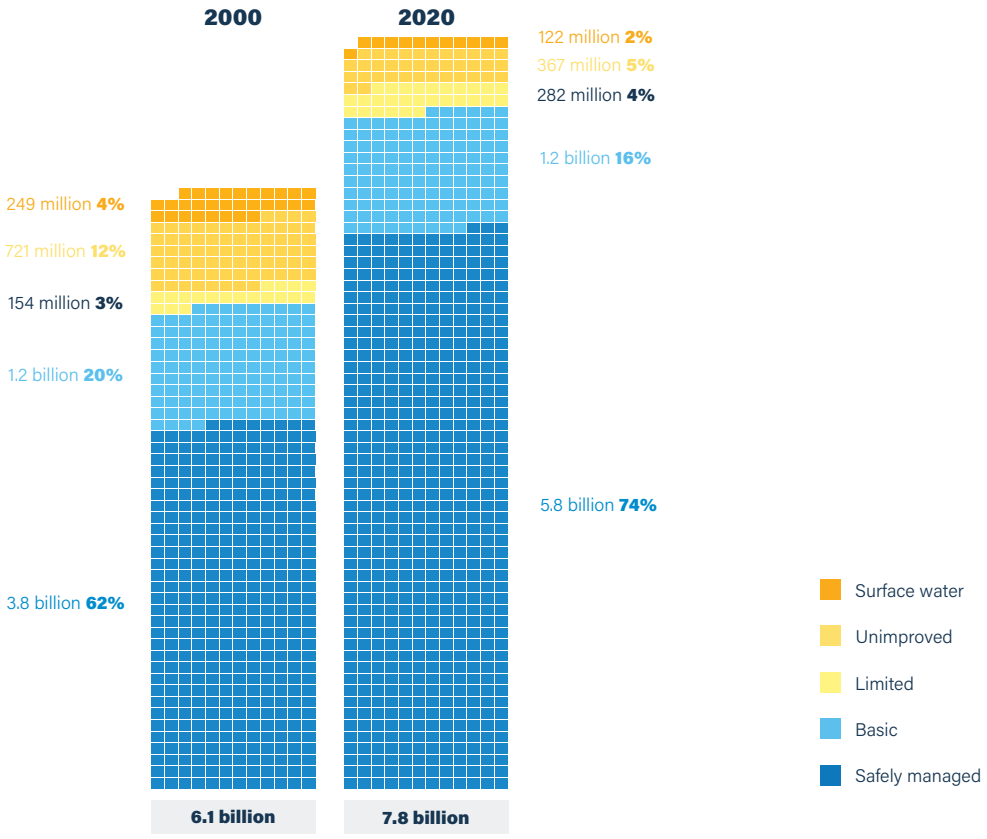
As of 2020, 138 countries had national estimates available for safely managed drinking water services, representing 45% of the global population. Global data coverage is much higher for basic drinking water services (210 countries, representing 99% of the population). Since global SDG baselines were prepared in 2017, there has been a three-fold increase in the number of countries with estimates of drinking water supply services in rural areas, and a more than two-fold increase in the number of countries with urban estimates.

Beginning in 2012, a water quality module was developed and standardized by the JMP in collaboration with UNICEF's Multiple Indicator Cluster Survey programme. Integration of water quality testing has become a feasible option due to the increased availability of affordable and accurate testing procedures and their adaptation for use by household survey experts. This has enabled the collection of data representative of the entire population, including those in rural areas and those not served by utilities or covered by regulators. As of early 2022, water quality data, collected through more than 50 nationally or subnationally representative household surveys, were available from over 40 countries.[80]

3.2 Status of drinking water services in households

Between 2000 and 2020, the global population with access to safely managed drinking water services at home has increased by over 2 billion, from 3.8 billion to 5.8 billion people. An estimated 74% of the global population had access to safely managed drinking water services in 2020. During the same period, the proportion using basic water services decreased from 20% to 16% (though the absolute number of people stayed the same at 1.2 billion, the proportion decreased because of population growth). The number of people using limited services has nearly doubled, from 154 million to 282 million, while the number using unimproved sources has been halved, from 721 million to 367 million people. The proportion using surface water fell from 4% to 2%, but this still left 122 million people in 2020 with this lowest level of service; these people have not benefited from any investment at all (see Figure 1).

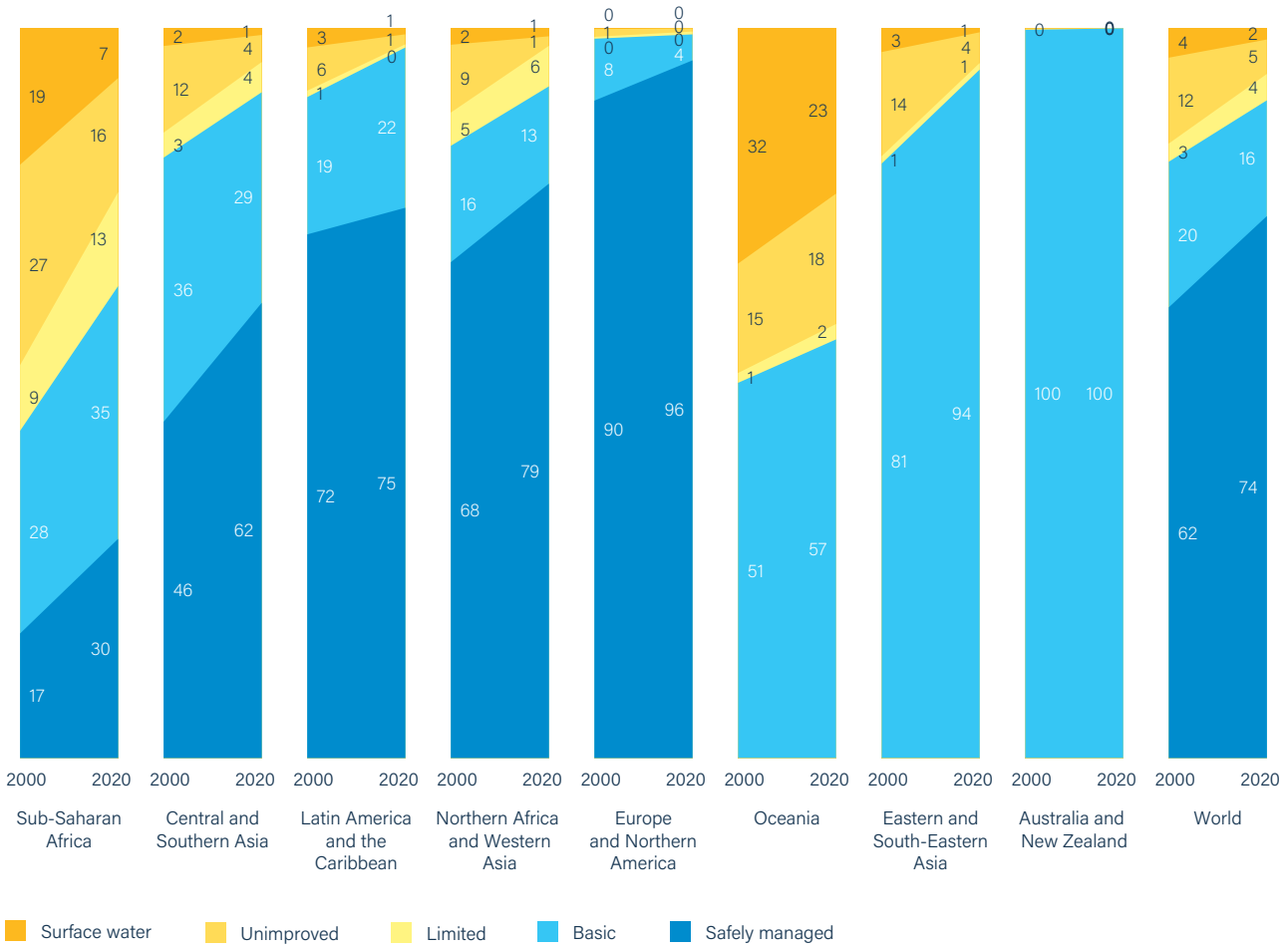
FIGURE 1 Progress in coverage of drinking water services between 2000 and 2020, percentage of global population



Source: Progress on household drinking water, sanitation and hygiene 2000-2020: Five years into the SDGs. Geneva: World Health Organization and the United Nations Children's Fund; 2021.

Service coverage varies significantly between regions (see Figure 2). The region with the lowest coverage of safely managed drinking water services is sub-Saharan Africa, at only 30%. There were insufficient data available to produce estimates for Oceania, Eastern and South-Eastern Asia, and Australia and New Zealand.

FIGURE 2 Regional drinking water coverage, 2015-2020, %



Source: Progress on household drinking water, sanitation and hygiene 2000-2020: Five years into the SDGs. Geneva: World Health Organization and the United Nations Children's Fund; 2021.

With the currently available data, trends to 2030 can be estimated. None of the SDG regions is on track to achieve universal access to safely managed drinking water services by 2030 (defined as greater than 99%). **Globally, a quadrupling of current rates of progress is needed to meet SDG Target 6.1.**

There are serious inequalities between urban and rural areas. Globally, coverage of safely managed drinking water services was only 60% in rural areas in 2020, compared to 86% in urban areas. However, over the first five years of the SDG period, rural coverage increased faster than urban coverage, increasing by seven percentage points, while urban coverage increased by just one percentage point, and stagnated in many regions. While the gap between rural and urban coverage decreased, in 2020, 65% of the population with safely managed drinking water lived in urban areas, even though these areas accounted for only 56% of the global population.

Figure 3 shows the large differences between rural and urban areas in the individual components of safely managed drinking water: accessibility, availability and quality. In almost all countries, service levels are higher in urban areas than in rural areas. In many countries, households in rural areas are much less likely to have drinking water accessible on premises. As described above, the burden of collecting water from sources located off premises falls mainly on women.

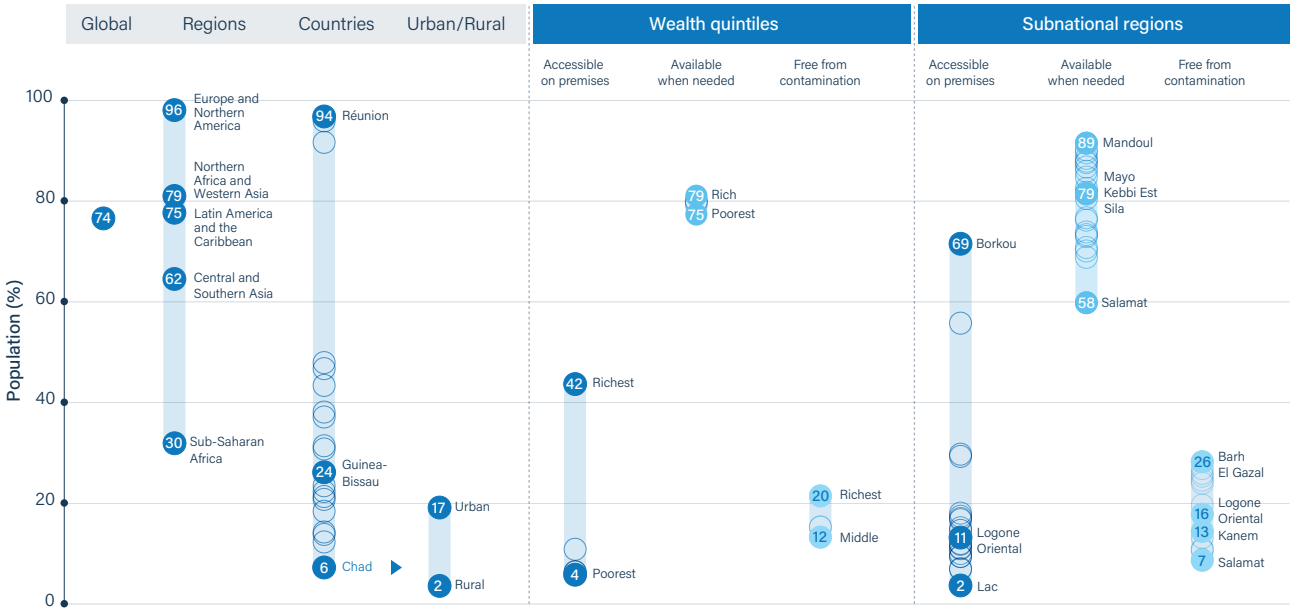
FIGURE 3 Disparities in accessibility, availability and quality of drinking water within countries and areas, rural and urban, 2020

† Including east Jerusalem. UNICEF reports and the Global SDG Indicators Database refer to 'State of Palestine'

Source: Progress on household drinking water, sanitation and hygiene 2000-2020: Five years into the SDGs. Geneva: World Health Organization and the United Nations Children's Fund; 2021.

As seen in Figure 3, disaggregated data reveal huge disparities in drinking water coverage between countries. Using results from Chad's 2019 Multiple Indicator Cluster Survey as an example (see Figure 4), large disparities also exist within countries.

FIGURE 4 Inequalities in safely managed drinking water services and its elements, Chad, 2019



Source: Progress on household drinking water, sanitation and hygiene 2000-2020: Five years into the SDGs. Geneva: World Health Organization and the United Nations Children's Fund; 2021.

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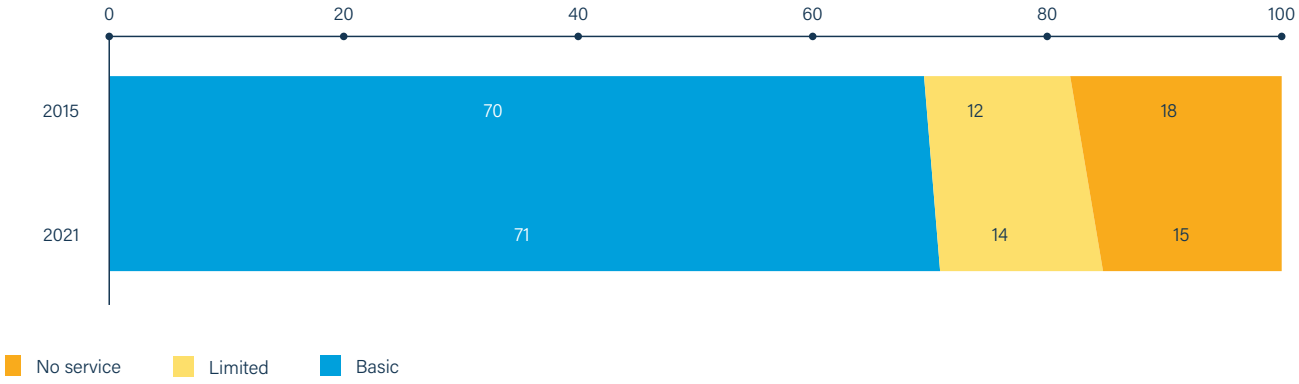
3.3

Status of drinking water services in schools

Millions of children attend schools that lack basic drinking water. In 2021, 546 million children lacked a basic drinking water service at their school, including 288 million whose schools had no drinking water service at all. Globally, 71% of schools had a basic level of drinking water service, and 15% of schools had no drinking water service at all (see Figure 5). Regionally, the lowest coverage of basic water services in schools was 46% in sub-Saharan Africa, followed by 51% in Oceania.

It is estimated that achieving universal coverage of basic drinking water services in schools by 2030 will require a fourteen-fold increase over current rates of progress.[81]

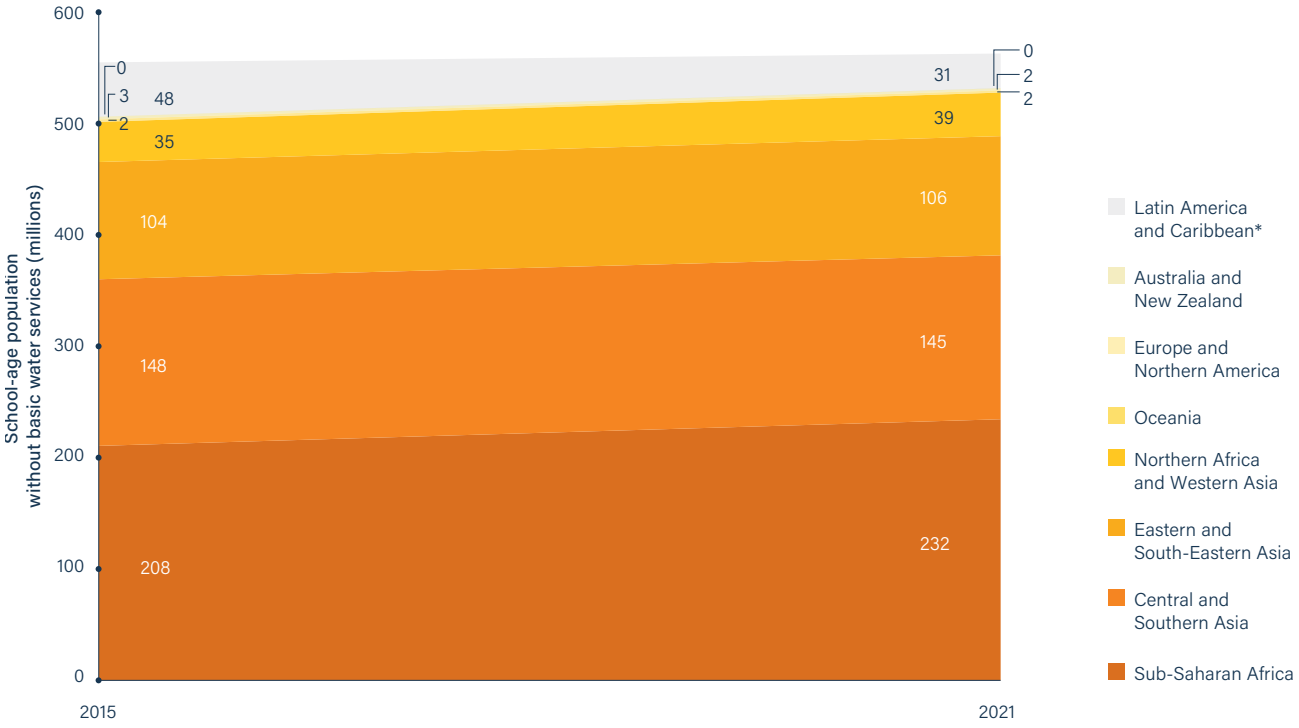
FIGURE 5 Global coverage of drinking water in schools, 2021, %



Source: Progress on drinking water, sanitation and hygiene in schools: 2000-2021 data update. New York: United Nations Children's Fund and the World Health Organization; 2022.

One third of children without basic drinking water services at their school in 2021 lived in countries categorized by the United Nations as least developed countries (LDCs), and over half lived in fragile contexts. Two out of five of those without at least a basic service lived in sub-Saharan Africa (see Figure 6).

FIGURE 6 School-age population lacking basic water services at school, 2015-2021, by SDG region, (millions)

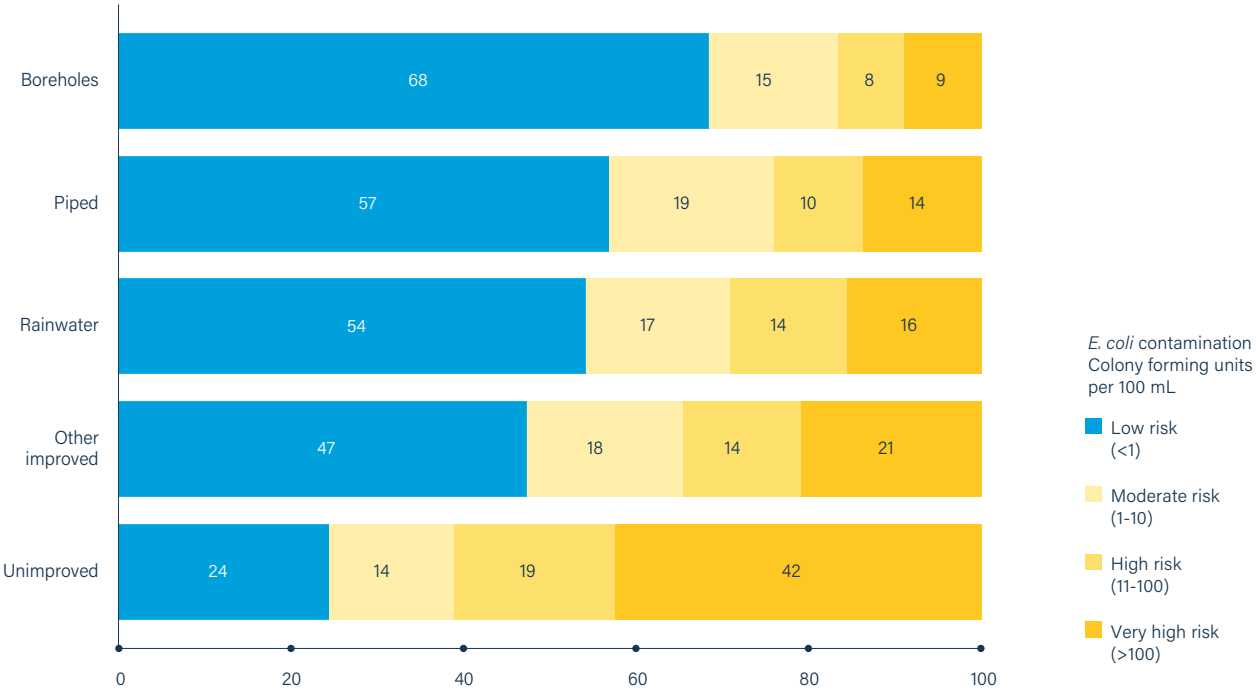


* Data coverage for Latin America and the Caribbean is less than 30%.

Source: Progress on drinking water, sanitation and hygiene in schools: 2000-2021 data update. New York: United Nations Children's Fund and the World Health Organization; 2022.

Data from rural sub-Saharan African show that water quality in schools is often poor, and the risk of faecal contamination of drinking water is significant, even from sources considered improved (see Figure 7).

FIGURE 7 Risk of faecal contamination of drinking water by source type in rural schools in 12 countries in sub-Saharan Africa, 2017, %



Source: Progress on drinking water, sanitation and hygiene in schools: Special focus on COVID-19. New York: United Nations Children's Fund and World Health Organization; 2020.

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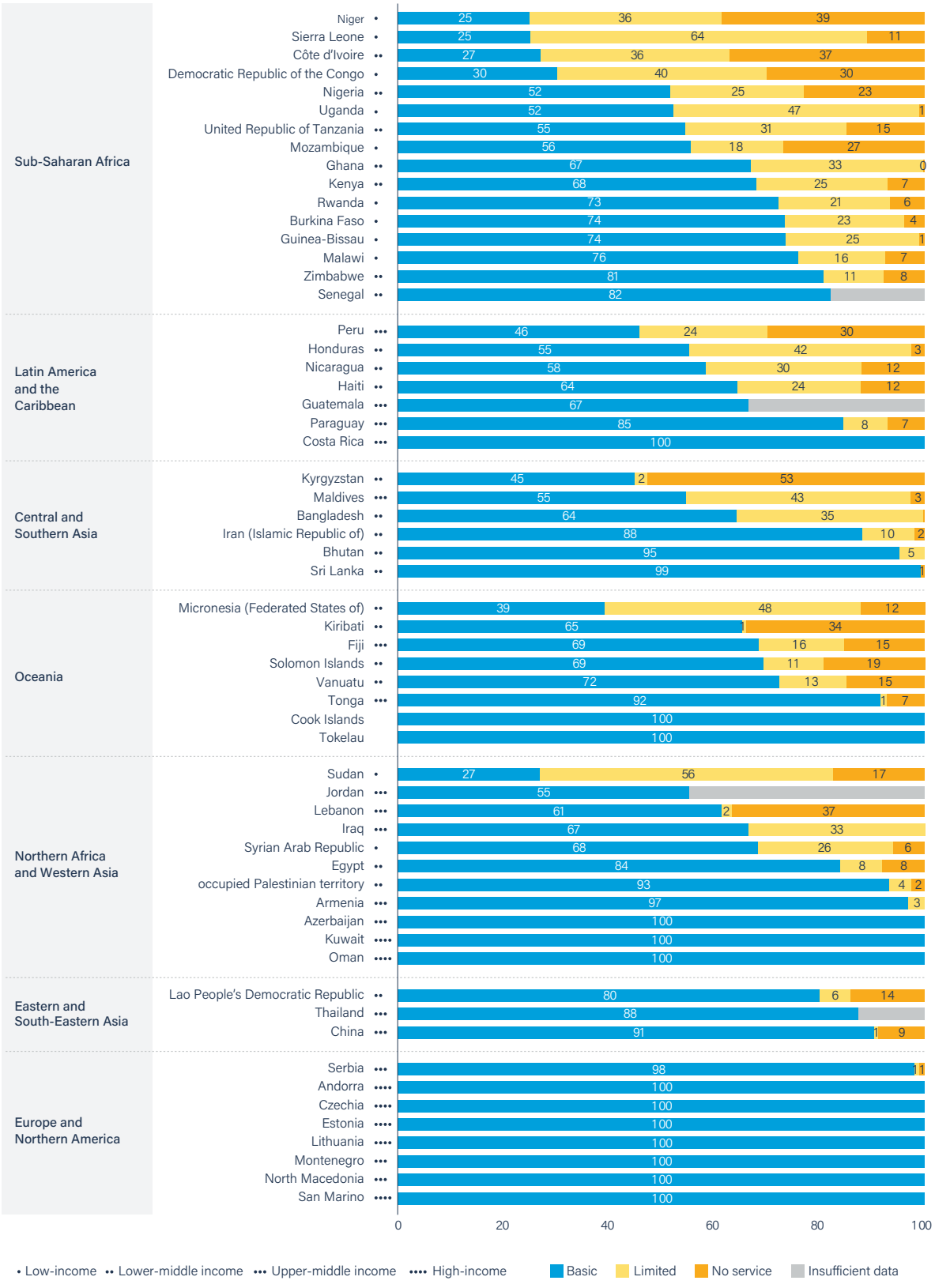
3.4 Status of drinking water services in health care facilities

The JMP estimates that in 2021, 78% of health care facilities globally had a basic water service, meaning that water was available from an improved water source located on premises. Service coverage varies significantly between regions (see Figure 8). In the LDCs, this was only 53%. Nearly one fifth (19%) of health care facilities in LDCs had no service at all, which meant they used water from an improved source that was more than 500 metres from the facility, used an unimproved source, or had no water source at all.[82]

This means that in 2021, 1.7 billion people globally lacked a basic drinking water service at their health care facility, including 857 million who used health care facilities that had no water service at all.[83] In general, drinking water services are worse in rural health care facilities than in urban ones, public facilities than private facilities and smaller health care centres than hospitals.

FIGURE 8 Coverage of water services in health care facilities in 59 countries and areas by SDG region in 2021, %



Source: Progress on WASH in health care facilities 2000–2021: Special focus on WASH and infection prevention and control (IPC). Geneva: World Health Organization and the United Nations Children's Fund; 2022.

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3.5 Status of drinking water quality

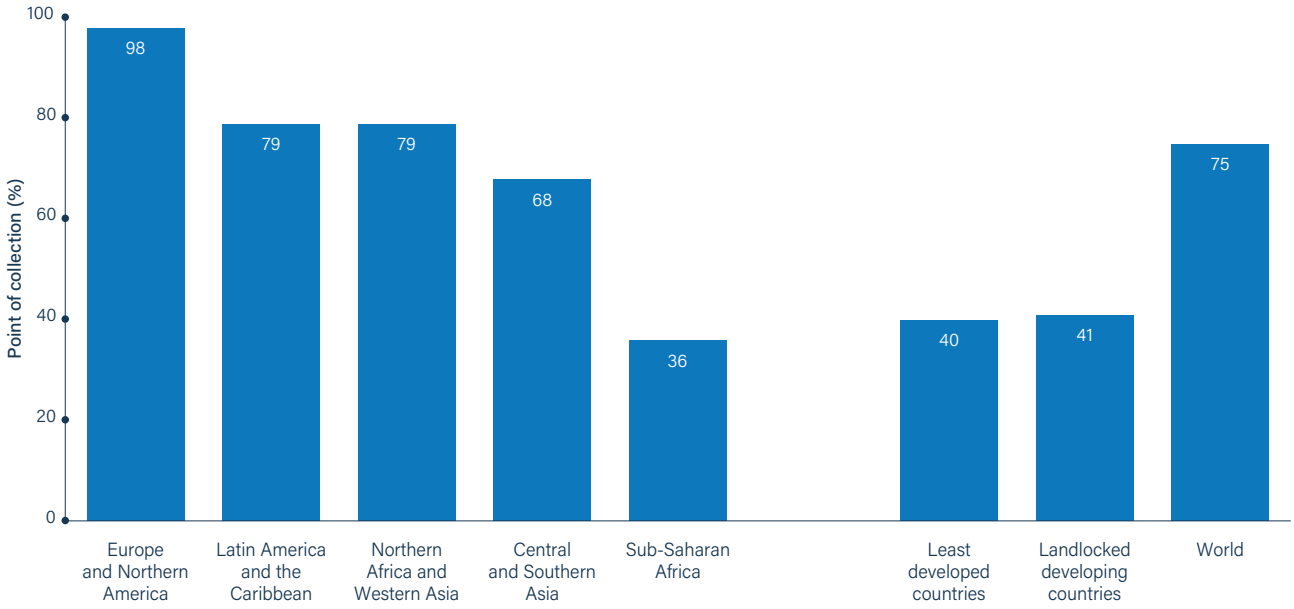
To qualify as 'free from contamination', drinking water must meet microbiological and priority chemical water quality standards.[84]

Significantly fewer data are available to assess quality than the other parameters of safely managed services (accessibility on premises and availability when needed). Data on drinking water that is 'free from contamination' are available at a national level for only 138 of the 234 countries, areas and territories in the JMP global databases, representing only 45% of the global population. In contrast, estimates are available for 99% and 82% of the population for accessibility and availability. Data on accessibility and availability are very often available from household surveys, whereas data on water quality are more likely to come from a ministry, regulator or surveillance agency.

As described in Section 3.1, water quality testing has been introduced into household surveys in some countries. For approximately one third of the countries that had estimates for safely managed drinking water in 2020, water quality data were gathered this way, rather than from administrative sources such as surveillance agencies. However, JMP methods for assessing water quality, including the use of snapshot data collected in household surveys, likely overestimate the population consuming water that is consistently free from contamination. Further, the limited water quality data available from administrative sources, including surveillance agencies, point to the need to strengthen national water quality monitoring systems.

In 2020, the JMP estimated that 75% of the global population used improved drinking water sources free from contamination. However, there are substantial differences between urban and rural settings and between countries and regions. For example, one third of people in Central and Southern Asia and two thirds of people in sub-Saharan Africa still rely on unsafe drinking water (see Figure 9).

FIGURE 9 Proportion of population using improved drinking water sources free from contamination by region in 2020, %



Source: Progress on household drinking water, sanitation and hygiene 2000-2020: Five years into the SDGs. Geneva: World Health Organization and the United Nations Children's Fund; 2021.

Microbiological safety

The most common and widespread health risk associated with drinking water is contamination with microbial pathogens transmitted through faeces. Based on JMP estimates for drinking water that is 'free from contamination', in 2020 nearly two billion people drank faecally-contaminated water.

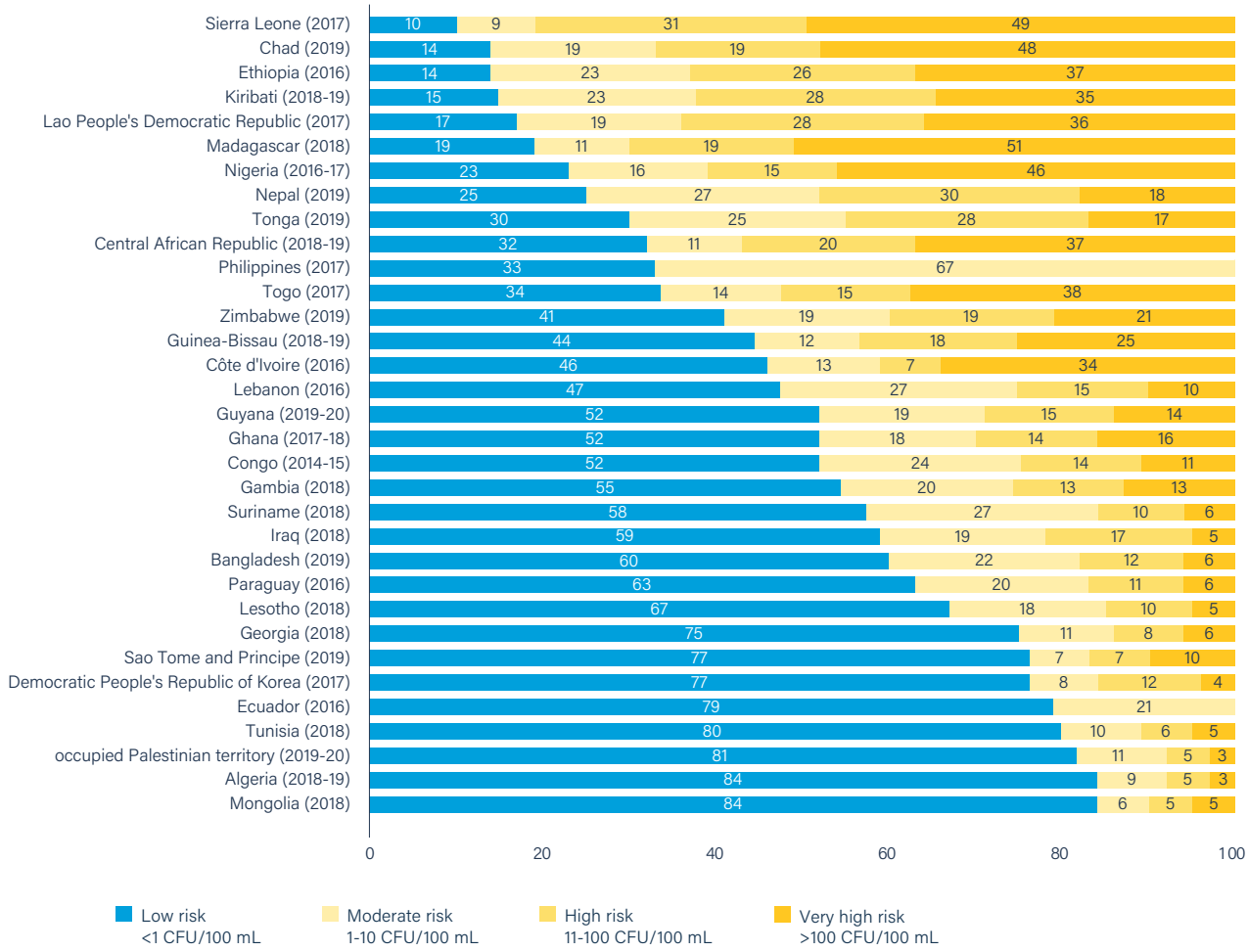
BOX 7 *E. coli* bacteria as an indicator of faecal contamination of drinking water

The WHO Guidelines for drinking-water quality, most national regulations, and the parameters for SDG Target 6.1 stipulate that drinking water should be free of indicators of faecal contamination. The most common indicator used globally is *E. coli* bacteria, found in the digestive tracts of humans and animals. *E. coli* is considered a reliable indication that water has been faecally contaminated, even though few strains of *E. coli* are pathogenic. Other faecal indicators may also be used; for instance, thermotolerant coliforms are an acceptable alternative to *E. coli*. Total coliform bacteria are a good indicator for recontamination of treated drinking water but should not be used as an indicator of faecal contamination.

To be considered free from contamination, no *E. coli* should be detected in a 100 ml sample. Risk of faecal contamination is related to the concentration of *E. coli* in water samples. This is measured by 'colony-forming units', which is a measure of the number of bacteria in a sample that are viable. Over 100 colony-forming units per 100 ml sample are considered 'very high risk' of faecal contamination. Water without detectable *E. coli* is considered to be 'low risk'. However, understanding the true risk level of a particular water source requires that microbiological testing is complemented by an assessment of vulnerability to faecal contamination, for instance, through a sanitary inspection or a water safety plan risk assessment.

Water quality data obtained from samples collected at water sources and within households through nationally representative surveys indicate that across low- and middle-income countries, there are many people using sources of drinking water that are at high or very high risk of faecal contamination (see Figure 10).

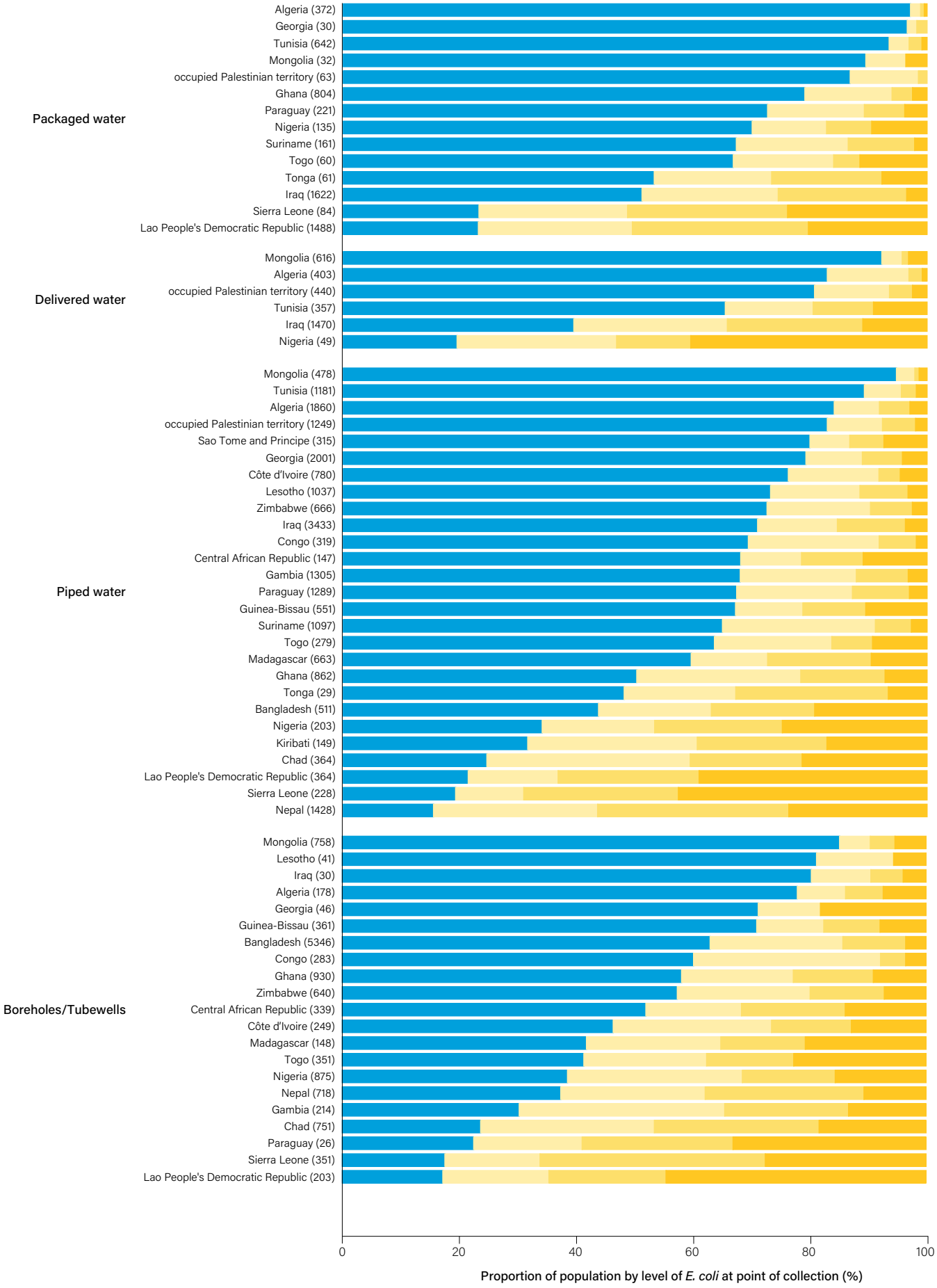
FIGURE 10 Percentage of population using drinking water sources by risk of faecal contamination, selected surveys, 2014-2020, %

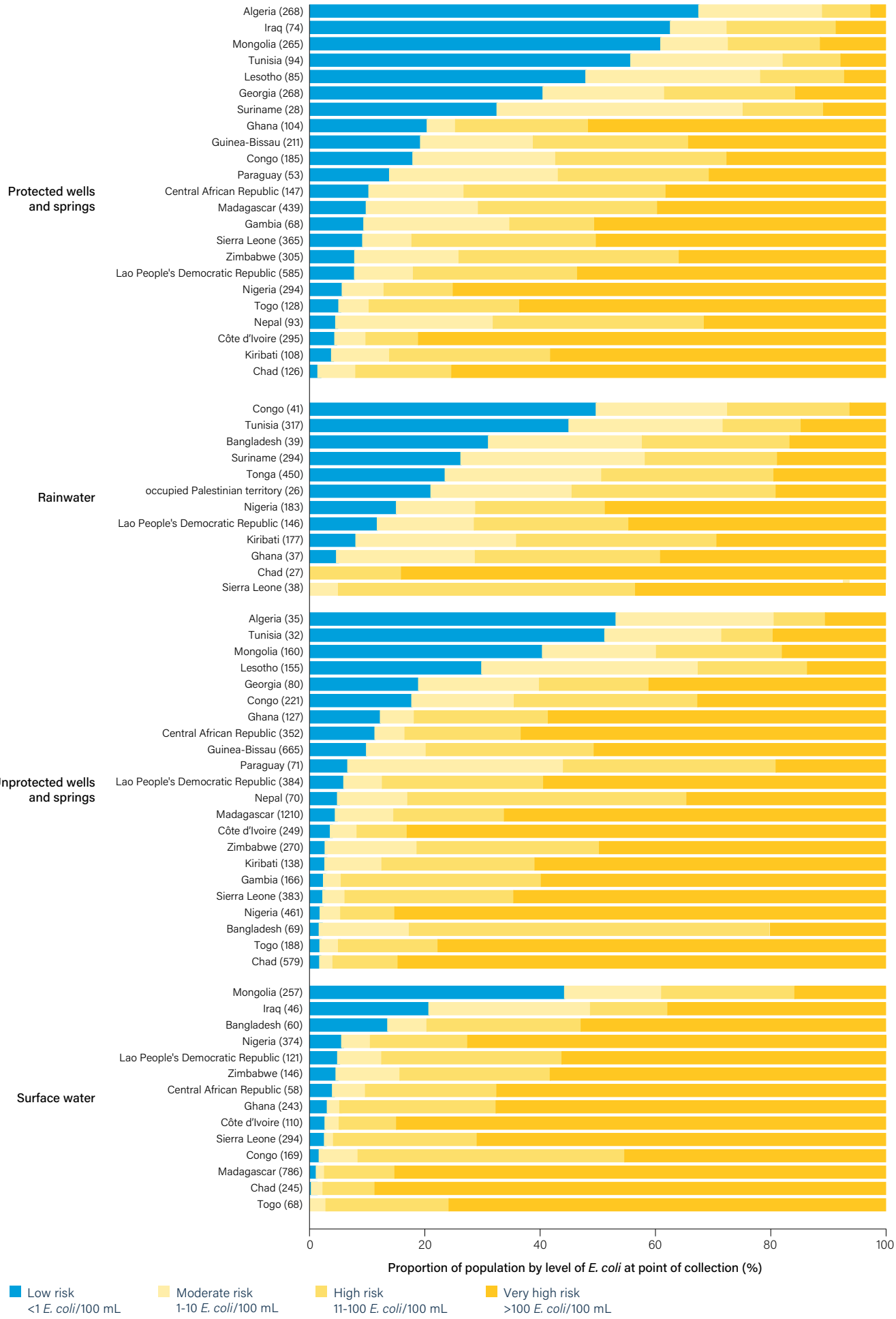


Source: Progress on household drinking water, sanitation and hygiene 2000-2020: Five years into the SDGs. Geneva: World Health Organization and the United Nations Children's Fund; 2021.

Figure 11 shows water quality by source type and reveals that the risk of contamination varies considerably depending on the source, with surface water and unprotected wells and springs at the most risk. However, the data show that all sources can be contaminated. Consistently ensuring water safety, therefore, requires proactive risk assessment and management (e.g., water safety planning, regardless of the water source). The need for risk management is further evidenced by data showing that microbial water quality often deteriorates between the point of collection and the point of use (see Figure 12), which is likely due to unsafe water storage and handling practices, and underscores the need for managing risks to water quality throughout the water supply chain.

FIGURE 11 Water quality by source type, by country

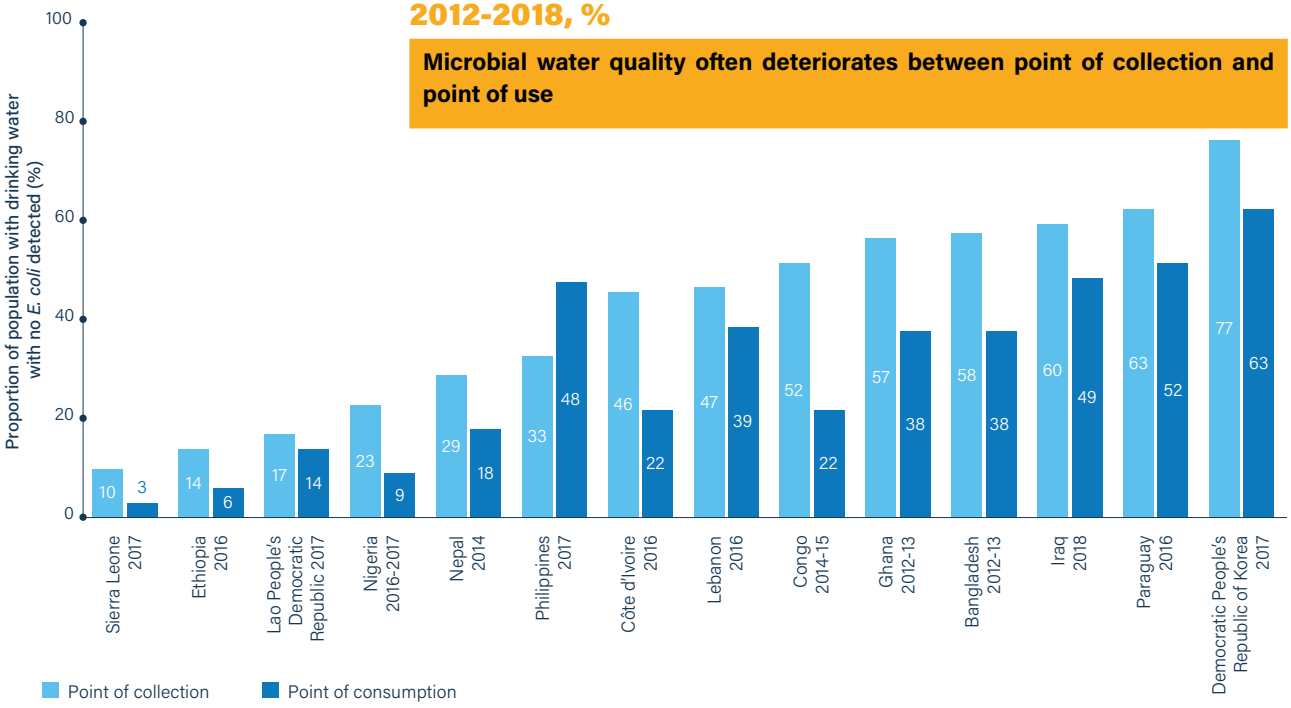




Source: Adapted from Bain R, Johnston R, Khan S, Hancioglu A, Slaymaker T. Monitoring drinking water quality in nationally representative household surveys in low- and middle-income countries: Cross-sectional analysis of 27 multiple indicator cluster surveys 2014-2020. Environ Health Perspect. 2021; 129(9):97010. doi:10.1289/EHP8459.

FIGURE 12 Drinking water free from contamination at point of collection and point of use, selected countries, 2012-2018, %

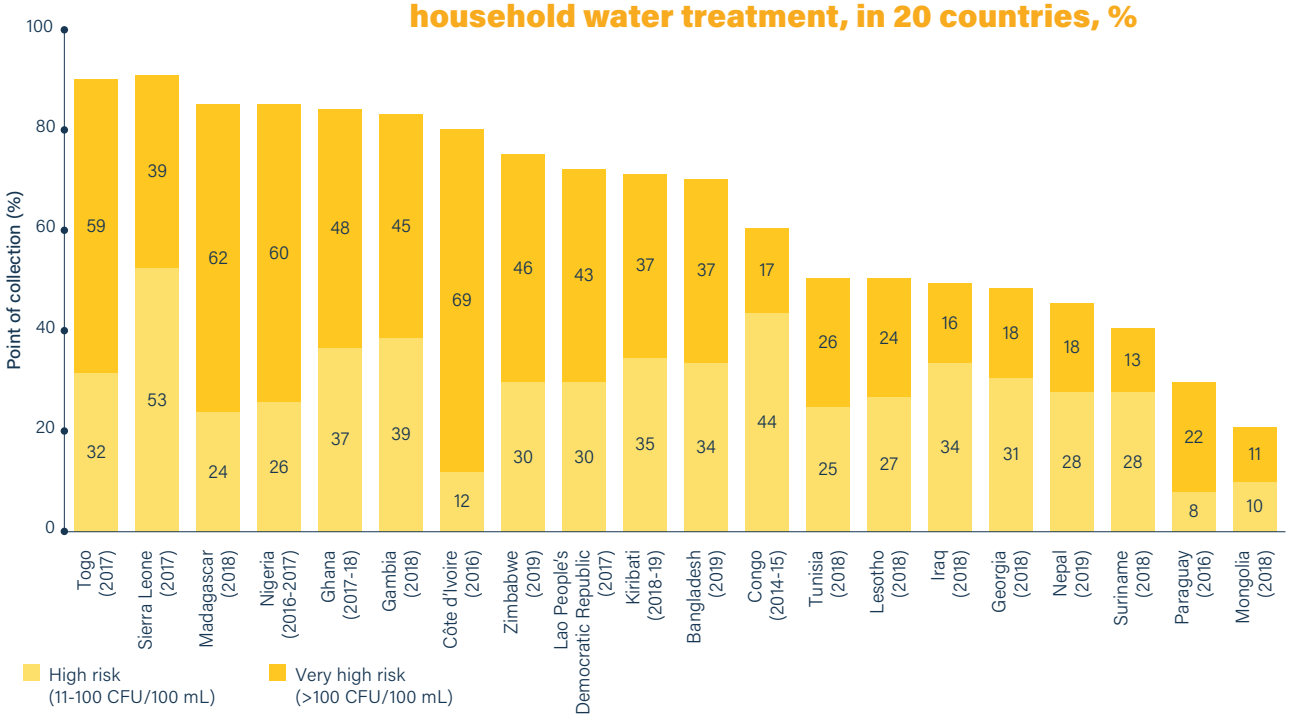
Microbial water quality often deteriorates between point of collection and point of use



Source: Progress on household drinking water, sanitation and hygiene 2000-2017. Special focus on inequalities. New York: United Nations Children's Fund and the World Health Organization; 2019.

Self-reported household water treatment practices appear to offer very little protection against faecal contamination. As seen in Figure 13, in many countries, most households with contaminated sources, despite reporting appropriate household water treatment practices, are still drinking water at high or very high risk of faecal contamination.

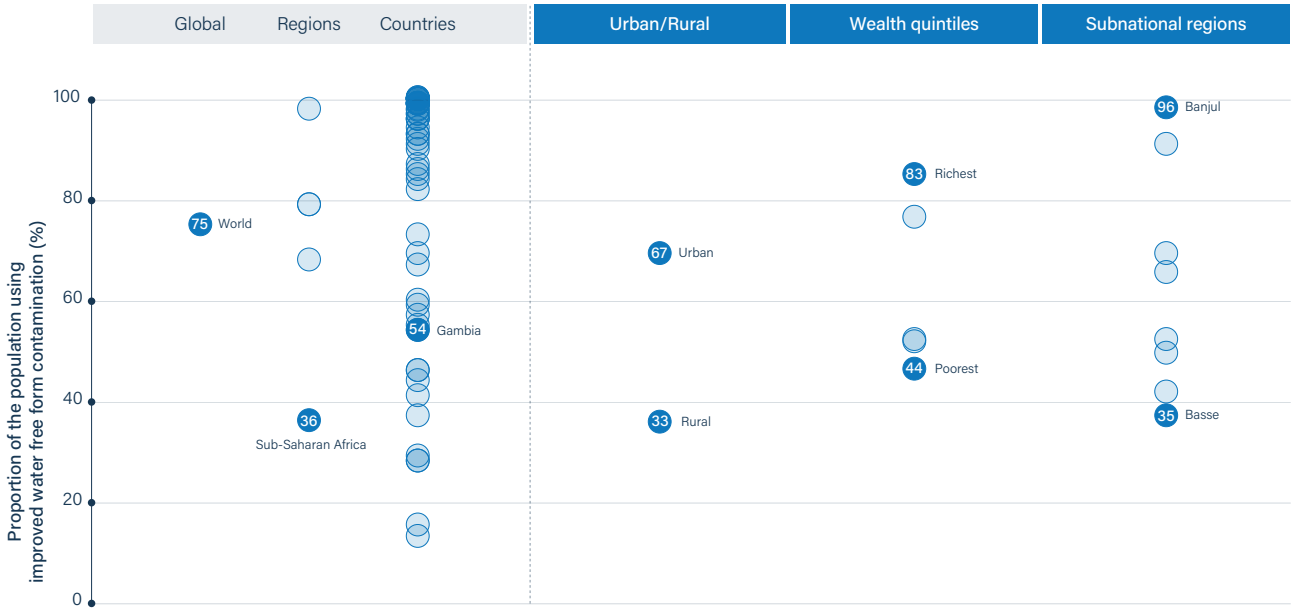
FIGURE 13 Quality of drinking water in households with contaminated sources that report appropriate household water treatment, in 20 countries, %



Source: Adapted from Bain R, Johnston R, Khan S, Hancioglu A, Slaymaker T. Monitoring drinking water quality in nationally representative household surveys in low- and middle-income countries: Cross-sectional analysis of 27 multiple indicator cluster surveys 2014-2020. Environ Health Perspect. 2021; 129(9):97010. doi:10.1289/EHP8459.

There are significant inequities in the availability of microbiologically safe drinking water between urban and rural populations and between wealth quintiles. The growing number of national household surveys with integrated direct testing for *E. coli* enables the measurement of associations between water quality and household characteristics, such as socioeconomic indicators. For example, JMP analysis of water quality data collected from Gambia's 2018 Multiple Cluster Indicator Survey shows that drinking water services serving the poorest wealth quintiles are at a significantly higher risk of faecal contamination (see Figure 14). In addition, there are substantial disparities in microbial drinking water quality between urban and rural areas, and between subnational regions, with rural water sources showing greater levels of contamination than urban, and all areas showing greater levels of contamination than the capital city region of Banjul.

FIGURE 14 Drinking water is most contaminated among the poorest and rural populations in Gambia



Source: Based on data from The Gambia multiple indicator cluster survey 2018: Survey findings report. Banjul, The Gambia: The Gambia Bureau of Statistics; 2019.

Chemical safety

Although many chemicals may be detected in drinking water, only a few have been confirmed to cause significant impacts on public health, and comprehensive data on the extent of chemical contamination are scarce. In most cases, microbiological contamination poses a vastly greater risk than chemical contamination, but a few chemicals cause serious health problems and are fairly prevalent in drinking water resources. Arsenic and fluoride are generally considered the most significant. Compliance with arsenic and fluoride standards is part of the SDG Indicator 6.1.1. In a few countries, chemical quality is the limiting factor for safely managed drinking water services.[i]

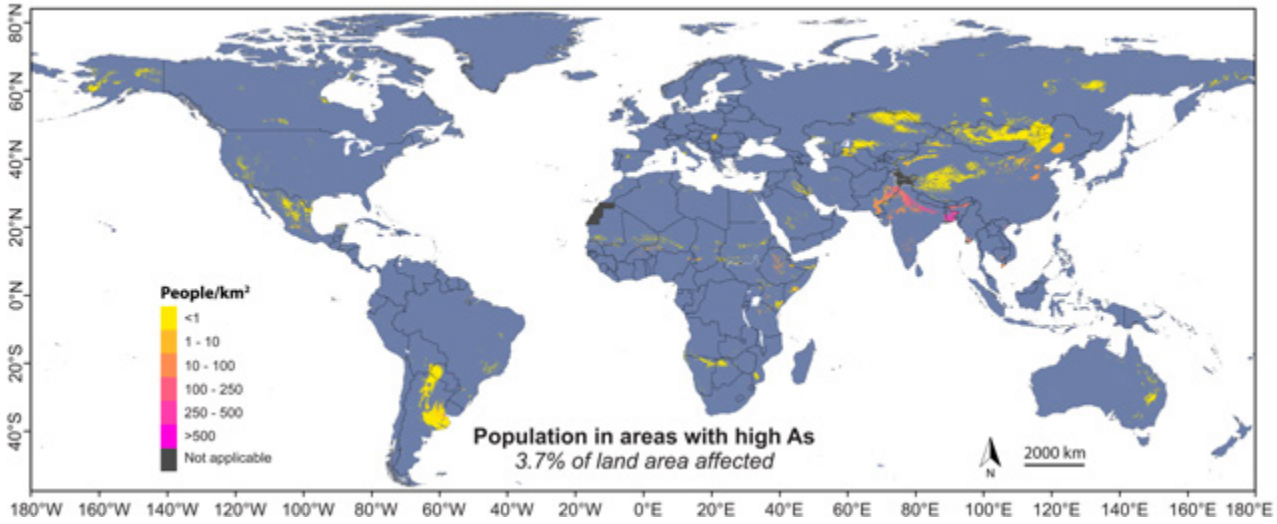
Other chemicals of significance in drinking water include lead and iron, while chemicals such as pesticides, pharmaceuticals and microplastics have generated increased concern in recent years.

[i] For example, arsenic contamination is more prevalent than microbiological contamination in Andorra, Austria, Croatia, Hungary and Italy; while fluoride contamination is more prevalent than microbiological contamination in Estonia, Finland and Lithuania.

Arsenic

Arsenic causes a variety of cancers in humans, including lung, bladder and skin, and is also associated with cardiovascular and pulmonary diseases, diabetes mellitus and other adverse health conditions.[85] Arsenic has been found at concentrations of concern in groundwater in at least 70 countries, including significant population exposure in Argentina, Bangladesh, China, India, Pakistan and Viet Nam.[86,87,88] Statistical modelling using machine learning suggests between 94 million and 220 million people are at risk of exposure to elevated arsenic concentrations in groundwater, the vast majority (94%) being in Asia (see Figure 15).

FIGURE 15 Population living in areas with high probability of arsenic in groundwater exceeding 10 µg/L



Source: Adapted from Podgorski J, Berg M. Global threat of arsenic in groundwater. Science. 2020; 368(6493):845-850. doi:10.1126/science.aba1510.

Fluoride

Fluoride is widely promoted as an additive to drinking water or toothpaste to strengthen tooth enamel. However, at high concentrations fluoride can cause mottling and pitting of teeth (dental fluorosis) and bone deformation (skeletal fluorosis). Although the geochemical factors that correlate with fluoride in groundwater are different from those that cause arsenic contamination, statistical modelling can also be done for fluoride, indicating that approximately 179 million people live in areas where fluoride is likely to exceed 1.5 mg/l, the WHO guideline value, with the vast majority of the population at risk living in Asia and Africa (see Figure 16).

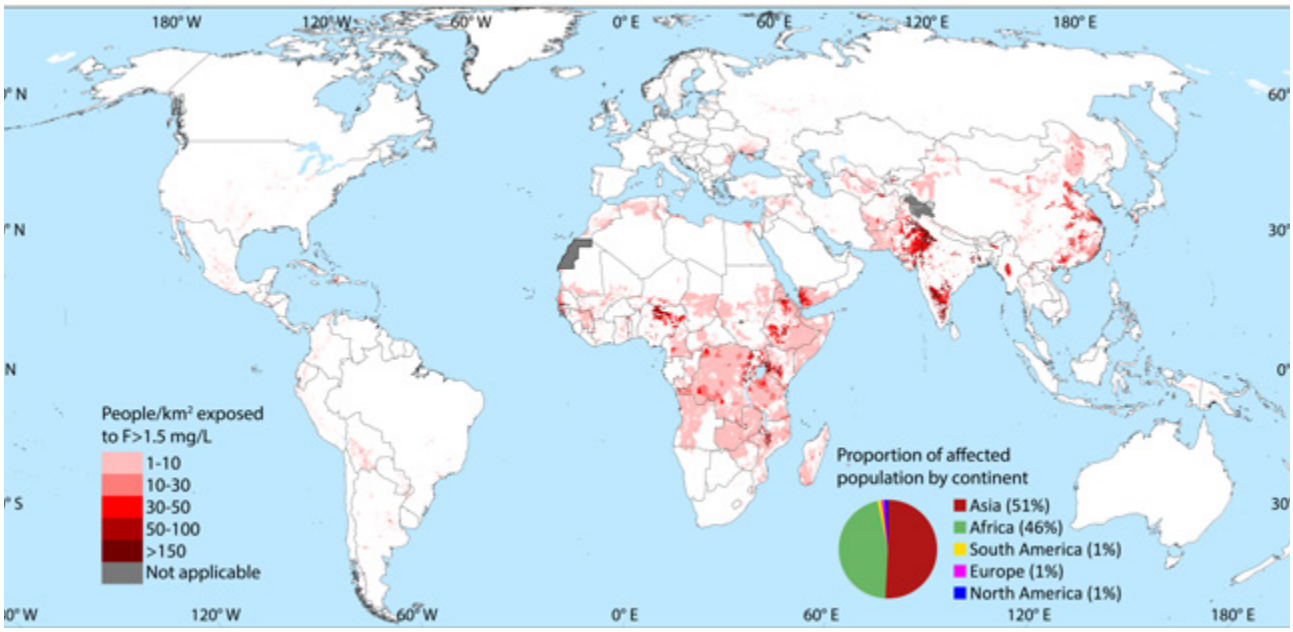
Geostatistical modelling[89] can help identify potential areas of concern but is not a substitute for actual water quality testing. Models can, however, help to optimize the allocation of limited resources for chemical water quality surveillance.

Lead

Lead is associated with a wide range of health effects, with children particularly vulnerable to neurodevelopmental effects. The most common source of lead in drinking water is leaching from materials in water systems that contain lead. There is no known level of exposure that is safe.

A recent study conducted by the University of North Carolina across rural areas of Ghana, Mali and Niger found that lead exceeded the WHO guideline value of 10 µg/l in 9% (24/261) of drinking water samples.[90] These results are broadly comparable to results observed in other studies, including in many high-income countries. Results did not vary significantly by geography or system type, suggesting that lead is more broadly present in drinking water (in both rural and urban areas) than previously known.

FIGURE 16 Population in areas with high probability of fluoride exceeding 1.5 mg/L



Source: Adapted from Podgorski J, Berg M. Global analysis and prediction of fluoride in groundwater. Nat Commun. 2022; 13(1):4232. doi:10.1038/s41467-022-31940-x.

Iron

The presence of iron in drinking water is not considered a direct danger to health but can affect taste and cause discolouration of laundry and plumbing fixtures. However, users often reject 'improved' water containing iron due to its taste, colour and staining effects. This can cause people to return to unsafe surface water.[91] A recent study found that communities in at least 20 countries in sub-Saharan Africa face the problem of rapidly corroding handpumps, leading to iron contamination of the drinking water they provide. Corrosion was found to be accelerated by low pH levels, high salinity and high chloride levels. In some countries, governments are taking action to prevent rapid corrosion, such as by banning or trying to prevent the use of galvanized iron pipes (e.g., Chad, Uganda and Zambia). [92]

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BOX 8 Other chemicals and contaminants of concern

More sensitive methods for chemical analyses have led to increased detection of many chemicals in drinking water and source waters, often in trace amounts. In many countries, public concern has developed around substances such as pesticides, pharmaceuticals, microplastics and PFAS. However, routine monitoring of these chemicals is generally not considered an effective use of limited resources. Concerns about trace chemicals should be considered within the overall priority of hazards to human health. For many of these substances, there are knowledge gaps, and the concentrations that may be detrimental to human health have not been determined.

Pharmaceuticals: More than 100 different pharmaceutical substances have been found in several European countries and the United States of America in the aquatic environment (surface water, groundwater, and/or tap/drinking water). In most regions of Asia, the Western Pacific, Africa and Eastern Europe, this number drops to 30 different pharmaceutical substances or fewer.[93] Pharmaceuticals have been detected in the water cycle mostly in the range of nanograms to low micrograms per litre, although higher concentrations have been detected in areas near poorly controlled pharmaceutical manufacturing sites and where there is inadequate wastewater treatment.[94,95] Although current risk assessments indicate that trace concentrations of pharmaceuticals in drinking water are very unlikely to pose risks to human health, little is known in terms of assessing risks associated with long-term exposure to low concentrations of pharmaceuticals and the effects of mixtures of pharmaceuticals. Where hotspots have been identified, further investigation may be needed.[96] A growing concern is the presence of antibiotics, which may contribute to bacterial antimicrobial resistance, although efforts to limit its emergence and spread require focus primarily on improving the management of sanitation systems.[97]

Per- and polyfluoroalkyl substances (PFAS): These are a broad class of synthetic chemicals used in a wide range of industrial, commercial and domestic applications. The most widely studied of these PFAS are perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA). Standard water treatment processes are ineffective at removing these chemicals, including PFOS and PFOA.[98] A 2018 study evaluated levels of a large number (n=133) of PFAS in bottled and tap water samples taken worldwide. For example, PFOS was detected in 18% of bottled water samples and 85% of tap water samples, with maximum detected levels of 0.67 ng/l, and 4.1 ng/l, respectively.[99]

3.6 The impact of climate change on drinking water services

Since the 1950s, there have been dramatic increases in both the intensity of heavy precipitation and length of dry spells in many regions. Additionally, the accelerated melting of glaciers, changes in frequency, magnitude and timing of floods, more frequent and severe droughts, a decline in groundwater storage and reduction in recharge, and water quality deterioration due to extreme events, have all become more intensified due to anthropogenic climate change. These climate change impacts have significant impacts on access to safe drinking water and represent a threat to gains made in recent years. The IPCC estimates that about 4 billion out of the world's 7.8 billion people experience severe water scarcity for at least one month per year.[100]

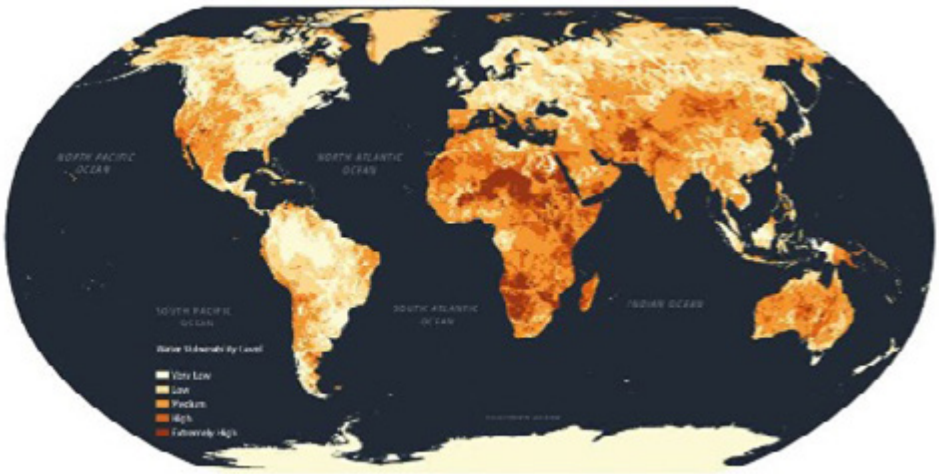
Water scarcity is affected not just by the physical water resources available at a particular location, but also by inequalities in access to drinking water services. There is increasing evidence that the impacts of

climate change are felt disproportionately by already-vulnerable communities.[101]

UNICEF has developed a map showing extreme water vulnerability (see Figure 17). Physical water scarcity risks continue to be exacerbated by climate change impacts - including water stress, interannual variability, seasonal variability, groundwater table decline and drought events. This information has been overlaid with drinking water service levels and child population density to create a composite index. The resulting map clearly highlights the main areas affected by high and extremely high water vulnerability, combining the highest levels of physical water scarcity and lowest levels of drinking water service. It is estimated that 1.4 billion people (including 450 million children) lived in these areas in 2020.[102]

As the world continues to urbanize, the demand for water in cities is projected to increase by 50% to 80% within the next three decades.[103,104] Urban residents, particularly the urban poor, will become more vulnerable to the effects of climate change. One in four cities worldwide already experiences water insecurity. Climate change adds to demographic and supply-chain pressures on cities, leading to fears of widespread water shortages, combined with periodic climate disasters, producing major social and economic disruptions. The social and economic consequences of climate shocks on cities are likely to be particularly devastating in low- and middle-income countries.[105] In rural areas, deficiencies in management capacity and lack of professionalized service provision puts drinking water services at greater risk from climate change impacts.[106,107]

FIGURE 17 UNICEF Extreme Water Vulnerability Index



Source: The UNICEF Extreme Water Vulnerability Index (EWVI): Methodology paper, WASH technical paper, TP/14/21, New York: United Nations Children's Fund; 2021.

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What is the status of the policy, regulatory and financing framework for drinking water?

To understand progress in drinking water supply globally, it is important to consider what efforts governments are undertaking to establish and operationalize policy and regulatory frameworks. It is also important to understand the various ways in which drinking water is funded and paid for.

Much of the data in this section came from the most recent GLAAS cycle of data collection in 2021/2022.[108] It will be published by WHO in the 2022 GLAAS report (expected to be released in December 2022), with the data in the full report being more comprehensive.

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4 of 11

Status of national drinking water policies and plans

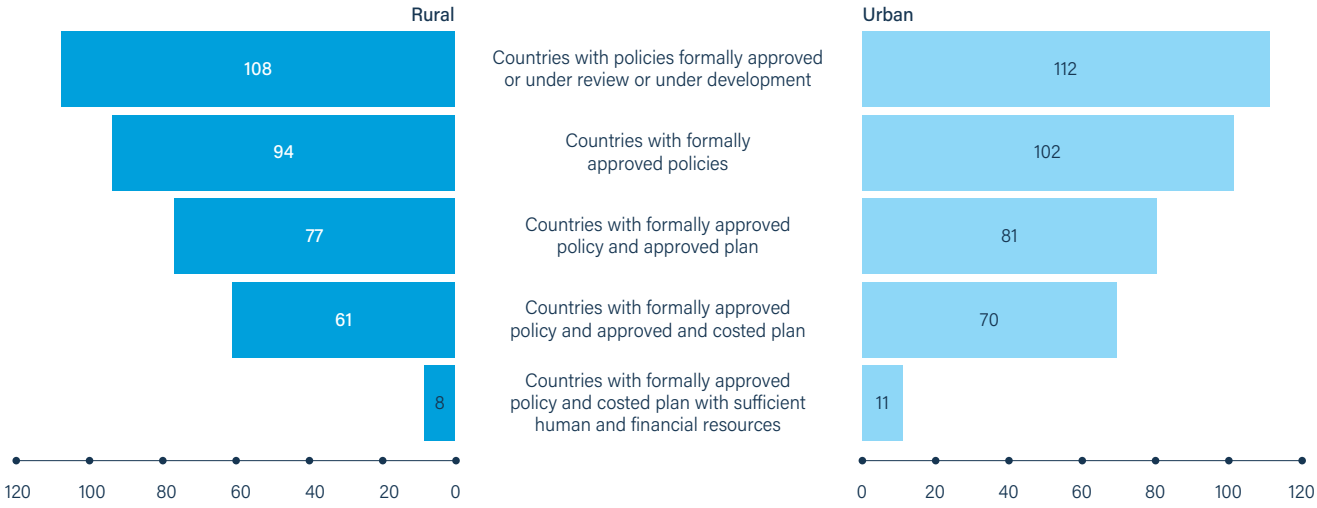
The majority of countries responding to the GLAAS 2021/2022 country survey reported having national drinking water policies for urban and rural areas that are formally approved.

While having policies and plans that address drinking water is important, to be effective they must be supported by sufficient human and financial resources (defined by GLAAS as having more than 75% of what is needed to implement the policies and plans). As shown in Figure 18, while the majority of countries reported having policies and plans in place for drinking water, very few reported sufficient human and financial resources to implement the plans.

Across the countries studied for the ESAWAS regulatory landscape assessment in Africa, national policy documents existed for 45 countries (83%).[109]

FIGURE 18 Number of countries reporting formally approved urban and rural drinking water policies supported by resourced plans

Few countries have formally approved, adequately resourced drinking water policies



Source: Data from the WHO UN-Water GLAAS 2021/2022 country survey results, to be released in December 2022.

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BOX 9 Common management models for drinking water supply[110]

Self-supply: Households invest in their own water supplies and maintain them themselves. Typically, these are wells and rainwater harvesting. For some, there is support available from government, including partial subsidies for capital investments, technical assistance for construction work, or quality monitoring. For many households, there is no formal financial or technical support available from the government.

Community management: Community organizations, with varying levels of formalization, take care of daily operation, maintenance and administration of drinking water services. Some are legally recognized as service providers, and may get support from government agencies, although this is not always the case. Communities may contract out certain tasks to individuals, such as a plumber or scheme attendant, or to small companies. Many community organizations have no legal recognition because organizations have not taken the necessary legal steps, or the government does not offer support or has not applied its policy. Many community-managed schemes rely on community volunteers. In some cases, community management is being professionalized, and rural utilities are emerging (referred to as 'utilitization'). These new rural entities share some characteristics with urban utilities: they are formalized legal entities that are accountable to service authorities and users, with remunerated positions for those operating and managing the system, and with regular collection of fees.[111] They take on tasks that tend to be neglected under community management. For example, asset management is a relatively new concept that is being introduced into the rural water sector. A 2017 review of rural water service delivery models showed that half the countries surveyed still needed to address issues such as clarity around asset ownership, inventories and water point mapping, and clearly defining responsibilities for capital maintenance—minor versus major repairs—and responsibility for asset renewal.[112]

Government provision: Drinking water supply is the responsibility of the local government. The municipal administration may be the direct service provider, or an autonomous municipal utility, which acts along commercial lines, may be established. In some cases, autonomous utilities are controlled by provincial or state government, rather than local government.

Delegated private sector provision: Private sector provision can have a wide range of models and scales, and delegate varying levels of control to private entities. Key models include:

- **Kiosk or public stand post operators**: An operator purchases water in bulk and ensures the retail sale of water, typically through a kiosk or public stand post. Operation and maintenance of the scheme are done by the service authority or utility, through the revenue from the operators.
- **Lease contract**: The service authority delegates operation and maintenance of an existing system to a private service provider. The private operator is remunerated through the sale of water and pays a fee to the authority.
- **Concession**: Similar to a lease contract, but the private operator has investment obligations, and the contracts are longer (up to 25 years) to recoup investments.
- **Design, build, operate, transfer contract**: A service provider is contracted to design and build a water system, based on a long-term contract based on the sale of water, whereby the service provider recoups the investment.

4.2

Status of policy regarding reaching poor populations

In many countries, a key government policy objective is to ensure affordability and reach the poor. Measures to make drinking water more affordable take many forms and present a multitude of challenges, and affordability is notoriously difficult to measure.[113]

While 84% of the 118 countries responding to a GLAAS survey question about reaching poor populations reported having specific measures in policies and plans in place, 56% responded that they have corresponding measures for monitoring, and only 38% said they have financing measures that are consistently applied to reach poor populations with drinking water services.[114] Data collected for the ESAWAS landscape assessment indicated that 39% of countries in Africa did not have a regulatory mechanism to address pro-poor aspects.[115]

However, while surveys ask for details of the types of measures, countries are not asked how successful they are, and they no doubt vary in effectiveness. For instance, it is known that in many cases, subsidies delivered through tariffs are expensive, poorly targeted, non-transparent and distortionary.[116]

4.3

Status of regulation of drinking water services

Robust regulatory frameworks are essential to delivering quality drinking water services. Sustainable and equitable provision of safe drinking water depends on effective regulation to formalize the sector, and to provide clear rules for those working within it.[117]

BOX 10 Regulation

Governments can establish regulations for several elements of drinking water services, including water quality, tariff setting, environmental impact, market structure (including competition in the sector), consumer protection (including recourse for consumers who have complaints), and other aspects related to the extent or quality of service delivery. Regulators are also often charged with protecting public health through a focus on compliance with health-based standards and risk management approaches for ensuring drinking water safety.

There are several regulatory models, including:

- **Ministerial (or government) regulation**: A government ministry is tasked with regulating the sector.
- **Regulation by agency**: An agency is established to regulate in an autonomous manner.
- **Regulation by contract**: Uses no separate regulatory agency, and the public sector asset holder that is a signatory to a contract monitors the performance of the operator against the terms of the contract.
- **Regulation by sourcing to third parties**: Uses external contractors to perform certain duties, such as tariff review, benchmarking or dispute resolution.
- **Self-regulation**: Service providers, such as public utilities, regulate their own activities, set tariffs and monitor their own performance (this may be legally mandated, but often arises due to the absence of a more formal regulatory structure).

Regulatory models need to be appropriate for the context in which they are to be applied, including institutional setup, political economy and legislative frameworks. Most independent regulators are initially established as economic regulators, focusing on water pricing (tariffs), value for money related to the quality of service broadly, and market structure. Over time, they may evolve to include a specific focus on other aspects, including water quality and public health. In many countries, there is a lack of clear institutional mandates and responsibilities in water policies. In addition, political interference has also been cited as a challenge for effective regulation and enforcement.

Data from the GLAAS 2021/2022 cycle show that the vast majority of countries have standards, or the equivalent, in place for drinking water quality and quality of service delivery.[118]

In urban areas, 87% of the 119 GLAAS 2021/2022 respondent countries reported having a regulatory authority responsible for overseeing urban drinking water quality, and 82% of 116 responding countries reported having an entity responsible for overseeing rural drinking water quality. The ESAWAS landscape assessment revealed that, across Africa, 59% of countries are regulating networked piped water supply services at scale, compared to just 11% for point water sources.

Results from the GLAAS 2021/2022 survey cycle show that the majority of respondent countries had drinking water regulatory authorities for urban and rural areas established by law. Most respondent countries also had drinking water regulatory authorities independent of the service providers that are being regulated in urban and rural areas.[119] The 2022 ESAWAS landscape assessment revealed that 54% of African countries had a strong legal backing for regulation of the water supply sector, but that 9% had no legal backing at all.[120]

There is relatively little systematic data on the regulatory models used in low- and middle-income countries, and how effective they are. The available literature indicates that self-regulation is fairly common, followed by regulation by agency, according to a 2018 survey of 123 low- and middle-income countries. The survey showed that 45% of the surveyed countries use a self-regulation approach in the water sector.[121] Across the 54 African countries studied for the ESAWAS landscape as-

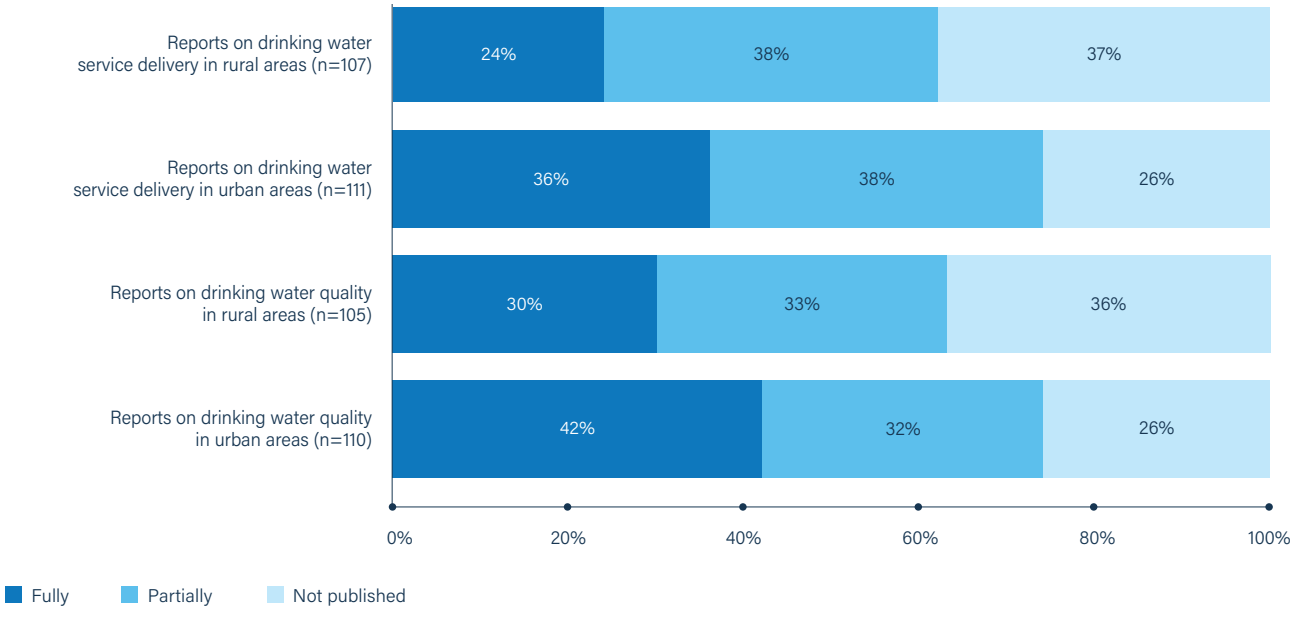
sessment, the predominant model of regulation was regulation by agency (37% of countries) or ministerial regulation (33% of countries). However, many countries had multiple models, and ministerial regulation was present in almost all (89%). The assessment revealed that in the African countries where regulation by agency is the predominant form, they have generally made the greatest progress in developing and applying regulatory mechanisms, and this type of regulation has performed better than other models. On the other hand, both ministerial regulation and self-regulation perform poorly.[122]

In Latin America and the Caribbean, preliminary results from a survey of 23 regulatory institutions indicate that the major domains they focus on are quality of service, legal aspects, economic regulation, consumer protection, and information (such as making information available to service users).[123] Similarly, most members of ESAWAS are responsible for economic and service quality regulation. However, the ESAWAS landscape assessment revealed that only a small number of countries had developed regulatory mechanisms across the full range of 16 aspects considered, covering environmental considerations, tariffs, pro-poor interventions, quality of service and economic efficiency. One quarter had developed five or fewer.[124] While drinking water quality is generally covered as a quality of service criterion, the available evidence suggests that public health requires greater regulatory attention.

An important function of regulators, and a contribution to transparency, is publishing reports that are publicly available. However, countries responding to the GLAAS survey indicated they did not always do this, particularly in the case of reports on drinking water in rural areas (see Figure 19). The ESAWAS landscape assessment showed that regulatory reports on service provider performance are publicly available in only 33% of African countries.[125]

Autonomy and independence of regulators are often lacking. For instance, the ESAWAS landscape assessment revealed that only 28% of lead regulatory actors in Africa are financially autonomous of government, and regulatory actors have the autonomy to set or approve tariffs independently of government in just 30% of African countries.[126]

FIGURE 19 Percentage of countries with regulatory authorities that publish publicly accessible reports on drinking water quality and quality of service delivery in urban and rural areas



Source: Data from the WHO UN-Water GLAAS 2021/2022 country survey results, to be released in December 2022.

Surveillance to assess water quality and service delivery is a critical aspect of regulatory frameworks. However, many of the GLAAS 2021/2022 respondent countries did not have surveillance frequency requirements (for water quality, 25% did not for urban areas, and 36% did not for rural areas), and of those that did, few fully met the required frequency (only 24% met the required frequency in urban areas, and 19% in rural areas).[127]

GLAAS survey results also identified deficiencies in using water quality surveillance data to inform decision-making and drive corrective action. Among 110 respondent countries, only 50% reported fully enforcing the implementation of planning and action to address noncompliance with water quality requirements in urban settings, and for the 104 countries that responded regarding rural settings, the percentage fell to 39%. Data also indicate gaps related to water safety plan auditing (independent and systematic checking of a water safety plan to confirm its completeness, satisfactory implementation and effectiveness), which is a core surveillance function (see Box 11).

BOX 11 Policies to require and enforce water safety planning

To drive proactive risk management to ensure water safety, at least 64 countries have policies or regulations in place that promote or require water safety plans or their equivalents.[128,129] However, available data indicate considerable room for improvement. A 2017 global survey on water safety plan policies and practice found that almost two thirds of countries reporting policies in place or under development did not have complementary requirements for auditing. Among countries where requirements for water safety plan audits were reported, when asked if they had established an audit frequency, only half responded yes, suggesting that audit schemes were at an early stage of implementation. Further, nearly half of responding countries identified a lack of enforcement as a critical challenge to water safety plan implementation.[130]

In many countries, water quality regulations may exist but are not enforced for myriad reasons. A common issue stems from the institutional arrangements and underlying mandates for the various institutions. For instance, the responsibility for water quality surveillance might lie with a government ministry that has limited enforcement authority over a separate government ministry that is providing water services. Enforcement can also be weak in cases where there is duplication, and multiple institutions are mandated to regulate the same services, and no clear line of authority (see Box 12 for an example from Ghana).

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BOX 12

Clarifying mandates for drinking water regulation in Ghana

In Ghana, a workshop aimed at validating GLAAS survey findings revealed gaps and overlapping mandates in the regulation of drinking water quality in the country. Prior discussions among stakeholders during the development of a National Drinking Water Quality Management Framework between 2013-2015 had suggested gaps, overlaps and an overall lack of clarity regarding which institution was responsible for overseeing drinking water quality.

Subsequent discussions were held with stakeholders during a validation workshop for a GLAAS survey conducted in 2018, which revealed that both the Public Utilities Regulatory Commission and the Food & Drugs Authority were apparently mandated to regulate drinking water quality. There were several challenges emanating from this overlap in mandates:

- Scarce resources not being put to efficient use as a result of the duplication of efforts, leading to high transaction costs;
- Lack of consensus on strategic goals due to the lack of coordination on the setting of sector targets;
- Weak compliance with and enforcement of water safety planning requirements; and
- Negative impacts on capacity-building initiatives for water safety planning, as it was unclear which institution should be invested in.

To help address this issue, the Government of Ghana established a National Coordinating Committee on drinking water quality management that seeks to improve coordination and collaboration between the Public Utilities Regulatory Commission and Food & Drugs Authority in the short- to medium-term, with a long-term view to revise the national water policy and underlying legal frameworks and clarify institutional mandates. Revision of the national water policy is underway. Additionally, members of the WHO International Network of Drinking-water and Sanitation Regulators are providing peer advice during the review process.[131]

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4.4

The cost of achieving universal safely managed drinking water supply

A 2016 study estimated the costs of meeting SDG Target 6.1 for safely managed water services.[132] The total capital cost of universal access was estimated to be US$ 37.6 billion per year between 2015 and 2030, a total of US$ 564 billion, if all users transitioned directly to safely managed drinking water services. As a step toward safely managed services, the costs of achieving a basic water supply, defined as an improved community water source within a 30-minute round trip, was also estimated. If 50% of households first achieved a basic level of water supply service before upgrading to a safely managed service, the cost was US$ 41 billion a year, for a total of US$ 615 billion. The study authors point out that it is important to strike the right balance between going straight to higher-level services, which might save some costs in the longer term, but will pose financial and technical constraints in the shorter term, and going through lower-level services first, which are more affordable and still provide socioeconomic benefits. The cost of operation and maintenance is in addition to these costs, and is estimated to be US$ 42 billion annually, or a total of US$ 635 billion between 2015 and 2030.[133]

The capital costs of reaching the unserved with safely managed WASH services (safe water, basic sanitation, safe faecal waste management, hygiene) were estimated to be, on average, 0.39% of the gross domestic product of the 140 countries included in the study, or approximately three times the historic spending on extending services to the underserved.[134] Applying the ratio of the cost of water services alone to the total cost of all WASH services to this percentage gives an average cost of 0.14%

of gross domestic product for achieving universal access to safely managed water services in the countries studied.[135]

As discussed in Section 2.3, investments in safely managed water services have been shown to provide a significant positive return in most regions of the world, and globally; governments save money when they invest in drinking water (in terms of reduced health costs, increased productivity and other quantifiable benefits).

The underlying cost data for the 2016 study were gathered from the best available secondary sources (i.e., available published and grey literature and other databases) and used an estimate of baseline water supply access rates made available by the JMP in 2014. The likely ranges of the cost estimates were calculated at global and regional levels. Thus, the cost estimates are useful as 'ballpark' estimates of what it would cost to meet Target 6.1. To assist countries in producing more accurate estimates of what it would cost to meet the SDG 6 targets, in 2017 a WASH SDG costing tool[136] was developed by UNICEF and the World Bank for use by countries attending the high-level meetings of the Sanitation and Water for All (SWA) partnership. A guideline for using the tool was developed collaboratively by the SWA Secretariat and UNICEF,[137] and has been used by more than 20 governments, including the Government of Ethiopia, which applied it as part of the process of estimating the costs of the second phase of the national One WASH programme.

BOX 13 Understanding water sector funding and financing

The provision of reliable, high-quality drinking water services depends on a sustainable financing environment, including adequate expenditure on both capital investment and maintenance, realistic revenue projections, and skilled financial management. There are three major sources of funds for water supply: taxes levied by government on households and businesses; transfers, such as overseas aid; and tariffs or user charges paid by consumers of water. Together, these are referred to as the 'three Ts.' The cost of providing a water supply service includes capital costs (including the costs of financing or borrowing), the costs of operating and maintaining water supply systems, and externalities (such as environmental costs). The failure to recover any one of these costs has distinct, adverse consequences, including deteriorating services and failure of water supply infrastructure. Many service providers struggle to cover costs through tariffs alone, hence the importance of funding received through government budget allocations (funded by taxes) and development aid (transfers). However, such funding, regardless of the source, must be accurately forecasted and accounted for, and may come with disadvantages for service providers in terms of predictability and autonomy. Development aid, in particular, is provided in low volumes compared to the needs in the sector, can be intermittent and sporadic, is unlikely to cover operation and maintenance, and is dependent on the priorities of donor agencies as much as the needs of service providers.

Correctly identifying and quantifying costs is fundamental to designing tariffs and user charges. Water tariffs charged by utilities providing piped water typically comprise fixed charges, volumetric charges, or a combination of the two. A range of tariff structures has been developed, and water tariff design demands a holistic, context-specific approach that carefully considers competing policy objectives. For cost recovery, the objectives may include economic efficiency, affordability and equity, environmental sustainability, simplicity and ease of implementation, acceptability, transparency, financial stability, and the promotion of access to services. Tariff complements can be added to core elements of the tariff to achieve specific aims, for example, addressing affordability or promoting water conservation through over-consumption penalties. The use of technology has allowed the design of more precise, effective and efficient tariffs (e.g., through smart meters, remote sensing, and street view data, combined with machine learning).[138]

Once a utility achieves financial sustainability, it may be able to access the capital market through a variety of financing instruments such as commercial loans, bonds or other arrangements.

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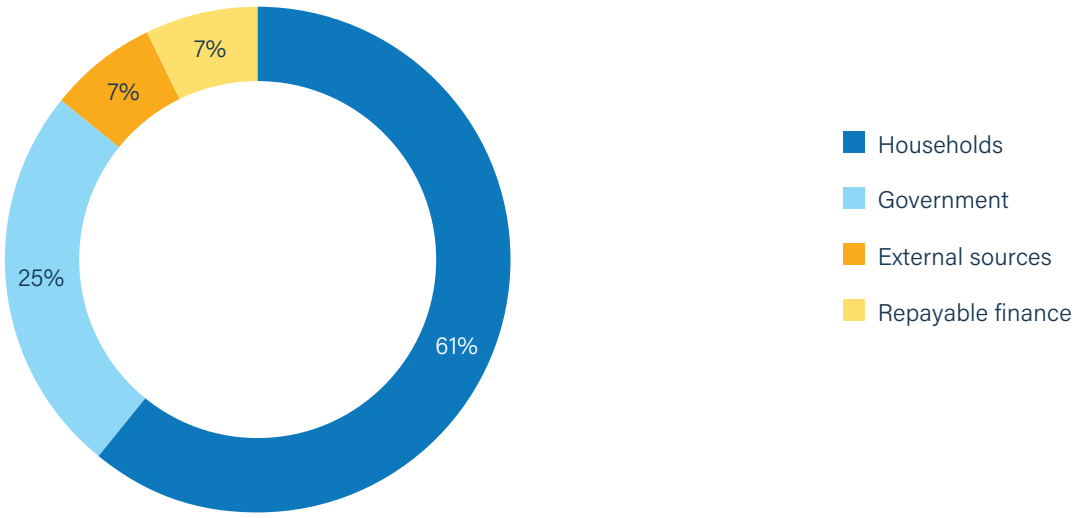
4.5 How much is being invested, and where is it coming from?

The GLAAS survey asks respondent countries about total expenditure on WASH activities (i.e., disbursements, or what is actually spent). Expenditures can take many forms, including government investment in capital works, government spending on staff, or amounts paid by households on tariffs, user fees or investments in their own water supply systems.

Preliminary GLAAS 2021/2022 results from 24 countries (Albania, Bangladesh, Belize, Burkina Faso, Cabo Verde, Costa Rica, Cuba, Ghana, Guatemala, Guyana, Lao People's Democratic Republic, Lebanon, Lesotho, Malawi, Mali, Mauritania, Mozambique, Nepal, Nicaragua, Nigeria, Paraguay, Seychelles, South Africa, Uruguay), representing 667 million people, 9% of the global population, show that while the governments in these countries provide one quarter of the funding for drinking water, households are the largest source of financial resources, accounting for 61% of the total expenditure (see Figure 20).

In addition to paying tariffs and user fees, investments by households in their own systems for drinking water supply ('self-supply') may play a major part in bridging the drinking water funding gap, particularly in rural areas, but also for significant numbers of people in urban areas where services can be limited geographically or expensive.[139] Data for seven countries in 2017 indicated that in three (Bangladesh, Ghana and Peru) self-supply investment exceeded the amounts contributed by households through tariff payments.[140] (However, unregulated self-supply can lead to problems of over-extraction and public health threats. Reliance on self-supply for certain sectors of the population, such as remote rural dwellers, results in inequalities. There is a role for government in both regulating and helping to fund household level systems, and governments should not use a policy of self-supply to relinquish their investment obligations.)[141] Another type of (unplanned) household investment occurs when low levels of service require

FIGURE 20 Sources of funding and finance for drinking water (24 countries)



Source: Preliminary data from the WHO UN-Water GLAAS 2021/2022 country survey results, to be released in December 2022.

users to pay 'coping costs' to compensate for intermittent or unreliable water supply. For instance, users experiencing intermittent piped supply may cope by purchasing water from tanker trucks or commercially packaged water, pumping to obtain the largest possible amount of piped water when it is available, and installing tanks to store water.[142,143] Some econometric studies have attempted to quantify coping costs, finding that households on intermittent piped supplies may pay between two and five times their current utility bill to cope with intermittency.[144,145,146]

External sources of funds, including repayable finance and official development assistance (ODA), make up a small proportion of the resources available for drinking water services.

While development banks are providing significant repayable finance, sometimes on a concessionary basis (for instance, the World Bank's portfolio of water-related lending is over US$ 50 billion)[147], very little borrowing for water supply is being done on commercial markets, either international or domestic. This is largely due to the difficulty in reaching creditworthiness on the part of water service providers, and the lack of an enabling regulatory environment.

Data from the Organisation for Economic Co-operation and Development (OECD) show that ODA commitments specifically for water supply systems were US$ 2.2 billion in 2020. While globally ODA has increased over the last decade, proportionally, investments in water have decreased. According to OECD data, since 2018, when ODA commitments to drinking water services peaked at 1.8% of total ODA, the proportion of total ODA commitments to drinking water had fallen to 0.9% in 2020 (its lowest since 2015). In 2018, aid for drinking water ranked twentieth among 42 sectors in terms of ODA commitments. However, in 2020 its ranking dropped to twenty-sixth among all sectors, with sectors such as energy policy, secondary education, forestry and business services jumping ahead.[148]

The majority of aid disbursements for water are focused on what are categorized as 'large systems', with 'basic systems' making up a smaller proportion. Large systems are often piped water systems in urban areas, while basic systems tend to be lower technology systems in rural areas. As shown in Figure 21, ODA disbursements for basic water supply systems have remained relatively stable, ranging from US$ 450 million to US$ 550 million per year, while disbursements for large water supply systems have increased over time, and fluctuated widely. In 2020, ODA disbursements

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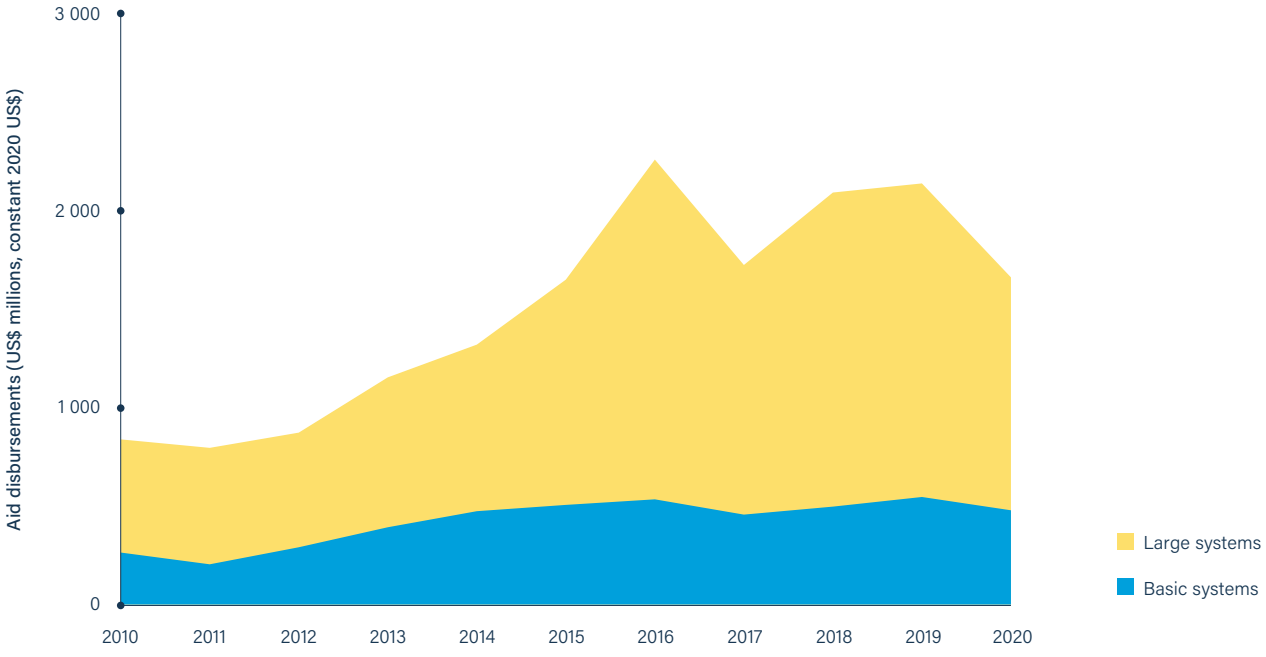
for basic water supply systems comprised only 29% of aid for water supply systems overall, even though most of the poor and unserved are in areas (rural, peri-urban) that are more likely to be served by basic systems. The wide variation in amounts disbursed, and the gap between commitments and disbursements, further underlines the unpredictability of ODA as a source of sector funding.

Financing and funding mechanisms specifically targeting climate adaptation and mitigation are emerging. Many donors are currently revising their ODA priorities and trying to identify sectors that can be considered as contributing to climate change adaptation or mitigation. OECD reports that of all bilateral ODA in 2019, 27.2% had climate objectives.[149] Water is often included in this 'green ODA'. Climate finance for water may become an important resource in the future. However, it is expected to complement the other sources of funding and financing for the water sector, not replace them.

FIGURE 21 Breakdown of water supply aid disbursements, basic versus large systems, 2010–2020



Source: Adapted from CRS Aid Activity database [online database]. Paris: Organisation for Economic Co-operation and Development; 2022 (https://stats.oecd.org/Index.aspx?DataSetCode=crs1 accessed on 25 April 2022).

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Imagining a better future: A dramatic acceleration in progress is possible

Despite the many challenges that remain in achieving universal access to safe drinking water, remarkable progress is possible. Acceleration requires governments to leverage their role successfully, and both public and private investments to be well used and sustained. The availability of accurate and appropriate data should be considered an important first step for governments as it allows them to identify the most pressing gaps and challenges in the delivery of safe drinking water so that investments can be targeted most effectively. Governments should aim to make progressive improvements, keeping their ultimate goals clearly in sight.

Every country that has made rapid progress in providing safe drinking water has had strong political leadership, and government has played an important role in setting policy, planning, mobilizing investment and regulating services.

5.1 The SDG 6 Acceleration Framework

The SDG 6 Global Acceleration Framework, coordinated by UN-Water, has identified five accelerators to support the achievement of SDG 6:

Governance: Make SDG 6 everyone's business through cross-sectoral and transboundary collaboration, clear roles, stakeholder involvement and effective and inclusive institutions.

Financing: Optimize financing for water and sanitation, particularly for countries and communities with limited access to financial resources.

Capacity development: Focus on inclusive human and institutional capacities at all levels to understand and deliver SDG 6.

Data and information: Build trust through data generation, validation, standardization and information exchange for decision-making and accountability.

Innovation: Leverage and scale-up innovative practices and technologies in schools, health care facilities and other public places, including technologies that are accessible for rural areas and marginalized communities.

5.2 Countries are rising to the challenge

There are promising examples in which investing in these five accelerators has been effective. There are many countries with stories of considerable success, even in resource-poor contexts. For instance, the Government of Ethiopia has played a strong leadership and coordination role, working on several of the SDG 6 accelerators at the same time, and addressing climate resilience (see Box 14).

BOX 14 The ONEWASH National Programme in Ethiopia

To address sector fragmentation and slow progress in achieving national and international targets, in 2013, the Government of Ethiopia initiated the ONEWASH National Programme. The programme is a collaboration across four different ministries: the Ministry of Water and Electricity, the Ministry of Health, the Ministry of Education and the Ministry of Finance and Economic Cooperation. The programme is also a collaboration with development partners. The main instrument is the Consolidated WASH Account, a pool fund with contributions from the Government of Ethiopia, the World Bank, the African Development Bank, UNICEF, and the governments of the United Kingdom of Great Britain and Northern Ireland, Finland and (more recently) Republic of Korea and Saudi Arabia.

Under the motto 'One Plan, One Budget, One Report', the second phase of the programme established an integrated and collaborative approach and set more ambitious targets. The guiding principles included alignment through a single planning, budgeting, financial management, reporting, procurement and monitoring and evaluation system, and harmonization with the policies, priorities, strategies, standards and procedures of the Government of Ethiopia. Phase 2 had a total budget US$ 6.5 billion for 2018-2020, including one third of the funds allocated to climate-resilient WASH. The Consolidated WASH Account pool fund has grown, with new donors contributing, and the duration of the pool fund has been extended until mid-2024.

The second phase of the programme incorporates measures to achieve climate resilience, including the management of climate-related risks through water safety planning. The government has developed a national framework for climate-resilient water safety planning, including urban and rural implementation guidelines and supporting national training materials. A number of larger urban utilities now also include water safety planning as a key performance indicator. Resilient water sources have been identified using remote sensing techniques, and climate-resilient service delivery models have been promoted, such as multi-village water schemes operated by public water utilities.

Between 2015 and 2020, JMP data show an increase in the number of people in Ethiopia using at least basic drinking water services from 42 million to 57 million (from 42% to 50% of the population or by 1.5 percentage points per year). During this period, Ethiopia also reduced the number of people relying on surface water from 12 million to 5 million, the fastest reduction of any African country.[150] The Ethiopian ONEWASH National Programme is a model of acceleration through government leadership and coordination across ministries and sector stakeholders and is now being replicated in other countries.[151]

In India, remarkable progress has been made in increased levels of drinking water service delivery (see Box 15).

The recommendations which follow, organized by the SDG 6 Accelerators, are targeted at governments in their roles as duty-bearers, with obligations to ensure their populations are served. However, many other stakeholders have roles to play in supporting progress, including donors, development agencies, civil society, researchers and consumers.

BOX 15 Government commitment to household tap connections for all rural dwellers in India

In August 2019, the Government of India committed to provide a "functional household tap connection" to every rural household by 2024. The Jal Jeevan (Water for Life) Mission[152] was launched by the Prime Minister with a mandate to ensure that, in full alignment with SDG criteria for safely managed water supply, every rural household is served with potable water supply, in adequate quantity and of prescribed quality, on a regular and long-term basis. This is to be achieved through household tap connections connected to locally-managed village piped water supply infrastructure.

This ambitious programme is currently being implemented in partnership with state governments. Across all levels of government, more than US$ 65.6 billion in public sector funding has been committed. The Indian Government is driving a paradigm shift away from simply building water supply infrastructure, to concentrating on providing water supply as an ongoing service. The focus is on establishing decentralized, demand-driven, community-managed water supply systems. Grassroots-level support is prioritized, and communities play a pivotal role in planning, implementing, operating and maintaining their schemes. At the village level, the local government institutions, called Gram Panchayats, are empowered to commission construction work, operate and maintain infrastructure, collect community contributions, monitor water quality monitoring, and ensure source sustainability through water resource management.

The Department of Drinking Water and Sanitation of the Ministry of Jal Shakti ('Water Power') provides technical and financial assistance to the states, supported by development partners. States have been encouraged and supported to develop robust institutions, with a focus on service delivery and financial sustainability. Approximately 11,000 support agencies, mainly NGOs, are being engaged by states to support implementation at the village level. They are following national guidelines, which cover aspects such as community empowerment and engagement, water quality testing and surveillance, utility operation, and water safety and security planning. There is an emphasis on source sustainability measures, such as recharge and reuse through grey water management, water conservation and rainwater harvesting. To provide support, 104 key resource centres have been selected and contracted by the ministry, and personnel within them trained by UNICEF. These centres will support capacity development, performance monitoring and course correction of the programme. The efforts to support and strengthen water governance systems within Gram Panchayats are implemented with a focus on women's empowerment; local women are encouraged to take leadership roles.

As a result of the programme, between August 2019 and March 2022, the government estimates that coverage of functional household taps in rural areas increased from 17% to over 49%. Tap water has also been provided to almost all schools and pre-schools in the country.[153]

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Governments can accelerate drinking water supply progress with proven, effective approaches

6.1

Good governance begins with leadership, effective coordination and regulation

Overarching Recommendation:
Governments should progressively strengthen existing institutions, fill institutional gaps and facilitate coordination. They should establish a stable regulatory environment supported by legislation and clear policies, including standards for service quality, and ensure enforcement.

Governments must develop holistic approaches to the reform of the water sector, aligning policy, institutional and regulatory interventions. Specifically, changes in institutional arrangements and the regulatory framework need to be supported by the necessary laws and policies to be effective and sustainable. Governments should establish institutions to coordinate and regulate the activities of both public and private service providers, improve efficiency, generate public benefits, and ensure service to all. Policies for drinking water service provision should be designed to eliminate inequalities in drinking water access and reach the most vulnerable, while ensuring sustainability and climate resilience. However, policies must also be practical and achievable. Governments should recognize that improving sector governance and service provider performance is difficult, takes years, and requires strong commitments across multiple levels of government, communities and citizens.

Governments should establish simple and transparent regulation that protect all consumers, allows and encourages continuous improvement, innovation and cost recovery, and facilitates service provision for the poor and vulnerable, consistent with the commitment to "leave no one behind".

Regulatory models need to be appropriate for the context and reflect the relevant institutional setup, political economy and legislative frameworks. Regulation should consider all drinking water services, taking into account the various types of systems and the particular needs and limitations of each. It is important to align targets with human and financial resource realities, initially setting realistic and risk-based goals that provide sufficient public health protection, with a view toward the progressive achievement of more ambitious targets in the longer term. There is limited value in establishing requirements that cannot practically be achieved, creating an environment in which noncompliance becomes the status quo and regulations lose their power to drive and incentivize improvement.

Small water supply systems, particularly in rural areas, require a customized, flexible regulatory approach that encourages incremental improvement. Despite the large number of people these systems serve, and clear evidence that they represent a comparatively high risk to public health through breakdowns, contamination and inadequate management, these systems are not always covered by national regulations. Safe and sustainable services can be supported through regulatory actions focused on supporting water suppliers with capacity development, technical advice, tools and financial incentives. For instance, in Peru, a recent reform extended the role of the regulator beyond urban areas to include small towns and rural communities, and the regulator is seeking to develop different regulatory modalities for small operators.

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BOX 16

A multi-tiered approach to regulation in Mozambique covers all types of service providers

Mozambique's water regulatory agency applies a flexible, decentralized, multi-tiered approach. The agency directly regulates the 19 systems in the country's major cities, which are owned by a public asset holder. The agency sets the standards for these service providers, gathers reports and directly audits service delivery performance. In 130 secondary systems, where the Water Supply and Sanitation Infrastructure Administration is the asset holder, the national level sets the standards and guidelines for service provision, and local regulatory commissions enforce regulations. For systems where local governments are the asset holders, and service provision is delegated to private operators, regulation is the municipality's responsibility. The national agency intervenes only if requested; this is referred to as consultative regulation.[154]

A variety of regulatory instruments are available that create incentives for utilities to expand access to the poor, including setting access targets (referred to as 'universal service standards'), with penalties in the case of unmet targets, and creating flexibility in reaching poor communities by allowing differentiated service standards and alternative service providers. Some governments subsidize the cost of water connections through performance-based instruments, whereby service providers are rewarded for the number of targeted households they connect. When low-income households already have access to services, regulators can design tariffs to ensure affordability for the poor, through such methods as a lifeline block in the tariff (though there has been varying success at targeting the poor and caution is needed) or targeted subsidies through direct transfers. The government's social and sector policies will ultimately shape the pro-poor objectives water-related regulation should try to achieve.[155]

Regulators must be as independent as possible, have authority for and conduct enforcement, and be mandated to publish results.

Investing in the regulatory environment is important. Building the capacity of the regulator, and ensuring financial viability and autonomy, are important priorities when a regulatory framework is being established. In the early stages of setting up a regulator, before a more formalized regulatory arrangement is developed, creating a 'ring-fenced' unit within a ministry or department may be the best or only option. Resources and data capacity-building should be provided so that the unit can establish a system to monitor and evaluate service providers and service delivery, and can be the initial foundations for a more substantive regulatory arrangement.[156] Regulators must enjoy institutional, financial, managerial and political autonomy, meaning that the regulator must have sufficient skills, capacity and financial resources to carry out its functions, be able to determine its own administrative and operational procedures, and be able to make decisions that are unbiased and free from undue influence.[157]

It is important for regulators to publish and disseminate the findings of their oversight activities. Public disclosure, comparison and discussion of a set of performance metrics is a powerful way to bring transparency and accountability to the sector. Poor performance of service providers is publicly exposed, incentivizing them to improve. Because of the light it shines on provider performance, it is often referred to as 'sunshine regulation'.[158]

BOX 17 The willingness of the regulator in Kenya to apply sanctions has improved service delivery

Kenya's Water Act empowers the Water Services Regulatory Board to issue fines to water service providers for breaching or contravening regulations. The board is also able to revoke the license of a water service provider or place a water service provider under a special regulatory regime for failing to meet the criteria for licensing, failing to comply with any license conditions, or neglecting to provide services for which they were licensed.

Unlike many other regulatory actors across Africa, Kenya's Water Services Regulatory Board has proven willing to use the sanctioning powers at its disposal to penalize noncompliant service providers. The board frequently fines licensed water service providers when noncompliance is identified. For example, fines were levied on four water service providers in 2021, and another nine were denied financial support. In 2021, the board came close to revoking two service providers' licenses. Instead, it stepped in to replace the board and senior management. This willingness to use its sanctioning powers has resulted in improvements in utility management and service provision. Sanctioned utilities have addressed the areas of noncompliance and are now in good standing. For instance, those that were sanctioned for noncompliance with the approved tariff and were required to reimburse customers, have adjusted their billing systems.[159]

BOX 18 Transparent regulation results in better service delivery in Portugal

In Portugal, the Water and Waste Services Regulation Authority is an independent authority with a mandate to regulate drinking water service provision, supported by both national legislation and the European Union's Drinking Water Directive. The authority has increased accountability and transparency by publishing annual reports, available to the public, which report against key performance indicators related to the quality of service from the national strategic plan for water, including an indicator for water quality. They have also established a public online data platform with information on individual utility performance across several indicators. This public benchmarking exercise has fostered a healthy environment of pride and competition amongst utilities.

The Water and Waste Services Regulation Authority has evolved previously rigid monitoring regimes to a more risk-based and flexible approach. The regulator's emphasis is on the use of inspection, meetings and capacity-building to resolve issues, rather than penalties. All municipal water supply service providers are required to establish a water quality control programme, which is key to the comprehensive annual water quality regulatory cycle. Cooperation with health authorities has been prioritized, and the authority's online information management system is accessible to them, so they can add their own data to the platform. They have final authority on health-related matters related to noncompliance, such as the decision to shut water supply due to contamination.

As a result of these changes, Portugal has seen a significant improvement in water safety. Between 2004 and 2008, the indicator for safe water, which measures compliance with the water quality standards, rose from 84% to 97%, and since 2016 has reached and been maintained at 99%.[160] While part of Portugal's success in improving drinking water quality is attributable to significant infrastructure investment over several decades, it has been complemented and sustained through an increasingly comprehensive, risk-based, transparent and collaborative regulatory system.[161]

Governments should create an enabling policy environment that supports higher service levels in households, health care facilities and schools, so that safe, abundant, on-premises drinking water becomes the norm.

Higher levels of service have been shown to provide greater benefits in terms of health,[162,163] convenience and time savings. On-premises water is particularly important to remove the disproportionate burden of water-carrying that falls on women and girls. Higher service levels may be achieved progressively, with the provision of basic levels of water service as an intermediate step.

Government policy should support improvement in the operational performance of service providers, and the establishment of management models that ensure sustainable, professionalized service delivery in both large and small systems.

Many water service providers need to improve their operational efficiency. Providers that are unable to collect a significant proportion of their allotted tariffs or have high non-revenue water rates are not financially viable or sustainable. They struggle to attract public finance, and they certainly are not able to attract private finance.

There is no one-size-fits-all solution for the performance problems of water service providers. However, countries and utilities that improve their performance tend to implement the same key actions in roughly the same order. Technical solutions alone are unsustainable, and for reform measures to endure, positive incentives need to be embedded in poli-

cy, institutional and regulatory structures, which must be aligned. Utilities under severe financial distress tend to focus first on achieving financial sustainability by either increasing revenues or reducing costs. Next, they set objectives through multiyear targets incorporated into sustainable business plans. In almost all cases, the first actions in their business plan involve improving human resource and management information systems. In almost all cases, performance contracts are signed with the government at some point during the turnaround, which define the utility's expected performance and the support to be provided by the government to achieve it.

BOX 19 Dramatic utility performance improvement in Phnom Penh, Cambodia

The Phnom Penh Water Supply Authority is responsible for providing water services to approximately 1.5 million people in Phnom Penh, the capital city of Cambodia. Prior to 1993, the authority was plagued by patronage and corruption. Lack of electricity, chemicals, funds and qualified personnel to undertake operation and maintenance prevented the utility from providing adequate service. Thousands of illegal connections existed, many installed by the utility's own staff. The appointment of a new director in 1993 saw the utility drastically improve its performance and begin a turnaround. The director cracked down on corruption, pushed for operational efficiency, and used donor support in an effective manner. To lower corruption, staff and government officials led by example—everyone was obliged to install a water meter and pay for water, even the Prime Minister. To improve operational efficiency, the director focused on increasing water pressure, reducing non-revenue water and improving collections. The changes were further backed by Cambodia's First Socio-Economic Development Plan (1996-2000), which stated that the Phnom Penh Water Supply Authority would become a self-sustaining commercial entity based on full cost recovery, meeting WHO standards for water quality. The government also committed US$ 95 million to the authority and adopted a National Policy on Water Supply and Sanitation, which re-emphasized the importance of sustained access to safe water.

The Phnom Penh Water Supply Authority raised revenues by reducing energy costs, improving the collection rate, and raising the average tariff. These revenues allowed the authority to increase salaries, introduce performance-based remuneration schemes, and invest in the distribution network, expanding service coverage. Progressive improvements in efficiency and performance increased the authority's credibility, which resulted in high levels of donor support, in turn allowing it to rehabilitate and expand its networks. The number of connections grew tenfold between 1993 and 2014, rising from nearly 27,000 to over 270,000, including many connections provided to poor households. Today, the Phnom Penh Water Supply Authority is considered Cambodia's best-run utility.[164, 165]

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In the rural areas of many countries, volunteer-based community management remains the norm and is often insufficient to meet the complex challenges of sustaining reliable service delivery. There is an urgent need to move towards competent, professionalized service delivery in both urban and rural areas, supported by institutional reform. A good example of government policy supporting professionalized rural water supply services and the shift towards 'utilitization' is found in Uganda (see Box 20).

BOX 20 Government policy drives successful utilitization of rural water supply in Uganda

Water services are increasingly being provided by utilities, not just in urban areas, but also in rural areas, even in low- and middle-income country contexts. Uganda is an example of a country where this transition is in progress, driven by the government's 'Vision 2040' of ensuring safe piped water supply to all by 2040. The 'utilitization' process is taking place through the extension of the national utility water services into rural areas, and the establishment of regional utilities, taking over management of schemes that were previously community-managed.

In 2016, the government gave the national utility, the National Water and Sewerage Corporation, the mandate to provide services to small towns and rural growth centres. Extension of the corporation's services into rural areas has been fuelled by its 100% Service Coverage Acceleration Programme, under which the corporation had a goal to supply 12,000 villages through new connections and public standpipes by 2020. The government also formed six regional utilities, called umbrella authorities for water and sanitation, in the same year. The 'umbrellas' were created from existing organizations that had provided support to community-managed piped schemes. Many small schemes that were previously community-managed have now been legally transferred to the new style, leading to a consolidation of service provision under a smaller number of larger operators. Private sector participation in water supply has been encouraged, though this is mostly limited to small-scale contracting for operation and maintenance. The new umbrellas currently manage about 440 piped water supply schemes, serving approximately 2.5 million people (about 7% of the country's rural population), and are being supported through government capacity-building.[166,167]

Even highly informal elements of the water sector can benefit from regulation and formalization. For instance, manual drilling is a method of providing drinking water that has rarely been regulated, but is now being professionalized by governments in many countries (see Box 21).

BOX 21 Changes in policy and regulation support professionalization of low-cost manual drilling

Manual drilling relies on human energy to construct boreholes. The equipment used is generally lightweight, and can easily be transported to remote locations, reaching difficult-to-serve populations that would otherwise be left behind. Costs are considerably lower compared to machine drilling, and manual drilling is often significantly faster. Modest initial investment costs mean that barriers to entry for enterprises that want to venture into the business are low. However, the informal nature of the work means that many practitioners learn by trial and error. There is an urgent need to professionalize, build capacity and raise quality standards.

Thanks to the availability of technical manuals and the mapping of many areas suitable for manual drilling ('feasibility maps'), the quality of manual drilling is improving, and is increasingly recognized in policy and regulations. For instance, in Zambia, the Water Resources Management Authority developed a legal and regulatory framework for the drilling industry that includes the licensing and certification of manual drillers, and has run capacity-building training programmes on manual drilling. In Madagascar, standards for manual drilling are included in the procedures manual of the Ministry of Energy and Mines, and include requirements for water quality testing, well development, pumping tests and sanitary seals. In the Democratic Republic of the Congo, the government adopted a strategy in 2009 to promote manual drilling, and the Ministry of Health and the Ministry of Rural Development launched an initiative to develop the capacity of the private sector and NGOs. Manual drilling in the country has since gone from a little-known technology to providing an estimated 650,000 people with safe drinking water.[168,169]

Drinking water quality should be regulated using risk-based approaches, for instance, through water safety plans undertaken by service providers and supported by surveillance.

A risk-based approach is important in ensuring that regulations are contextually relevant and based on the risks relevant in the local context. This includes requiring the adoption of a preventive 'catchment to consumer' risk management approach by water suppliers, such as water safety planning, to complement monitoring undertaken to ensure compliance with parameter limits. It also includes establishing a priority set of parameters in regulations that is both protective of public health and sensitive to the human and financial resources required to monitor an extensive list of parameters, not all of which may be locally relevant. Such prioritization also provides a sound basis for incremental improvement, whereby a modest set of high-priority parameters could initially be regulated, and additional parameters included as more resources become available.

BOX 22 Taking a risk-based approach to mandated water quality monitoring in Viet Nam

Prior to 2018, Viet Nam's drinking water regulations required larger water service providers to routinely monitor 109 water quality parameters. The monitoring requirements created a considerable cost burden for service providers and, by extension, water users. Further, many laboratories used by service providers and surveillance agencies lacked the capacity to analyse the full set of regulatory parameters. To better direct monitoring resources toward the most significant threats to public health, the Government of Viet Nam, with support from WHO, revised its regulations to reflect a risk-based approach. Through this process, a tenth of the parameters were removed completely from the mandatory monitoring list, and the number of parameters to be monitored monthly was cut by half. For the remaining parameters, the new regulations stipulate that provincial authorities may reduce the required monitoring frequency from every six months to every three years for parameters determined to be a lower risk in the local context. Local risk assessments consider geological conditions, historical quality of both raw and treated water, agricultural and industrial activities, and water treatment processes. Among those provinces that have conducted risk assessments since the revised regulations took effect, the median number of water quality tests to be carried out on an annual basis has been reduced by approximately one third relative to prior requirements.[170]

BOX 23 Embedding water safety planning in national policy in Bangladesh

Despite significant increases in water supply coverage in Bangladesh, poor water quality remains a public health threat. Drinking water at the household level has been found to contain microbiological contamination in almost 82% of cases,[171] with two thirds of this contamination linked to poor hygiene at, or after, the point of collection.[172] One initiative aimed at improving this situation was the introduction of water safety planning. In pilot projects supported by WaterAid and WHO starting in 2006, a water safety planning approach was introduced whereby community members, particularly women, identified potential risks of contamination and helped to design step-by-step measures to improve hygiene and protect water quality from source to consumption. These were coupled with systems for periodic monitoring of control measures, including water quality testing. One of the key successes during the pilot phase was increased community awareness that installing a tubewell would not ensure water safety on its own, and that other water safety behaviours, along with regular monitoring, are also required. Other benefits that emerged included better operation and management practices, greater cost recovery, increased water quality monitoring and better communication among stakeholders.[173] Water safety plans were also found to support the systematic consideration of the most disadvantaged water users in a community and to facilitate equitable participation, interventions and outcomes.[174]

To scale up the approach, the Government of Bangladesh integrated water safety planning into the National Water Safety Framework in 2011, which promotes the plans and addresses their oversight and auditing. By 2017, the government had initiated requirements for water safety plans for all new projects under the Planning Commission vetting guidelines. The National Strategy for Water Supply and Sanitation, revised in 2021, now mandates the introduction of water safety plans and water quality surveillance, including water safety plan auditing, in 100 cities and 50 villages by 2024.[175]

Governments should consider the impact of climate change and take action to increase the resilience of water infrastructure and services, and mitigate their climate impact.

When making policy, governments should consider both the adaptation aspects of drinking water, including the need to build resilience to more extreme weather events, and the role it can play in climate change mitigation. There is a need for stronger collaboration and coordination between the government entities responsible for climate and water. The inclusion of water in Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs) is paramount.

Governments should promote coordination between mandate-holders in the water sector, and encourage collaboration across drinking water service provision and water resources management, between rural and urban authorities, and across ministries.

It is important to overcome the historic fragmentation in the water sector and bridge the divide between those responsible for financing and service delivery, as well as between the various water subsectors. It is essential to manage competing demands for water resources and to exploit synergies in the sector. For instance, increased wastewater treatment and access to sanitation are needed to protect ambient water quality, which, in turn, greatly facilitates the provision of safe drinking water, while increasing use efficiency and reuse safety makes more water available for drinking and other uses.[176]

Governments should review policies, regulatory arrangements, strategies and implementation models to ensure they are inclusive and gender sensitive.

For instance, implementation approaches must allow for the meaningful participation of women in decision-making and governance related to drinking water, and lead to their social, political and economic empowerment. Other practical steps include ensuring that marginalized groups are represented in coordination bodies, improving accountability mechanisms, including accountability to users, and considering affordability aspects when setting tariff policy.[177]

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6.2 Smart public finance unlocks effective household and private investment

Overarching Recommendation:
To achieve the quadrupling of progress needed, funding and financing from the public sector, private sector and donors must increase dramatically, water service providers must improve efficiency and performance to ensure funds are used optimally, and governments should provide a stable and transparent administrative, regulatory and policy environment that encourages investment.

Governments should develop clear policy objectives to guide funding and financing decisions, fully understand all the costs of drinking water service provision, and make informed, evidence-based decisions on the allocation of funds and the setting of tariffs and user charges.

Governments should invest in drinking water services, using allocations from the public sector budget catalytically and strategically, creating incentives for efficient, sustainable service provision and prioritizing reaching the unserved.

Safe, accessible and reliable drinking water provides economic and health benefits and essential gender-equality outcomes. Government investment in the sector is justified by the returns it produces, including reduced costs in other sectors, such as health. Even governments with little fiscal space can still take meaningful steps to progressively improve services. However, increased investment requires better governance and stronger institutions, and government budget allocations must be used well, and incentivize efficiency and sustainability.

BOX 24 Strategic use of public sector funds in Mexico and Peru

In Peru, the General Directorate of Public Budget at the Ministry of Economy and Finance established a system of transfers to local governments called the 'Incentives Programme for the Improvement of Municipal Management.' To improve the quality of public sector services, funding from the national government is provided to municipalities on the condition that they achieve agreed-upon goals. In the water sector, these include the number of rural water operators registered, the number of water supply systems built or rehabilitated, and the number of water systems chlorinated. The programme also provides technical assistance to improve the managerial skills of local government personnel. Under the programme, public funding of Peru's water and sanitation sector has steadily increased, rising from roughly US$ 2.5 million in 2015 to US$ 32 million in 2020. Between 2015 and 2019, 15,901 rural water and sanitation operators were registered, 31,917 water systems were built, 2,500 rural water systems were rehabilitated, and 1,997 chlorinated systems were installed.[178]

In Mexico, investment in water supply services is predominantly made by municipalities, state governments, and private housing developers, but most of the money ultimately comes from the federal government. The six-year development plans prepared at state level set priorities for water investments, for which states and municipalities seek federal co-funding. About 25% of water and sanitation investments are paid with funds channelled as transfers to local agencies through the Comisión Nacional del Agua (National Water Commission). Most of the commission's funding to municipalities and states is provided through the Programa de Agua Potable, Alcantarillado y Saneamiento en Zonas Urbanas (Water Supply, Sewerage and Sanitation in Urban Areas). Funds are provided on a matching fund basis, which has successfully stimulated state and local investment in water. The National Water Commission provides help and technical assistance for local planning, (e.g., as part of the federal Programme for the Modernization of Water Utilities). In addition, under the Water Rights Return Programme, municipalities and utilities can reclaim the amount they pay in mandatory water charges to the federal government, provided they fulfil certain limited conditions and invest an equal sum financed by state, municipal or utility funds.[179]

Governments should encourage and support improvements in water service providers' financial performance.

Whether the source of their funding is from public or private sources, it is essential that drinking water service providers perform well financially. Financially efficient service providers focus on reducing non-revenue water (through improved billing, better revenue collection systems and improved operation, such as leak detection and control), optimizing their energy use, and controlling staff numbers. Improving service provider efficiency is critical to establishing creditworthiness, attracting investment from both the public and private sectors, and reducing reliance on government transfers and development aid. There are well-established indicators of service provider efficiency related to tariff collections, non-revenue water, employees per connection and other important parameters. These can be applied to diagnose weaknesses, incentivize improvements and track progress.[180]

BOX 25 In Viet Nam, a partnership builds the financial health of the Da Nang water utility

A partnership between a Vietnamese water utility, Da Nang Water Supply Company, and a Dutch company, VEI, between 2007 and 2010 helped transform the utility from an entity that relied on subsidies from the regional government into a profitable company able to expand its services to new consumers. The primary objectives of the initiative were to extend and improve water service delivery in Da Nang, the largest city in central Viet Nam, especially the urban poor, increase the water supply company's management autonomy and strengthen its financial position.

Dedicated capacity-development, and the incorporation of pro-poor strategies into the utility's operation, led to improved performance. The partnership also supported leakage detection models, changes in the tariff structure, and system improvement processes, such as metering, asset management, and the creation of a central control unit. Service coverage increased, water quality improved, full-cost recovery was achieved, and non-revenue water was reduced. Several years after the partnership ended, connections continued to increase, non-revenue water kept dropping (eventually reaching 15% in 2017, from 39% when the partnership started), and by 2018 Da Nang Water Supply Company's net revenue had increased to triple what it was in 2010. The improved creditworthiness of the company paved the way to access new sources of finance.[181]

Governments should ensure they achieve an appropriate balance between investing in new infrastructure and supporting the maintenance of existing infrastructure.

Although the operation and maintenance costs of new assets might be included in financial models at the project development stage, these costs are not necessarily budgeted once the assets are built. Assets that are not properly maintained do not reach their full economic life and reduce the effective and efficient use of allocated capital ('capital expenditure efficiency'). The expected benefit stream is curtailed as service deteriorates, infrastructure fails, and new assets must be built prematurely. A 2018 study examined the costs of poor operation and maintenance, and determined that "design, build, maintain is a more cost-effective solution than design, build, neglect, rebuild." Governments should consider costs associated with such maintainability issues as the robustness of the plant and equipment (including an efficient supply chain of spare parts), skills and competencies of the operation and maintenance staff, availability of maintenance tools and equipment, effective maintenance management systems, performance management systems for maintenance activities, and an overall enabling environment for effective maintenance management.[182]

Governments should budget for the costs associated with a supportive regulatory environment.

Regulators must have the financial resources needed to conduct surveillance, monitoring, reporting and enforcement. Governments should budget for costs associated with water quality surveillance activities and auditing of water safety plans. Allocations should also be made for regulatory activities to build the capacity of service providers.

Governments should seek to establish a conducive environment for the use of commercial repayable finance, both domestic and international, bearing in mind the complexities and the time and expertise involved. Governments should also develop the expertise and understanding to comply with the requirements of climate finance and access it.

Commercial repayable finance, in the form of loans, bonds and other instruments, is a possible source of funding, but only if drinking water service providers are tech-

nically and financially efficient, and governance, regulatory and administrative arrangements are clear and transparent. Private investment is only an option for creditworthy service providers in a predictable, stable regulatory environment.

In some cases, governments may find it beneficial to use a mix of resources, including repayable commercial finance, public funds and donor grants, to optimize investment. This is referred to as 'blended finance'. [183]

Climate finance for water is emerging as an important funding and financing opportunity. However, governments will need to fully understand the requirements and limitations associated with it, and ensure that initiatives for which it is proposed are designed with climate finance in mind.

BOX 26 Borrowing on the domestic capital market by water utilities in Kenya

Sector reforms implemented by the Government of Kenya in the early 2000s created autonomous utilities and an independent sector regulator, ring-fencing revenues and establishing a framework to move toward cost-reflective tariffs. These measures resulted in more self-sufficient providers, with the stronger ones covering operation and maintenance costs and generating surpluses for investment. Working with Kenyan banks, service providers and local governments, the World Bank provided support to financial management, project modelling and business planning. The regulator was supported to establish a mechanism to assess utility creditworthiness, integrating the process into utility performance evaluations. This support, plus partial credit guarantees from the United States Agency for International Development, allowed utilities in Kenya to enter into arrangements with lenders that extend floating rate loans for up to 10 years. The total volume of financing achieved totals more than US$ 25 million, and over 450,000 people have benefitted from new or improved services as a result.

This experience in Kenya confirms that commercial bank financing of water and sanitation utilities is possible under a conducive environment, specifically, adequate liquidity in capital markets; political commitment to the process; an independent regulator that supports cost recovery, transparency, and fairness; and utilities with demonstrated financial and technical capacity.[184]

Governments should work with agencies and institutions that support and provide microfinance to households for water supply investments.

The high upfront costs associated with access to safely managed water services are often prohibitive for many low-income households in the developing world, whose incomes can be variable and uncertain. Microfinance can play an important role in overcoming obstacles for these households.

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BOX 27 Incorporating repayable household finance into the government's programme for water supply in India

In India, small-scale repayable finance has emerged as a key part of the funding available in the push for universal access to piped wate. The government is supporting banks interested in providing loans to households and entrepreneurs to accelerate water supply access.

The Government of India is building an enabling environment favourable to repayable finance for water supply. In 2015, the Reserve Bank of India included water supply and sanitation within its Priority Sector Lending designation, meaning that financiers could lend to households for water supply and have it count towards their requirement to provide at least 40% of their lending as social lending. Furthermore, in 2017, the Ministry of Rural Development made access to water an eligible category for preferential interest rates within the National Rural Livelihoods Mission, its flagship program for Self Help Groups. Together, these decisions created critical incentives to mobilize additional lending. The international NGO, Water.org, partnered with Indian financial institutions, providing technical assistance and resources to encourage them to include water connection loans in their portfolios and develop new products.

Massive public investment in water supply and sanitation infrastructure notwithstanding, the sheer scale and complexity of providing access across states motivated many public and private institutions to be open to innovative financing approaches, such as household borrowing. The combination of government subsidies and access to loans has not only accelerated water supply access in alignment with ambitious national targets for success, but it has also complemented these efforts by enabling governments to target their investments more effectively, showing there is value in combining public and repayable finance.[185]

6.3 Capacity at all levels drives progress and sustains services

Overarching Recommendation:
Governments should build robust and competent institutions and a capable and motivated workforce through a range of capacity-development approaches based on innovation, partnership and collaboration.

Capacity development is essential to build strong foundations for the effective governance, financing, innovation and data management needed for sustainable and equitable drinking water services. Capacity development is far more than just training. It encompasses:

- **Human resources development:** Ensuring that institutions tasked with drinking water service oversight and provision employ the right types and numbers of adequately qualified, trained and motivated personnel, and that regular training is in place to address staff turnover and new knowledge.
- **Organizational development:** Ensuring that institutions are adequately empowered and use effective systems and procedures.
- **Resourcing:** Ensuring that institutions have access to sufficient financial, material and technical resources.

Governments should adopt approaches that overcome resource constraints, such as using private sector capacity to its full potential, harnessing the expertise and resources of NGOs and development agencies, and instituting peer-to-peer learning.

Capacity should be built in technical areas specific to water supply services and also to create a conducive enabling environment for sustainable water supply services, including competence in long-term planning and budgeting, improved cost recovery, revenue generation and financial sustainability.

Governments should strengthen their capacity to develop and administer the fundamentals of safely managed drinking water systems, including regulations, policies, time-bound strategies and costed plans, along with coordination mechanisms to ensure cross-sectoral integration and private sector involvement.

The water sector is changing and evolving rapidly, and capacity is required to assess, use and promote new and emerging technologies, including improved data collection technologies, and energy-efficient and climate-resilient technologies.

BOX 28 Building capacity for district master planning in Burkina Faso

In Burkina Faso, the national water utility was supported by NGOs to build local government capacity in the municipality of Banfora to lead the development of a long-term, district-level strategic plan for SDG 6. The support included coaching the municipal authority and staff in planning, budgeting, coordination, facilitation, supervision and engagement with local and national stakeholders, as well as monitoring and reporting. The municipality's strategic plan has since helped improve coordination, strengthen local capacity and attract funders for implementation. Based on the plan, local government, development partners and citizens raised 90% of the required expenditure for the implementation of the first phase,[186] and, as a result, the proportion of the population using improved water sources in the municipality increased from 69% in 2017 to 89% in 2020.[187] The development and implementation of district-level, strategic long-term master plans are being scaled up by the national water utility and local governments, with financial support from the European Union, with the intention of reaching all 50 urban communes in the country.[188]

The growth of professionalized service delivery must be supported by capacity development, particularly in small and rural systems.

Sustainable water service delivery requires both institutional reform and capacity-building to ensure ongoing, high-quality operation and maintenance. Professionalized service providers must have adequately trained and paid staff.

BOX 29 Building the capacity of small water utilities in Indonesia

Local water utilities, known in Indonesia as Perusahaan Daerah Air Minum, are responsible for service delivery to millions of Indonesians. These small piped systems typically serve several thousand households in a peri-urban or urban context, and are owned by a district or municipal government responsible for budgeting, tariff approvals and investment decisions. They are governed by a complex legal and regulatory framework and interact with and report to multiple national and local government stakeholders. Almost all rely heavily on government budget allocations, and many suffer from inadequate infrastructure and poor governance. As a result, many can serve only a fraction of the households in their jurisdiction. To serve more customers, they need increased revenue and the ability to overcome problems, such as the lack of bulk water, limited networks and high non-revenue water. To expand their customer base, and thus their revenues, the local utilities were assisted by Water.org to conduct market analyses, learn marketing approaches and develop schemes to allow new customers to pay connection costs in instalments. The utilities started offering instalment plans to households wishing to connect. Some utilities signed memoranda of understanding with microfinance institutions so that they could offer loans to households to support connection costs. These loans have longer repayment periods and allow a customer to borrow additional money to make larger investments, such as installing a bathroom or constructing a septic tank.[189]

Governments should seek to build their own capacity, and that of partners in the sector, by establishing fully institutionalized training programmes.

These programmes should have established curricula, regularly recurring training offerings, and not be overly dependent on support from external agencies. Ongoing training that addresses staff turnover is needed, as are updated skills as new technologies and methods are introduced, and to create career paths in the sector.

Governments should strengthen their capacity to integrate climate resilience and mitigation into planning, designing and delivering drinking water services, including protection of source water. Capacity should be built among regulatory agencies, service providers and users to ensure they have the knowledge and instruments to address climate change impacts.

There is an urgent need to identify and analyse relevant climate data and translate findings into policy, regulation, planning and practice. Capacity must be strengthened to support water safety planning that addresses all risks to the safety and adequacy of drinking water services, including those presented by climate variability and change, backed up by water quality surveillance. As part of water quality surveillance, where water safety plans are required, these must be audited and, if the agency responsible for auditing does not have the necessary expertise in water supply, capacity may be acquired by, for example, appointing government-approved third-party agencies to carry out the audit on its behalf or coordinating the audits across agencies.

For example, in Victoria, Australia, the Safe Drinking Water Act requires audits of water safety plans (called risk management plans) to be conducted by qualified independent consultants who have successfully completed a rigorous auditor certification process. In the Lao People's Democratic Republic, the Department of Housing and Urban Planning provides technical support to the health department. This is underpinned by a drinking water quality regulation that requires the health department to establish a water safety plan audit committee to lead auditing.[190]

Governments should foster inclusion in the sector, and seek to achieve gender, ethnic and cultural balance among the staff of sector institutions.

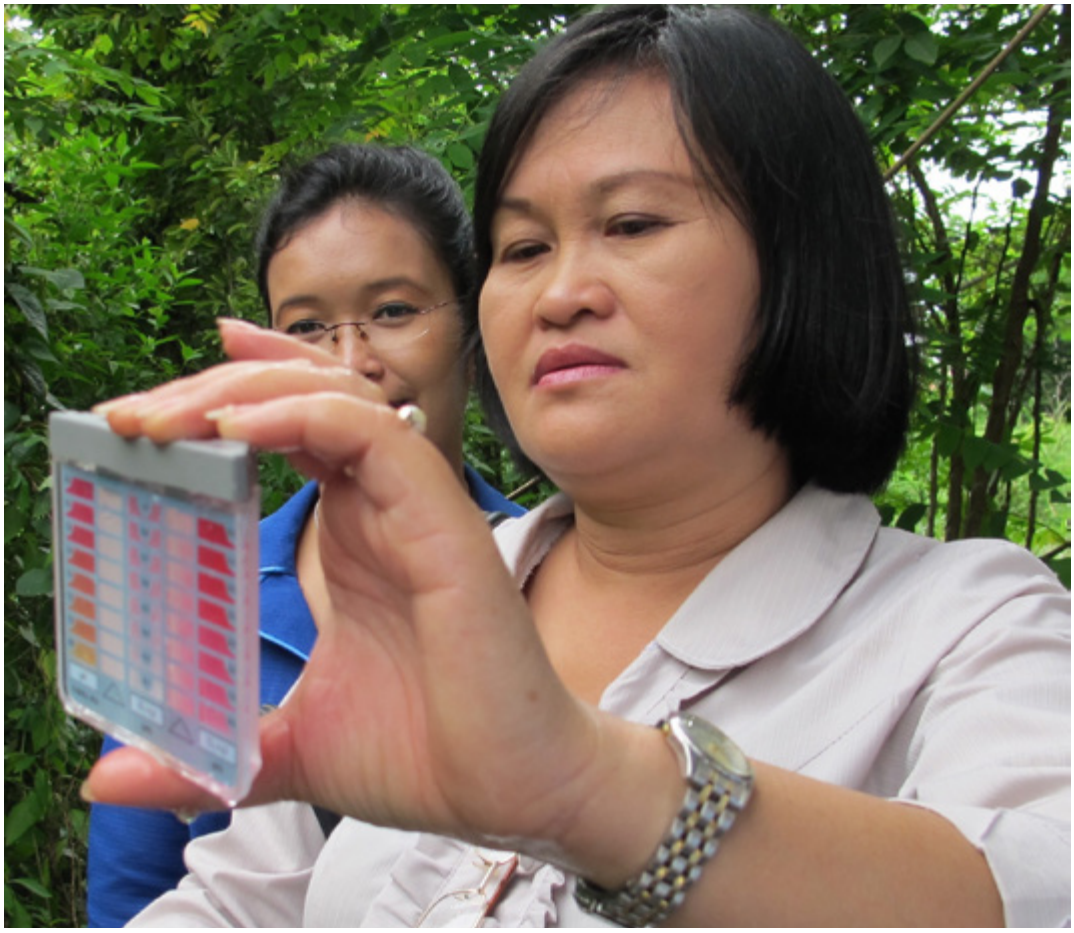
A well-balanced gender, ethnic and cultural mix among water sector personnel is important to enable a fully responsive relationship with users and provide equal opportunities for employment to all.

BOX 30

Addressing gender diversity in the water sector in the Lao People's Democratic Republic and Malawi

In the Lao People's Democratic Republic, less than 12% of the staff of the Department of Water Supply were women, and out of these, most were employed in administrative or financial positions. The department faced challenges in finding women to fill technical and managerial positions, due to a limited supply of female talent. To address this, the Asian Development Bank developed a project to strengthen the talent pipeline of future women engineers and leaders in the water sector. The project supported women by identifying and recruiting high school graduates at the provincial level, offering four-year scholarships for undergraduate degrees in a related engineering field, providing two-month internship programmes in water utilities and mentorship, and offering professional development workshops to women once hired. The pipeline of women engineers was supported with sustained human resource commitment, such as regular counselling and mentoring.[191]

In Malawi, the Lilongwe Water Board has historically been a heavily male-dominated organization. In 2019, women made up only 15% of the total workforce.[192] Women were totally absent from managerial positions, with not a single woman represented in executive management. A gender assessment found that key barriers experienced by female employees included a lack of flexible work arrangements to accommodate mothers of young children, a shortage of female-friendly sanitation facilities for women's menstrual hygiene management, and a lack of leadership and management skills among women. The Lilongwe Water Board management is now implementing a host of measures that foster gender diversity and inclusion. The utility has changed board composition so that women now outnumber men six to four. Since April 2020, employees at the utility have access to a childcare facility on premises that allows them to bring their young children to work, and allows nursing mothers to feed their babies on-site. Women now make up 26% of supervisory positions and 22% of management roles.[193]



6.4

Reliable data support better decision-making and stronger accountability

Overarching Recommendation:
Governments should ensure they have relevant data and information to be better informed, understand gaps and inequalities in drinking water services, and make evidence-based decisions.

Reliable, consistent and disaggregated data are essential to stimulate political commitment, inform policymaking and decision-making, identify those who are most vulnerable and enable well-targeted investments that maximize health, environmental and economic gains, and allow governments to make timely course corrections. Quality data are also important in measuring progress towards SDG targets and other goals, critical in all aspects of sector governance, and essential to ongoing efforts to improve accountability, transparency and participation. For many governments, improved data collection and analysis is a first step to identifying needs, gaps and investment priorities.

Accurate and regular surveillance and data collection and management, including utilization of other data sources, such as meteorological and long-term climate projections, are essential to efforts to effectively target resources allocated to safely managed drinking water to respond to specific challenges, including climate change, declining water quality, and disease outbreaks.

Reliable and publicly available data and reporting on drinking water services increase accountability to customers and drive healthy competition among utilities or responsible agencies.

Governments should support the institutionalization of data collection and monitoring within national systems and at all levels (community, utilities, subnational and national), the use of consistent methodologies, including standardized terms and questions, and the use of the data collected.

Governments should identify gaps in data collection and analysis, and prioritize those areas in which missing data are a constraint, with particular emphasis on the identification of communities and individuals at risk of being left behind in service provision.

For instance, water quality data are often weak or missing, and this undermines consistent water quality surveillance efforts. It is also important to collect gender-disaggregated data, and to prioritize the collection of data relevant to issues of gender equality. This includes data on who collects water, how much time they spend, and how many women are in decision-making positions in governance institutions and service providers. Disaggregated data relevant to other contexts is also vital, for instance, to understand disparities between ethnic groups.

Governments and other stakeholders should encourage and fund research in the water sector, work with academic institutions, and disseminate results to inform decision-making.

Disseminating data on service provider performance should be prioritized by governments to drive improvements and promote accountability to users.

BOX 31 Research influences regulatory reform to safeguard drinking water quality in Uganda

In Uganda, the most commonly used handpump is largely made from galvanized iron. It is well known that galvanized iron handpump components, such as rising mains and rods, corrode in aggressive groundwater conditions. In 2014-2015, the United Kingdom-funded UpGro research programme, which focused on sustainable use of groundwater for the benefit of the poor across sub-Saharan Africa, found evidence of extensive hand pump corrosion in many parts of the country.[194] The research results, gathered with the buy-in of the national government and support of national and international academic institutions, were presented to key government officials at national working groups and in sector coordination meetings at the district level with the Ministry of Water and Environment.

As a direct result of the research, the Government of Uganda issued two national directives. One prohibited using easily corroded materials, including galvanized iron pipes, for handpump installation, and required using more robust materials, such as stainless steel and unplasticized polyvinyl chloride. The second mandated that drilling contracts be structured as a bill of quantities, rather than lump sum agreements, to facilitate clearer specification of the materials used in borehole construction and handpump installation and closer scrutiny of construction quality. The findings also informed new guidance issued by the Ministry of Water and Environment for high-quality borehole drilling and pump installation, and included specific guidance on corrosion-resistant materials. Since these changes, major handpump and borehole material suppliers in Kampala have significantly increased their stocks of stainless steel handpump components.[195]

BOX 32 Water quality testing in household surveys leads to a new strategy and monitoring system in Nigeria

In Nigeria, the inclusion of water quality testing in the 2016 Multiple Indicator Cluster Survey revealed that over three quarters of the population used contaminated water sources, and that nearly half used sources at very high risk of faecal contamination. These data were featured in the World Bank's 2017 WASH Poverty Diagnostic, which led to vigorous political debate at a high level. In 2018, Nigeria's WASH sector was declared to be in a state of emergency by President Muhammadu Buhari.[196] The government subsequently launched the National Action Plan, a 13-year strategy for the revitalization of Nigeria's WASH sector.

These events led to the establishment of a national monitoring system, supported by an annual WASH National Outcome Routine Mapping survey[197] to collect information from households, water facilities, primary health centres and public places. The WASH mapping survey was commissioned by the Federal Ministry of Water Resources and carried out by the National Bureau of Statistics, with technical and financial support from UNICEF, the African Development Bank and the World Bank. The survey captures details of the WASH sector using questionnaire modules that collect more than 350 pieces of information from households, water facilities, schools, primary health care centres and public places, which allows data users to understand, analyse and address the complexities of the WASH sector in Nigeria.

BOX 33 Rapid assessment of drinking water supply systems informs regulations in Serbia

The Serbian water sector suffers from urban-rural disparities, weak surveillance, unresolved ownership issues and unsustainable financing. Resolving these problems is made more difficult by a lack of data on small water supply systems. Under the European Protocol on Water and Health, Serbia committed to conducting a baseline analysis of drinking water supply systems in rural areas. A rapid assessment was conducted in 2016, and information was collected on prevailing types of small systems, risk factors, chemical and microbiological water quality, system age and operator training. The assessment revealed that approximately one third of water samples did not meet microbiological standards. Individual wells were found to have higher risk scores and more urgent improvement needs than networked systems. The data also showed that most systems were operated by non-authorized service providers.

The rapid assessment was found to be reliable, inexpensive and easy to implement. The data provided a strong foundation for the revision of regulations, establishment of a national register of small water supply systems, and advocacy for the use of water safety plans.[198] Subsequently, a new law was drafted that will include a provision mandating water safety plans in systems that produce more than a certain volume of drinking water.[199]

BOX 34 Digitization of WASH monitoring facilitates evidence-based decision-making in Myanmar and Papua New Guinea

In Myanmar, the capacity of the Department for Rural Development to make informed planning and budgeting decisions was hindered by a paper-based system for recording new water infrastructure, and the lack of a system to monitor water services. With support from WaterAid, the departments developed a digital water services monitoring system using a free, publicly-accessible, data collection, analysis and visualization platform.[200] Indicators were harmonized and agreed upon in consultation with a wide range of national WASH sector actors, including UNICEF. Testing for microbiological contamination was also introduced and subsequently integrated. This system better enables the department to track implementation of sector policies and respond to poor performance. Both local and national government use it to inform annual planning processes.

Similarly, in Papua New Guinea, the Department of National Planning and Monitoring, WaterAid, UNICEF and the European Union piloted a WASH management information system based on the same platform. The system uses harmonized indicators and has increased availability of routine data to track progress against policy targets and improve coordination. It also has driven evidence-based planning and finance, informing district-level WASH investment plans.[201]

6.5 Innovation leads to better approaches and meets emerging challenges

Overarching Recommendation:
Governments should encourage innovation and experimentation through supportive government policy and regulation, accompanied by rigorous monitoring and evaluation.

Given the challenges in achieving SDG Target 6.1 in the context of a growing water crisis, innovation has a vital role to play. Innovation cuts across all the accelerators - it is required in technology, institutional structures, regulation, finance, data management, capacity-building and stakeholder engagement. 'Future-proofing' the sector necessitates innovative approaches, partnerships, systems and technologies that will meet the challenges of tomorrow, including disease outbreaks, migration, urbanization, a changing climate, and increasing pressure on natural resources. Yet the water sector has historically been conservative, risk-averse, and slow to adopt and disseminate new technologies. Water service providers face short windows of opportunity to integrate new technologies: the long lifespan of water infrastructure translates into infrequent opportunities to upgrade water systems. The sector must overcome these obstacles to innovation.

Innovative practices and technologies can be leveraged, including those that support increased climate resilience, improved energy efficiencies and the acceleration of improved service provision in rural areas and marginalized communities. Governments can also support the dissemination of research and innovation.

Governments should create a policy vision and foster the political leadership required to identify innovative approaches and bring them to scale.

This means addressing valid regulatory concerns about protecting public health while integrating new technologies and approaches. Innovation champions are needed, working within a supportive culture that uses systems thinking to breakdown siloes and encourage the successful uptake of new technologies or approaches. Governments should regularly evaluate progress in the sector and identify innovative approaches that can improve efficiency and effectiveness in service delivery, while also being realistic about innovations that have not proved beneficial and should be abandoned.

Governments should create a flexible regulatory environment to encourage innovation, and regulations should be regularly updated to reflect changes in the evidence base and the availability of better technologies.

New approaches, such as nature-based solutions, or 'green infrastructure', offer enormous potential. For instance, in the

United States of America, the State of California passed a bill that classified source watersheds as water infrastructure, a major legal change that allowed the use of the types of financing typically reserved for grey infrastructure to be used in green infrastructure projects.[202]

Circular economy approaches to wastewater management increase water resource sustainability. Technological innovation in treatment processes is facilitating wastewater reuse, creating water systems designed to capture and reuse wastewater. In several water-constrained areas, wastewater is being treated to drinking water quality standards (known as 'potable reuse'), though there are many options for non-potable wastewater reuse, such as industrial cooling, toilet flushing and irrigation.

Advancements in decentralized, off-grid and localized solutions for water and wastewater treatment and distribution have huge potential for providing access to the currently unserved. Innovative ways have been found to extend water services to people who are otherwise hard-to-reach, in peri-urban areas, informal settlements and remote rural areas. For instance, 'water ATMs', or automated dispensing units, are increasingly being used as a solution for those lacking access to a piped water connection

BOX 35 Green infrastructure contributes to improved water quality in Brazil

Struggling with poor water quality, and trying to keep pace with rapid urbanization, the state of Espírito Santo in Brazil implemented green infrastructure to restore and protect upstream forests through a range of interventions, including payments for ecosystem services, which are incentives offered to farmers or landowners in exchange for managing their land to provide some sort of ecological service. Through a World Bank-supported project, sedimentation has been reduced and water quality improved by a payments-for-ecosystem scheme that encourages conservation of forest cover and restoration of degraded ecosystems in upstream watersheds. Silt loads have been reduced through an approach that combines reforestation and improved land management with a range of other interventions, such as improvements to roads and sanitation.[203]

BOX 36 Wastewater reuse reduces pressure on water sources in Singapore, Mexico and Australia

Singapore's national water agency, the Public Utilities Board (PUB), has been treating and reclaiming municipal wastewater to drinking water standards since 2003. The agency uses advanced treatment technologies in three stages: microfiltration or ultrafiltration, reverse osmosis and ultraviolet disinfection. The high-grade reclaimed water, referred to as NEWater can now meet about 40% of Singapore's water needs, including for non-potable industrial applications and blending with reservoir supplies for potable reuse. The plan is to expand NEWater capacity to meet about 55% of the country's water needs by 2060.[204] Singapore's success with reclaimed water is also attributed to securing public acceptance through a comprehensive public communications programme.[205,206]

In San Luis Potosi, Mexico, instead of using freshwater, a power plant uses treated effluent from the nearby wastewater treatment plant (Tenorio) in its cooling towers. This wastewater is 33% cheaper for the power plant than groundwater, and has resulted in savings of US$ 18 million for the power utility in six years. For the water utility, this extra revenue covers all its operation and maintenance costs. The remaining treated wastewater is used for agricultural purposes. Additionally, the scheme has reduced groundwater extractions by 48 million cubic metres in six years, restoring the aquifer.[207]

Due to droughts and water scarcity, in the Australian state of New South Wales, water utilities are encouraged to invest in water recycling infrastructure. The 2021 Water Strategy[208] states that "recycled water provides options for supplying fit-for-purpose water for industry and agriculture, and for maintaining green spaces – reducing reliance on drinking water supplies". At the national level, Australia has issued guidelines for water recycling.[209]

Innovation should be encouraged in methodologies and approaches, as well as in technologies.

These can include new ways to achieve stakeholder engagement, innovation in pricing water and delivering subsidies, and new approaches to making data available both for decision-making and to empower communities and individuals. Users who can access data on their water services are able to demand improvements in their water supply, and to better understand risks and take action. New approaches must also be encouraged to build climate resilience throughout the water supply sector.

Technological solutions offer water service providers new options for improving their customer service and relationships with the communities that they serve. There has been a shift towards interacting with customers online, responding to incidents and complaints through social media, educating customers, and providing around-the-clock information and support. There has been an upsurge in other digital technologies, like artificial intelligence and augmented reality, used by utilities to improve customer service. Through smartphones and cloud-based communications, customers can share real-time information about service disruptions, water leaks and meter readings.

The emerging field of financial technology (Fintech) is growing due to increased smartphone usage and cheap computing power. Fintech can build the capacity of water utilities, particularly small-scale service providers, to grow their customer base, reduce payment risks and increase revenues. Fintech solutions can help eliminate barriers to financial inclusion by addressing the needs of low-income households. Applications include instalment payments and mobile money, pay-as-you-go models, insurance technology and virtual banks.

BOX 37 Financial technology supports small water service providers in Cambodia

In Cambodia, more than 300 small water providers operate piped networks in small towns and struggle to attract well-qualified staff for management and accounting. A power company called E-Power Cambodia originally developed management software for the power sector, but has since expanded its approach to introduce E-Water software. The software offers accounting, production management (for costing of water), and a billing system that connects to payment networks so customers can pay via mobile money, agents or banks. Water companies in areas with sufficient internet connectivity can use a cloud-based version of the software, minimizing information technology costs. In the next phase, the software will work with smart meters, readable within a one km radius using a mobile phone, and a module is under development to manage and monitor the piping network. As of 2018, half of small water providers in Cambodia use E-Water.[210]

Emerging technologies enable smarter management of water resources, increase the availability of water, and can reduce treatment costs. Innovative utilities use natural assets such as ecosystems and water resources to improve water and sanitation services and build resilience to environmental challenges such as climate change. Advances in sensor technology, information, communications, computing, artificial intelligence, and big data help monitor water quality and inform operational decision-making by water utilities. Sensors can monitor water quality on-site and in real-time, helping utilities, for example, detect elevated numbers of bacteria in raw water and transmit this information automatically to a control room.

BOX 38 Using digital platforms to monitor piped water supply systems

In Bangladesh, as part of water safety planning for piped water services, the Department of Public Health Engineering has strengthened operational monitoring systems. In six municipalities, traditional paper-based data recording systems have been migrated to a digital platform that allows staff to record data using a mobile-based app called Kobo Toolbox. The app is connected to a central database that allows the status and performance of components of the system to be easily checked. The system incorporates a wide range of information that is categorized based on the types of employees using the information (e.g., pump operators, water superintendents, sanitary inspectors, treatment plant operators, pipeline mechanics and bill distributors). Users can both record and access the data necessary to identify and respond in a timely manner to breakdowns, leakages and water quality problems. The data for any given period can also be accessed for analysis, and the database allows analysis of relationships, such as those between extended drought periods and water level, allowing enhanced management of water quantity risks into the future.[211]

The Kenya-based company Wonderkid offers a mobile management platform that incorporates data insights to inform decision-making and infrastructure investment planning, as well as regulatory oversight to monitor the compliance of service delivery standards to citizens. The platform also allows utilities to improve their customer care and billing services. Currently, the platform offers solutions such as customer database management, self-service customer portal, billing, payments and receipting management system, and mobile meter reading and meter management. The platform has been used in more than 35 utilities in sub-Saharan Africa, including in Kenya, Liberia, Malawi and Nigeria.[212]

BOX 39 Remote sensing to improve drilling success rates in Ethiopia and Madagascar

Ethiopia and Madagascar have plentiful groundwater resources, but in both countries drilling success rates are low due to hydrogeological complexity, a weak knowledge base and low capacity within the drilling sector. Reliable groundwater investigations are vital to improve drilling success rates and reduce the overall costs of failed boreholes. However, conventional methods of generating large-scale hydrogeological maps require considerable human, logistical and financial resources. In the past, these have taken a long time and produced limited results in the most complex areas. In contrast, a new hybrid methodology that uses satellite remote sensing to scan the earth and identify high potential sites for the extraction of groundwater combined with on-the-ground geophysics investigations has changed this. This new methodology, developed by the European Union's Joint Research Centre enables more reliable identification of the most suitable sites for borehole drilling.

The governments of both countries are being supported by UNICEF to use remote sensing technology. These initiatives are helping to significantly increase the efficiency and cost-effectiveness of borehole drilling. In Ethiopia, remote sensing helped increase drilling success rates from less than 50% to over 90%. The methodology is being expanded to additional countries in East Africa.[213]

The introduction of technical innovations in pricing water and delivering subsidies will lead to both increased financial sustainability and more equitable access to safely managed drinking water. Likewise, new models for operation and maintenance hold promise in terms of reducing the amount of service 'downtime' experienced by users.

BOX 40 FundiFix: An innovative approach to professionalized maintenance in Kenya

Nearly half of rural Kenyans lack access to basic water services, with many relying on unsafe surface water to meet their daily needs. In 2010, the devolution of the mandate for many public services, including rural water, to county governments created opportunities for policy reform at the local level.

With the support of a rural water research programme led by the University of Oxford, a new model for professionalized maintenance was developed, called FundiFix.[214] Under this model, rural water infrastructure is serviced through performance-based contracts with communities, schools and health facilities. The FundiFix model departs from the community-based management historically used in Kenya, and is a professionalized alternative that provides preventive maintenance and rapid repair of rural water supply systems. Success is measured by 'uptime' (i.e., the amount of time that infrastructure is functional), and service providers are recompensed based on uptime and reducing breakdown duration rather than for the number of repairs they make. Today, FundiFix maintains 130 piped water schemes and handpumps in Kitui and Kwale counties in Kenya, repairing 95% of all breakdowns and 99% of handpump breakdowns within three days. Revenue from user fees does not fully cover the costs of maintenance services, so Fundifix is supported by a Water Services Maintenance Trust Fund, financed by private partners and donors, to bridge shortfalls between costs and revenues, using a performance-based approach to motivate service provider success.

Through its use of performance-based contracts, piloting remote sensing to improve monitoring of handpump functionality and use, and 'water ATMs' to improve revenue collection, FundiFix illustrates the potential of innovative models of professional maintenance services and accountable and transparent rural water service delivery.

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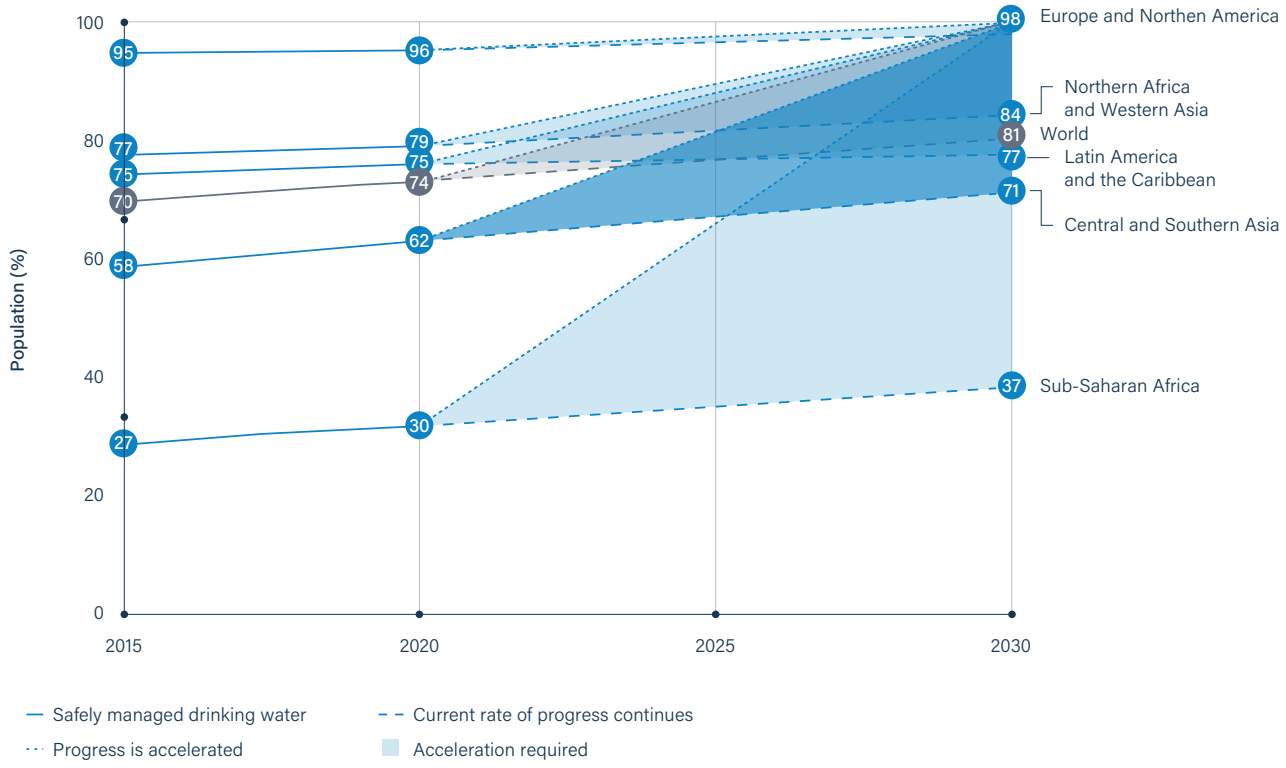
6.6 Looking ahead: A pathway to 2030

There are key opportunities in the years up to 2030 to strengthen government leadership, show political will, deepen partnerships and make strategic and catalytic public investments in drinking water. This will be necessary to achieve the acceleration in progress required to achieve safely managed drinking water for all. As can be seen from Figure 22, on average, a **quadrupling of progress is needed to meet SDG Target 6.1.**

As this report has shown, governments have many opportunities to make progress on the provision of reliable, safe and sustainable drinking water services. Working across all the SDG 6 accelerators will result in sustainable results and greater impact. **As a service that provides immeasurable economic and health benefits, and essential gender equality outcomes, the need to dramatically increase political commitment to drinking water is clear, as is the need to strengthen governance and institutions and significantly increase the financial resources available.** Given the complexity of sustaining safe drinking water supply, efficient, professionalized management of water supply is needed, including in rural areas. Environmental and climate issues must be integrated into drinking water planning and risk management to ensure resilience, adaptation and sustainability of drinking water services. Finally, drinking water services need to reach everyone, including the poor, vulnerable and marginalized, consistent with the promise to leave no one behind.

The list of potential actions presented in this report is comprehensive, and some changes will take sustained action by multiple stakeholders over many years. However, there are many ways committed governments can make significant steps to start the process, even with limited budgets and while capacity is developing, thereby laying the groundwork for future progress.

FIGURE 22 Progress in safely managed drinking water services and acceleration required to meet SDG Target 6.1



Source: Adapted from Progress on household drinking water, sanitation and hygiene 2000-2020: five years into the SDGs. Geneva: World Health Organization and the United Nations Children's Fund; 2021.

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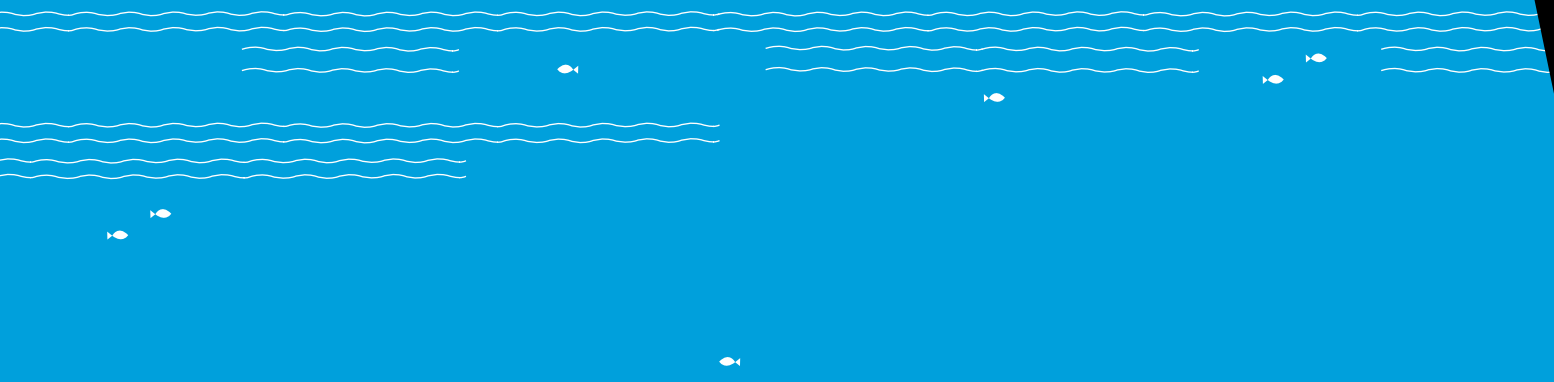

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