WSH Data Labs
DATA SYSTEMS FOR SANITATION SERVICE DELIVERY

Dev-Afrique

BRIDGING THE DATA DIVIDE:

INTEGRATING HEALTH INSIGHTS INTO WASH SYSTEMS

2025
REPORT

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ACRONYMS

CBA: Cost-Benefit Analysis
CRVS: Civil Registration and Vital Statistics
DALY: Disability-Adjusted Life Year
DHS: Demographic and Health Surveys
GBD: Global Burden of Disease
GLAAS: Global Analysis and Assessment of Sanitation and Drinking-Water
HIS: Health Information System
ICD: International Classification of Diseases
IHME: Institute for Health Metrics and Evaluation
JMP: Joint Monitoring Programme (for Water Supply, Sanitation and Hygiene)
LMIC: Low- and Middle-Income Country
MICS: Multiple Indicator Cluster Surveys
SDG: Sustainable Development Goals
UNICEF: United Nations Children's Fund
UN-Habitat: United Nations Human Settlements Programme
USAID: United States Agency for International Development
VOC: Volatile Organic Compound
WASH: Water, Sanitation, and Hygiene
WHO: World Health Organization

GLOSSARY OF TERMS

Access to safely managed drinking water: Water that is accessible on premises, available when needed, and free from contamination, as defined by the SDG 6.1 indicator.

Burden of disease: A measure of the impact of diseases and injuries, often expressed in disability-adjusted life years (DALYs) and mortality rates, used to quantify the gap between current health status and an ideal situation.

Civil registration and vital statistics (CRVS): A government system for recording vital events such as births, deaths, and causes of death, used to inform public policy and track population health trends.

Cost-benefit analysis (CBA): An economic evaluation method that compares the costs of an intervention with the monetary value of its benefits, such as healthcare savings or productivity gains.

Disability-adjusted life year (DALY): A composite measure of overall disease burden, combining the number of years of life lost due to premature mortality and the number of years lived with disability.

Health information system (HIS): A structured mechanism for collecting, storing, analyzing, and disseminating health data to support decision-making in the public health field.

Health-based surveillance: The systematic collection and use of health data to monitor and evaluate the public health impact of environmental conditions, for instance relating to the WASH sector.

International Classification of Diseases (ICD): A standardized coding system developed by the World Health Organization (WHO) for recording diseases and health conditions in health records and statistics.

Joint Monitoring Programme (JMP): A global WASH monitoring initiative led by WHO and UNICEF, tracking progress toward SDG targets in the area of water, sanitation, and hygiene.

Low- and middle-income countries (LMICs): A category of countries classified by the World Bank based on gross national income (GNI) per capita, which often face resource constraints in the areas of public health and infrastructure.

Multiple Indicator Cluster Surveys (MICS): Household surveys developed by UNICEF to monitor the situation of children and women, including their access to WASH services.

Routine health surveys: Surveys conducted at regular intervals to collect data on health indicators, including those related to water, sanitation, and hygiene.

GLOSSARY OF TERMS

Sanitation: The safe management of human excreta through access to and use of hygienic toilets and treatment systems that prevent environmental contamination.

Sustainable Development Goals (SDGs): A collection of 17 global goals established by the United Nations in 2015 to address issues relating to poverty, inequality, environmental sustainability, and health by 2030.

WASH: An acronym referring to water, sanitation and hygiene. The term is widely used to refer to an integrated public health field focused on ensuring access to clean water, safe sanitation, and effective hygiene practices, with the goal of preventing disease and improving well-being.

Waterborne diseases: Diseases caused by pathogens ingested through contaminated water, including cholera, typhoid, and diarrhea.

World Bank, "World Bank Country and Lending Groups – World Bank Data Help Desk," accessed July 9, 2025, https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups.

EXECUTIVE SUMMARY

REPORT OBJECTIVES AND PURPOSE

Effective water, sanitation, and hygiene (WASH) services are essential for reducing waterborne diseases, improving public health, and advancing broader development goals such as gender equality, education, and economic productivity. Inadequate WASH services contribute to significant inequities, particularly in the context of global health-related Sustainable Development Goals (SDGs).

Despite the well-established links between WASH conditions and health outcomes, health data remains underutilized in characterizing WASH needs, demonstrating impact, and guiding investments. This report aims to support WASH professionals in understanding the value of health behavior and outcome data for targeting, prioritizing, and assessing WASH interventions, as well as for evaluating health outcomes. It calls for integrating health data into WASH performance monitoring in order to bridge existing gaps and enhance decision-making. By leveraging routinely collected data, these approaches are designed to be practical and cost-effective, minimizing the need for new investments in infrastructure.

The report highlights the need for intergovernmental and cross-sector collaboration to create a robust monitoring system encompassing both WASH and health data. This can help improve service delivery efficiency by leveraging existing data infrastructures across sectors. Anchored in the ambitions of SDG 3 (health and well-being) and SDG 6 (clean water and sanitation), this report emphasizes the critical role of health data in achieving global targets that improve public health, foster inclusive economic growth, and reduce inequalities.

KEY FINDINGS

This report presents an assessment of existing health data systems, summarizes key health surveillance frameworks, and offers recommendations intended to strengthen coordination between WASH and health sectors. Key findings include:

- **The Health Burden Of Inadequate WASH Services:** Unsafe water, poor sanitation, and inadequate hygiene remain major contributors to the global burden of disease, driving diarrheal illnesses, acute respiratory infections, undernutrition, and soil-transmitted helminth infections. Integrating health data into WASH monitoring mechanisms could help quantify these impacts and guide targeted interventions that could in turn reduce morbidity and mortality rates.
- **Data Availability and Utilization:** Despite resource constraints, many countries collect extensive WASH-relevant health data through national health surveys, routine health information systems, and civil registration and vital statistics (CRVS) systems. These datasets can help identify WASH service gaps and associated health disparities, supporting stakeholders as they design targeted interventions that improve WASH sector performance and advance health equity.
- **Health-Based WASH Surveillance:** Establishing a health-focused WASH surveillance system can strengthen public health responses by allowing disease trends to be systematically tracked and correlated with WASH service access, while additionally identifying vulnerable populations and assessing the effectiveness of interventions. Robust surveillance ensures that WASH programs are grounded in data and evidence, enabling targeted actions to improve health outcomes and reduce inequalities.

- **Economic And Social Impacts:** Improved WASH services can contribute to reducing healthcare costs, increasing school attendance rates, and enhancing economic productivity. By leveraging health data, decision-makers can quantify the economic returns on WASH investments and/or the economic losses due to inadequate investments, thus enabling them to advocate for targeted and sustained funding.
- **Cross-Sectoral Collaboration:** Effective data integration requires strong partnerships between the WASH and health sectors. Collaborative frameworks enable data sharing, joint monitoring and evaluation, and coordinated policy development, ensuring that WASH improvements align with broader public health goals.
- **Policy And Programmatic Implications:** Health data can be instrumental in enabling the effective prioritization of WASH investments, allowing stakeholders to identify high-risk populations to be targeted and informing the design of cost-effective interventions. Incorporating routine health metrics into WASH evaluations ensures that interventions will be impactful, sustainable, and responsive to community needs.
- **Key Health Surveillance Frameworks:** To support the integration of data derived from health and WASH systems, several foundational health surveillance frameworks can be used. Routine health information systems (HIS) track disease incidence and healthcare utilization, while civil registration and vital statistics (CRVS) systems record births, deaths, and causes of death, providing critical data on population mortality and other trends. Population-based surveys, such as the Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS), provide disaggregated data on WASH access and related health outcomes at the national and subnational levels. Additionally, the Global Burden of Disease (GBD) study provides modeled estimates of WASH-related health impacts across geographies and time. Together, these frameworks offer a robust foundation for tracking disease patterns, assessing the effectiveness of WASH interventions, and prioritizing high-risk populations.

RECOMMENDATIONS FOR WASH DATA SYSTEM MANAGERS

Building on this report's findings, WASH data system managers can apply the following strategies to strengthen data integration and maximize impact:

- **Develop Integrated Indicators:** Collaborate with health sector counterparts to define a core set of indicators reflecting WASH and health data that can be used for routine reporting, program planning, and performance tracking.
- **Strengthen Data Interoperability:** Invest in digital platforms and data standards that facilitate seamless data exchange across ministries and sectors, including linking WASH asset and service data with health outcome databases.
- **Initiate Cross-Sector Data Reviews:** Establish regular data-sharing and joint analysis forums with health ministries with the goal of identifying high-priority geographic areas for WASH interventions based on disease burden and health outcome data.
- **Incorporate Health Outcomes Into Monitoring And Evaluation (M&E) Frameworks:** Revise WASH monitoring and evaluation frameworks to include relevant health impact indicators, enabling programs to assess and communicate the full benefits of WASH service improvements.
- **Build Capacity For Health Data Use:** Train WASH program staff to interpret and apply health data effectively for planning, program targeting, and advocacy purposes.

RECOMMENDATIONS FOR NATIONAL GOVERNMENTS AND DEVELOPMENT PARTNERS

To implement effective health-based WASH surveillance, national governments and development partners should consider the following strategies:

Develop National Frameworks:

Establish clear national guidelines that clearly define the respective roles and responsibilities of health and WASH ministries, as well as the data-sharing protocols to be used, in order to facilitate coordinated action.

Pilot Integrated Surveillance Systems:

Launch subnational pilots that link disease surveillance data (e.g., diarrheal disease outbreaks) with WASH service data in order to test feasibility, refine tools, and enhance stakeholder buy-in.

Invest In Real-Time Data Systems:

Deploy digital solutions such as mobile data-collection platforms and integrated dashboards to capture and visualize health and WASH indicators, thus enabling timely decision-making.

Ensure Sustainability:

Embed health-based WASH surveillance functions within existing routine reporting systems and financing mechanisms so as to promote institutionalization and long-term sustainability.

Advocate For Policy Change:

Leverage evidence from integrated data systems to inform policy decisions, target investments effectively, and advocate for increased funding for WASH services aligned with public health objectives.

This report underscores the necessity of integrating health data into WASH planning and evaluation functions. A robust system that jointly tracks and correlates WASH and health data will not only strengthen service delivery but also reinforce the impact of WASH investments on public health.



Integrating health and WSH data enables early detection of workplace risks, supports targeted prevention, and improves overall worker well-being. It provides a fuller view of safety and health performance, not just incidents.

CHAPTER 1:

THE IMPORTANCE OF WASH SERVICES AND DATA

Safe water, sanitation, and hygiene are the foundation of public health

CHAPTER 1:
THE IMPORTANCE OF WASH SERVICES AND DATA

1.0

Effective water, sanitation, and hygiene (WASH) services are fundamental to human health, and play a significant role in shaping broader development outcomes. Access to safe WASH reduces the burden of waterborne diseases, promotes healthier communities, and advances education and gender equality objectives. However, millions of people around the world still lack access to adequate and safe services, thereby perpetuating health inequities and hindering progress toward the Sustainable Development Goals (SDGs) (see Table 1). Strengthening understanding of these health impacts is essential for designing effective interventions that advance health outcomes and social equity alike.

Organizations such as UNICEF, UN-Habitat, and WHO emphasize the role of WASH in achieving multiple SDGs. For instance, improvements in WASH services directly support SDG 3 by reducing the incidence of waterborne diseases, SDG 4 by creating healthier learning environments, and SDG 5 by enhancing safety and dignity for women and girls. These connections underscore the central role of the WASH sector in achieving global health and development goals.

Health data can enhance WASH initiatives by providing a clearer view of service availability and performance. When effectively integrated with information on WASH conditions, health data acts as a powerful tool for monitoring and evaluating WASH services, enabling more targeted interventions.

For example, linking health data with WASH service metrics can enable precise identification of the specific areas in which infrastructure or service delivery improvements are most needed. This information can in turn be used to support actions that reduce disease prevalence and improve community health. The data can also help in identifying service gaps and track progress, while further informing policy decisions to ensure that resources are directed to where they will have the greatest impact.

One of the most significant challenges in securing adequate investments for WASH initiatives is the lack of comprehensive data capturing the full economic benefits of such services. While the health advantages of improved WASH infrastructures—such as the reduced incidence of waterborne diseases—are well documented, the broader economic impacts are often less visible due to insufficient data. These impacts include reduced medical costs, improved childhood development outcomes, increased longevity, and greater overall productivity, as healthier populations can participate more fully in economic activities.

One global estimate indicates that improved WASH services yield a return on investment of USD 4.13 for every USD 1.00 spent, based solely on healthcare savings and increased productivity. However, financial cost-benefit analyses of many WASH projects often produce negative results—such as low return-cost ratios or unfavorable internal rates of return—making them appear economically unviable to public and private investors.

Guy Hutton and Claire Chase, "Water Supply, Sanitation, and Hygiene," in Injury Prevention and Environmental Health, 3rd ed., ed. Charles N. Mock et al. (The International Bank for Reconstruction and Development / The World Bank, 2017), http://www.ncbi.nlm.nih.gov/books/NBK525207/.

These assessments frequently underestimate the true economic value of WASH by excluding health-related benefits that are difficult to quantify without reliable data. Incorporating health data into WASH project appraisals can help reveal these hidden benefits and strengthen the economic case for investment. Without robust, locally relevant data to inform these analyses, the true value of WASH interventions is often underestimated, resulting in chronic underinvestment.

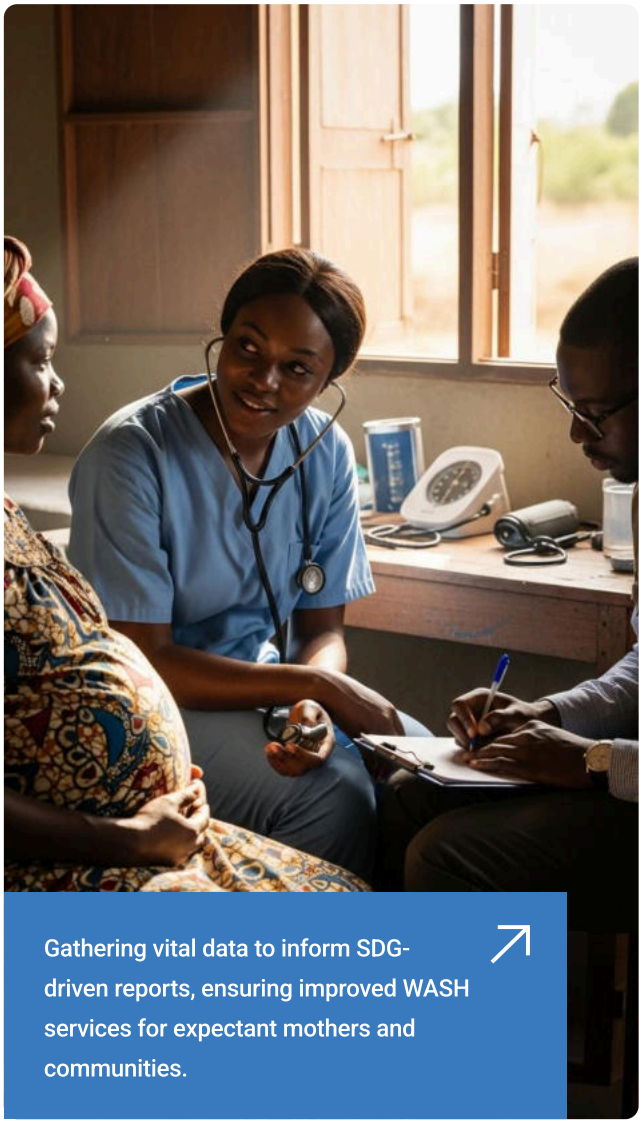
The risk of WASH-related illnesses is shaped by a combination of health, social, and service-related factors. Poor sanitation, inadequate hygiene, and unsafe water significantly increase morbidity risks, particularly among populations facing poverty, limited education, and inadequate housing. These social determinants intersect with health conditions to amplify vulnerability to WASH-related diseases.

Recognizing vulnerabilities within specific population segments can help prioritize investments in WASH services. Evidence of health improvements—such as reduced disease incidence and lower healthcare costs—can increase public and private sector interest, strengthen financial commitments, and support the development of more sustainable service delivery models.

In this report, policymakers will find guidance, case studies, and actionable insights that can be applied to improve WASH services and outcomes in their respective contexts. It is structured for easy navigation, enabling readers to locate relevant information and guidance tailored to their specific needs. By engaging with this report, stakeholders can better understand how to leverage health data and strengthen collaboration with the health sector to improve WASH performance monitoring and service delivery.

Table 1 (below) summarizes the SDGs and associated targets most relevant to WASH and health, illustrating how improvements in WASH services are interconnected with progress in health and education outcomes, gender equality, climate resilience, and sustainable development.

This framing demonstrates the importance of integrated, cross-sector strategies in achieving local, national, and global goals.



Gathering vital data to inform SDG-driven reports, ensuring improved WASH services for expectant mothers and communities.

WaterAid and Vivid Economics, Mission-Critical: Invest in Water, Sanitation and Hygiene for a Healthy and Green Economic Recovery, 2021, https://washmatters.wateraid.org/publications/mission-critical-invest-water-sanitation-hygiene-healthy-green-recovery.

World Health Organization, "INVESTING IN WATER AND SANITATION: INCREASING ACCESS, REDUCING INEQUALITIES," 2014, https://doi.org/10.1163/2210-7975_HRD-9841-2014003.

Britta Augsburg and Tristano Sainati, "Editorial: WASH Economics and Financing: Towards a Better Understanding of Costs and Benefits," Journal of Water, Sanitation and Hygiene for Development 10, no. 4 (2020): 615–17, https://doi.org/10.2166/washdev.2020.002.

Table 1. Relevant SDGs and targets for WASH and health

SDG Goal	Target	Relevance
Goal 3: Good Health and Well-Being	**Target 3.3:** By 2030, end the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases and combat hepatitis, waterborne diseases, and other communicable diseases.	The incidence of waterborne diseases is significantly influenced by WASH conditions.
	Target 3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water, and soil pollution and contamination.	WASH improvements are critical for reducing water pollution and contamination, thereby preventing related health issues.
Goal 4: Quality Education	**Target 4.8:** Build and upgrade education facilities that are child-, disability- and gender-sensitive and provide safe, nonviolent, inclusive and effective learning environments for all.	Access to safe and adequate WASH facilities in schools promotes school attendance, especially among girls. It reduces the incidence of waterborne illnesses that cause absenteeism, and supports inclusive and healthy learning environments.
Goal 6: Clean Water and Sanitation	**Target 6.1:** By 2030, achieve universal and equitable access to safe and affordable drinking water for all.	Safe water promotes better health outcomes.
	Target 6.2: By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.	Improved access to safely managed sanitation safeguards the environment and public health.
	Target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping, and minimizing the release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and substantially increasing recycling and safe reuse globally.	Contaminated wastewater affects drinking water quality and food safety, and may result in direct exposure to chemical pollutants.

	Target 6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of fresh water to address water scarcity and substantially reduce the number of people suffering from water scarcity	Water scarcity elevates the risk of physiological and physical harm.
Goal 11: Sustainable Cities and Communities	**Target 11.1:** By 2030, ensure access for all to adequate, safe, and affordable housing and basic services, and upgrade slums.	Access to basic services, including WASH, is essential for healthy living conditions, particularly in informal settlements and urban slums.
	Target 11.5: By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations.	Resilient WASH infrastructure helps reduce waterborne hazards during floods and other water-related disasters, reducing public health risks and economic losses.
Goal 13: Climate Action	**Target 13.1:** Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	Enhancing WASH infrastructure is vital for building resilience against climate-related health impacts.
Goal 17: Partnerships for the Goals	**Target 17.9:** Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the SDGs, including through North-South, South-South, and triangular cooperation.	Collaborative efforts and capacity-building are necessary for successful and sustainable WASH improvements.
	Target 17.18: By 2030, enhance capacity-building support to developing countries, including for least developed countries and small island developing tates, to increase significantly the availability of high-quality, timely, and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location, and other characteristics relevant in national contexts.	

CHAPTER 2:

IMPACT OF WASH ON HEALTH AND THE CASE FOR HEALTH-BASED SURVEILLANCE

Unsafe water and poor sanitation drive preventable illness

CHAPTER 2:

IMPACT OF WASH ON HEALTH AND THE CASE FOR HEALTH-BASED SURVEILLANCE

2.0

Safe water, adequate sanitation facilities and good hygiene conditions are critical factors in promoting human health. Despite historical progress, poor WASH conditions continue to make a significant contribution to global morbidity and mortality, particularly in low- and middle-income countries (LMICs). This chapter outlines the direct and indirect health impacts—broken down by exposure pathway (microbial, viral, parasitic, and chemical)—of inadequate WASH services, and presents the case for integrating health data into WASH surveillance systems. It concludes with a discussion of how health data can support more targeted, equitable, and cost-effective WASH interventions.

Access to safe drinking water is fundamental to preventing a range of health issues associated with water contamination. The health impacts of unsafe water are caused by two major types of exposures: disease-causing microbes and chemical exposures. Furthermore, there are significant health effects associated with inadequate water supplies, including nutritional deficiencies, dehydration, and adverse mental health outcomes. Waterborne diseases—such as cholera and typhoid fever—can occur when a person ingests a biological agent such as a bacteria, virus, or parasite. In addition, a lack of reliable access to clean water serves as a barrier to good sanitation and hygiene practices and limits handwashing, which in turn increases vulnerability to a range of communicable diseases and chemical exposures.

Intoxications occur when pollutants or toxic chemicals are present in water, leading to harmful health outcomes through ingestion or absorption.

Equally vital to public health is the need for access to safely managed sanitation services, which mitigates the risk of exposure to dangerous pathogens, chemicals, and pollutants. Safely managed sanitation includes the entire value chain, from containment and transport to treatment and disposal. The lack of access to safely managed sanitation particularly in communities, healthcare facilities, and industries poses significant health risks; for example, this may lead to the transmission of infectious diseases, a rise in antimicrobial resistance, or the exposure of local populations to toxic substances. Poor management of human excreta is especially prevalent in many developing countries. This can be found in contexts such as households, agricultural activities, and industrial processes, with profound consequences both for human health and environmental sustainability. Exposure to human waste facilitates the spread of diseases such as diarrhea, hepatitis, and parasitic infections. Poor hygiene practices—particularly the lack of handwashing with soap—further amplify transmission pathways for communicable diseases, especially in settings where sanitation practices are weak or nonexistent. Together, the combined absence of safe water, adequate sanitation facilities, and good hygiene conditions compounds public health risks and limits the effectiveness of any single intervention.



ORD US EPA, "Drinking Water," Reports and Assessments, 2024, https://www.epa.gov/report-environment/drinking-water.
US EPA, "Drinking Water." Matthew Adah Onu et al., "Challenges of Wastewater Generation and Management in Sub-Saharan Africa: A Review," Environmental Challenges 11 (April 2023): 100686, https://doi.org/10.1016/j.envc.2023.100686.

Given the complex and far-reaching health impacts of poor access to WASH services, there is a growing need for health-based WASH surveillance systems that systematically track the relationships between WASH conditions and health outcomes. By leveraging health data to monitor disease patterns and environmental conditions (such as water quality), identify vulnerable populations, and assess intervention effectiveness, WASH surveillance can provide critical insights for evidence-based decision-making. Strengthening this integration will not only improve health outcomes but also ensure that WASH interventions are targeted, efficient, and sustainable.

2.1 The WASH Burden of Disease

Global estimates of the burden of WASH-related diseases are typically expressed in terms of WASH-attributable morbidity and mortality. Morbidity is typically quantified using disability-adjusted life-years (DALYs), which combine the years of life lost due to premature mortality with the years of healthy life lost to periods lived in a state of less than full health.

According to the World Health Organization (WHO), unsafe WASH conditions were responsible for 69% of all diarrhea deaths in 2019, totaling over 1 million deaths, while poor hand hygiene contributed to an additional 356,000 deaths from acute respiratory infections.

A 2023 study published in The Lancet examined the global burden of disease linked to inadequate WASH, looking at outcomes including diarrhea, acute respiratory infections, under-nutrition, and soil-transmitted helminthiasis. The study compared actual WASH service levels with a hypothetical scenario in which the WASH targets contained in the United Nations' SDGs were fully achieved.

The study found that in 2019, universal access to safe WASH could have prevented 1.4 million deaths and 74 million DALYs globally, a total that represented 2.5% of all deaths that year and 2.9% of its DALYs. The impact on children under five was even greater, with 7.6% of all deaths and 7.5% of all DALYs in this population globally attributable to inadequate WASH.

The burden of unsafe WASH is disproportionately higher in Africa (see Figure 1), where inadequate infrastructure drives rates of illness and mortality that exceed those typically found in other regions. In 2023, WHO reported that the number of deaths attributable to unsafe WASH in Africa reached 46.7 per 100,000 people—13 times the comparable mortality rate in Europe (3.6 per 100,000) and over nine times higher than the rate in the Americas (5 per 100,000).

Across low- and middle-income countries (LMICs), waterborne illnesses remain prevalent due to poor sanitation and limited access to clean drinking water. As of 2022, at least 1.7 billion people were using drinking water sources contaminated with feces, with most such individuals living in rural areas or low-income, informal, or unregulated urban settlements.



World Health Organization, "Water, Sanitation and Hygiene Burden of Disease," accessed June 19, 2025, https://www.who.int/data/gho/data/themes/topics/water-sanitation-and-hygiene-burden-of-disease.

Jennyfer Wolf et al., "Burden of Disease Attributable to Unsafe Drinking Water, Sanitation, and Hygiene in Domestic Settings: A Global Analysis for Selected Adverse Health Outcomes," The Lancet 401, no. 10393 (2023): 2060–71, https://doi.org/10.1016/S0140-6736(23)00458-0.

Figure 1: Mortality rate attributed to unsafe WASH services, per 100,000 population, by region



Source: World Health Organization

2.2 Human Illness Caused by Inadequate WASH

MICROBIAL THREATS FROM UNSAFE WATER, SANITATION, AND HYGIENE

BACTERIA

Water can harbor various pathogenic bacteria, including Vibrio cholerae, Escherichia coli (E. coli), Shigella, and Salmonella typhi, all of which cause serious waterborne diseases such as diarrhea and dysentery, and can lead to death. Vibrio cholerae, the cause of cholera, remains a major global concern particularly in LMICs, where outbreaks are fueled by unsafe water, poor sanitation, and inadequate waste management.

Between January 2022 and May 2024 alone, the WHO Regional Cholera Bulletin for Africa reported 381,392 cases and 6,733 associated deaths on the continent. Beyond its direct health impact, cholera is a stark indicator of social and economic inequality, disproportionately affecting the poorest and most vulnerable populations.

Escherichia coli, found both in human and cattle feces, contaminates water sources through untreated waste and causes gastrointestinal illnesses when ingested via drinking water or food.

Regions with extensive cattle farming often have elevated E. coli concentrations in water sources, which in turn increases disease risk and severity. Other bacterial pathogens, such as Salmonella typhi (typhoid fever), Shigella (shigellosis), and Campylobacter (acute gastroenteritis), also cause significant health burdens, particularly in areas with poor water quality and unsafe sanitation. The continued prevalence and impact of these pathogens highlight the urgent need to improve access to adequate WASH services in order to reduce the global burden of bacterial diseases.

Between January 2022 and May 2024 alone, the WHO Regional Cholera Bulletin for Africa reported 381,392 cases and 6,733 associated deaths on the continent.

World Health Organization, "Cholera in the WHO African Region," October 21, 2024, https://www.afro.who.int/health-topics/disease-outbreaks/cholera-who-african-region. Risky Ayu Kristanti et al., "Microbiological Contaminants in Drinking Water: Current Status and Challenges," Water, Air, & Soil Pollution 233, no. 8 (2022): 299, https://doi.org/10.1007/s11270-022-05698-3. Evariste Bako et al., "Characterization of Diarrheagenic Escherichia Coli Isolated in Organic Waste Products (Cattle Fecal Matter, Manure and, Slurry) from Cattle's Markets in Ouagadougou, Burkina Faso," International Journal of Environmental Research and Public Health 14, no. 10 (2017): 10, https://doi.org/10.3390/ijerph14101100. Kristanti et al., "Microbiological Contaminants in Drinking Water." Aimee M. Gall et al., "Waterborne Viruses: A Barrier to Safe Drinking Water," PLOS Pathogens 11, no. 6 (2015): e1004867, https://doi.org/10.1371/journal.ppat.1004867. Kristanti et al., "Microbiological Contaminants in Drinking Water."

VIRAL THREATS

Waterborne viruses are commonly transmitted through contaminated water via direct consumption, inhalation of water droplets, or contact with skin and eyes. This category of pathogen includes adenovirus, astrovirus, the hepatitis A and E viruses, rotavirus, norovirus, and enteroviruses such as coxsackie and polioviruses, all of which can lead to serious health consequences. These viruses thrive in environments characterized by inadequate sanitation and water treatment systems, putting vulnerable populations at heightened risk.

Hepatitis A and E are among the most prevalent waterborne viral diseases, causing significant global morbidity. Hepatitis E alone infects an estimated 20 million people annually. Both viruses spread primarily through water or food contaminated with fecal matter, with outbreaks common in regions with poor sanitation and during humanitarian crises when infrastructure is disrupted. Hepatitis A and E cause acute liver disease, with symptoms ranging from fever and fatigue to jaundice and, in severe cases, liver failure. Although both viruses are usually self-limiting, asymptomatic carriers may still transmit either variant. This can lead to substantial public health impacts, as outbreaks can strain healthcare systems and lead to considerable loss of productivity.

Rotavirus and norovirus are leading causes of viral gastroenteritis, particularly among young children. Rotavirus is a major cause of severe diarrhea in children under five, leading to dehydration, malnutrition, and nearly 200,000 child deaths annually, primarily in LMICs. Norovirus causes widespread outbreaks of acute gastroenteritis across all ages, leading to vomiting, diarrhea, and abdominal pain.

Both viruses are highly contagious, with transmission exacerbated by inadequate handwashing, poor sanitation, and contaminated water.

Enteroviruses, such as coxsackie and poliovirus, are also transmitted via contaminated water. As of 2024, poliovirus remained endemic only in Afghanistan and Pakistan, but recent circulation has occurred in several African countries, including Nigeria, Sudan, Chad, DRC, Cameroon, and Angola. Poliovirus can cause meningitis and acute flaccid paralysis, while coxsackie viruses cause hand, foot, and mouth disease and can lead to viral meningitis.

The impacts of these viruses extend beyond immediate illness. They also lead to long-term consequences such as chronic liver disease from hepatitis, growth and developmental delays in children due to rotavirus-related malnutrition, and the continued transmission of vaccine-preventable diseases like polio in regions where WASH services are insufficient.

Hepatitis A and E are among the most prevalent waterborne viral diseases, causing significant global morbidity.

World Health Organization, "Hepatitis E," 2025, https://www.who.int/news-room/fact-sheets/detail/hepatitis-e

World Health Organization, "Hepatitis E."

Caitlin E. LeClair and Kelly A. McConnell, "Rotavirus," in StatPearls (StatPearls Publishing, 2024), http://www.ncbi.nlm.nih.gov/books/NBK558951/

World Health Organization, "Global Polio Surveillance Status Report," 2019, https://polioeradication.org/wp-content/uploads/2020/02/Polio-surveillance-status-report-2019.pdf.

PARASITIC THREATS

Inadequate WASH conditions also facilitate the transmission of multiple types of parasites, including protozoa and helminths, via contaminated water and soil through the fecal-oral route. These infections cause significant morbidity and mortality, particularly in low-resource areas of sub-Saharan Africa. Key waterborne parasites include Giardia, Entamoeba histolytica, Cryptosporidium, schistosomes, and Guinea worm.

Giardia is a protozoan parasite that causes giardiasis, one of the world's most common parasitic infections. It is primarily transmitted by ingesting water contaminated with fecal matter, particularly in areas where sewage treatment is inadequate. Giardiasis manifests as severe diarrhea, abdominal pain, and dehydration, contributing to malnutrition and impaired growth in children. In developing regions, Giardia infects 15%-20% of children under 10 annually. Chronic infections can lead to long-term gastrointestinal issues, including irritable bowel syndrome and nutritional deficiencies, increasing vulnerability to other illnesses.

Cryptosporidium causes cryptosporidiosis, a diarrheal disease characterized by watery stools, vomiting, and abdominal cramps. It poses a serious risk to population groups with comparatively weak immune systems, such as children, the elderly, and people living with HIV/AIDS, and can be life-threatening in immunocompromised individuals. Cryptosporidium is highly resistant to chlorine disinfection, making it a persistent risk even in treated water supplies. Outbreaks often occur following contamination of municipal water systems, leading to severe dehydration and malnutrition, particularly among young children in low-resource settings.

Entamoeba histolytica, the causative agent of amoebic dysentery, is responsible for approximately 100,000 deaths annually, and ranks as the third leading cause of parasite-related deaths globally. This protozoan parasite invades the intestines, leading to severe diarrhea, bloody stools, and in some cases, liver abscesses. It is transmitted through contaminated food and water, with the most severe impacts in areas with poor-quality sanitation infrastructure. Left untreated, amoebic dysentery can cause long-term damage to the intestines and other organs, resulting in chronic health issues and a weakened immune system.

Schistosomes, the parasitic worms responsible for schistosomiasis, are transmitted to humans through contact with fresh water contaminated by larvae released from infected snails. Schistosomiasis is endemic in many tropical and subtropical regions, particularly in Africa, where inadequate water management and sanitation practices perpetuate the transmission cycle. The infection can manifest in various forms, but common symptoms include blood in the urine or stool, abdominal pain, and organ damage, particularly to the liver, kidneys, and bladder. Chronic schistosomiasis can lead to anemia, stunted growth in children, and increased susceptibility to other infections.

The WHO estimates that more than 240 million people are affected globally, with 700 million at risk of infection due to exposure to contaminated water. Guinea worm **(see Figure 2)** is a helminth transmitted through contaminated drinking water containing infected water fleas. Guinea worm disease causes painful ulcers as the adult worms emerge from the skin, often incapacitating individuals for extended periods.

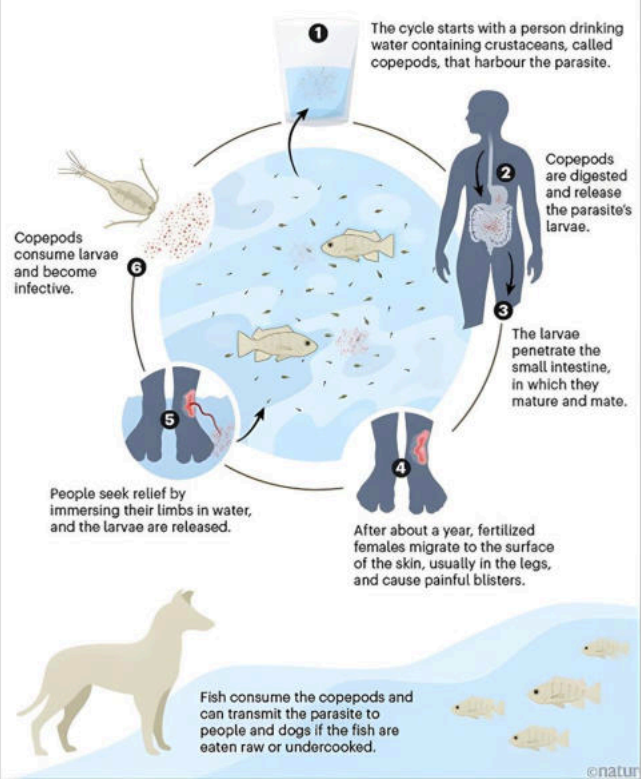
Kristanti et al., "Microbiological Contaminants in Drinking Water." Mpho Tawana et al., "A 'One Health' Perspective of Africa-Wide Distribution and Prevalence of Giardia Species in Humans, Animals and Waterbodies: A Systematic Review and Meta-Analysis," Parasitology 150, no. 9 (2023): 769–80, https://doi.org/10.1017/S0031182023000513. Tawana et al., "A 'One Health' Perspective of Africa-Wide Distribution and Prevalence of Giardia Species in Humans, Animals and Waterbodies." Hebatalla M. Aldeyarbi et al., "Cryptosporidium and Cryptosporidiosis: The African Perspective," Environmental Science and Pollution Research 23, no. 14 (2016): 13811–21, https://doi.org/10.1007/s11356-016-6746-6. Arthur Chou and Richard L. Austin, "Entamoeba Histolytica Infection," in StatPearls (StatPearls Publishing, 2024), http://www.ncbi.nlm.nih.gov/books/NBK557718/. Kristanti et al., "Microbiological Contaminants in Drinking Water."

Although global eradication efforts have drastically reduced the incidence of infection, it remains a public health concern in isolated pockets, particularly in conflict-affected regions where access to safe drinking water is limited. Beyond the immediate pain and disability produced, infections can lead to additional secondary infections, long-term impairment, and economic losses, particularly in agricultural communities.

Figure 2: The Guinea worm life cycle

THE GUINEA WORM LIFE CYCLE

The parasitic roundworm Dracunculus medinensis is the cause of Guinea worm disease, and spreads through contaminated water.



Source: DeWeerdt, 2024



World Health Organization, "Schistosomiasis (Bilharzia)," accessed October 24, 2024, https://www.who.int/health-topics/schistosomiasis. World Health Organization, "Dracunculiasis (Guinea-Worm Disease)," 2025, https://www.who.int/news-room/fact-sheets/detail/dracunculiasis-(guinea-worm-disease). Sarah DeWeerdt, "Even with No Drug or Vaccine, Eradication of Guinea Worm Is in Sight," Nature, ahead of print, July 18, 2024, https://doi.org/10.1038/d41586-024-02306-8.

CHEMICAL THREATS

Contamination of water sources with chemicals occurs through multiple pathways, including agricultural runoff, leaching from heavy industry, and naturally occurring elements in groundwater. Untreated or inadequately treated wastewater introduces pharmaceuticals, traces of personal care products, and other chemicals into rivers, lakes, and groundwater. Industrial discharges compound the problem by releasing heavy metals, persistent organic pollutants, and microplastics into the environment. These chemicals accumulate in ecosystems and can enter the human food chain, triggering health effects ranging from acute toxicity to chronic diseases. Moreover, their effects can be magnified as they bioaccumulate and move up the food chain.

Agricultural runoff exposes populations to nitrates, pesticides, and other chemicals associated with serious health risks such as endocrine disorders. In infants, nitrates can cause methemoglobinemia or "blue baby syndrome," a condition that impairs oxygen transport in the blood. Acute exposure to pesticides or volatile organic compounds (VOCs) can cause poisoning, respiratory distress, and neurological damage. Long-term exposure to contaminants such as arsenic, lead, and cadmium is associated with chronic illnesses. For example, arsenic, a widespread groundwater contaminant in some countries like Bangladesh, is associated with cancers of the skin, lungs, bladder, and kidneys, as well as cardiovascular diseases and diabetes. Lead exposure in children leads to cognitive impairments, developmental delays, and behavioral problems, while in adults it can cause kidney damage, hypertension, and reproductive issues.

Many chemicals in contaminated water act as endocrine disruptors, interfering with hormonal systems and potentially causing reproductive disorders, developmental abnormalities, and cancers such as breast and prostate cancer. Heavy metals such as mercury, lead, and cadmium are also associated with neurodegenerative conditions such as Alzheimer's disease and multiple sclerosis. Chronic exposure to these metals can cause permanent neurological damage, impairing memory, attention, and learning abilities.

The health risks posed by chemical contaminants in water extend beyond immediate toxicity, also encompassing long-term conditions such as cancer, neurological disorders, and organ damage. Addressing these threats requires comprehensive water quality monitoring, strict regulation of pollutants (e.g., wastewater discharge into the environment), and proactive mitigation strategies aimed at protecting public health and ensuring that all communities have access to safe drinking water.

ILLNESS CAUSED BY INADEQUATE WASH CONDITIONS ACROSS THE LIFE COURSE

Unsafe water, poor sanitation, and inadequate hygiene drive illness across the life course, starting in early childhood and extending into adulthood. Frequent exposure to waterborne pathogens leads to recurring infections such as diarrhea, which is a leading contributor to malnutrition and stunted growth in children. Malnutrition weakens the immune system and impairs nutrient absorption, resulting in deficiencies that impair the function of every major organ system.

US EPA, "Drinking Water." Zaccheus Shehu et al., "Overview of African Water Resources Contamination by Contaminants of Emerging Concern," Science of The Total Environment 852 (December 2022): 158303, https://doi.org/10.1016/j.scitotenv.2022.158303. M Samuel Collin et al., "Bioaccumulation of Lead (Pb) and Its Effects on Human: A Review," Journal of Hazardous Materials Advances 7 (August 2022): 100094, https://doi.org/10.1016/j.hazadv.2022.100094.

Manoj Kumar et al., "Environmental Endocrine-Disrupting Chemical Exposure: Role in Non-Communicable Diseases," Frontiers in Public Health 8 (September 2020): 553850, https://doi.org/10.3389/fpubh.2020.553850.

Saikat Mitra et al., "Impact of Heavy Metals on the Environment and Human Health: Novel Therapeutic Insights to Counter the Toxicity," Journal of King Saud University - Science 34, no. 3 (2022): 101865, https://doi.org/10.1016/j.jksus.2022.101865.

Children who experience recurrent diarrheal infections are at heightened risk of stunted growth, which affects both physical and cognitive development. Stunted children are more likely to experience learning difficulties, reduced educational attainment, and lower earning potential, all of which perpetuate cycles of poverty.

Nutritional deficiencies such as vitamin A and iron deficiency further compound these impacts. Vitamin A deficiency increases the risk of blindness and susceptibility to infectious diseases such as measles, while iron deficiency leads to anemia, which can impair cognitive performance and physical stamina, particularly in pregnant women and adolescents.

These nutritional deficits have cascading effects on an individual's ability to participate fully in education, employment, and daily life. In later stages of life, individuals who experienced early childhood malnutrition due to inadequate WASH conditions are more prone to chronic illnesses, including cardiovascular diseases, diabetes, and obesity, creating a double burden of disease that places additional strain on health systems, particularly in LMICs.

Moreover, chronic exposure to chemical contaminants such as heavy metals or excessive fluoride in water sources exacerbates the health impact of poor WASH conditions. For example, although some amount of fluoride in drinking water is beneficial for dental health, excessive fluoride can lead to IQ deficits and skeletal fluorosis, which causes joint pain, stiffness, and long-term damage to bones.



These health risks, coupled with the dangers of malnutrition and stunted growth, demonstrate how inadequate WASH conditions create a complex web of interrelated health challenges that persist across an individual's life course, affecting development, productivity, and overall well-being.

Dilruba Nasrin et al., "Moderate-to-Severe Diarrhea and Stunting Among Children Younger Than 5 Years: Findings From the Vaccine Impact on Diarrhea in Africa (VIDA) Study," Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America 76, no. Suppl 1 (2023): S41, https://doi.org/10.1093/cid/ciac945. Nasrin et al., "Moderate-to-Severe Diarrhea and Stunting Among Children Younger Than 5 Years." Jonathan C. Wells et al., "The Double Burden of Malnutrition: Aetiological Pathways and Consequences for Health," Lancet (London, England) 395, no. 10217 (2019): 75, https://doi.org/10.1016/S0140-6736(19)32472-9. Yogendra Singh Solanki et al., "Fluoride Occurrences, Health Problems, Detection, and Remediation Methods for Drinking Water: A Comprehensive Review," Science of The Total Environment 807 (February 2022): 150601, https://doi.org/10.1016/j.scitotenv.2021.150601.

2.3 How Health Data Can Support WASH Surveillance and Monitoring

As described earlier in this chapter, WASH goals are focused on improving human health. From a public health and policymaker perspective, achieving SDG-6 targets is widely recognized as a pathway to better health outcomes. It is essential that population health surveillance be tied to these WASH goals, for four key reasons:

01

Justifying Investments:

WASH infrastructure requires significant financial investment relative to LMIC gross domestic product. Characterizing, tracking, and demonstrating these investments' potential health benefits, along with the amount of disability and death averted, is essential for justifying, calibrating, and prioritizing funding decisions.

02

Targeting High-Need Areas:

Policymakers seeking to engage in effective geographic prioritization should consider not only the prevalence of waterborne disease but also population vulnerability, best characterized by extant health and social needs. The data needed to assess these needs fall within the purview of local government administrations, health ministries and healthcare systems.

03

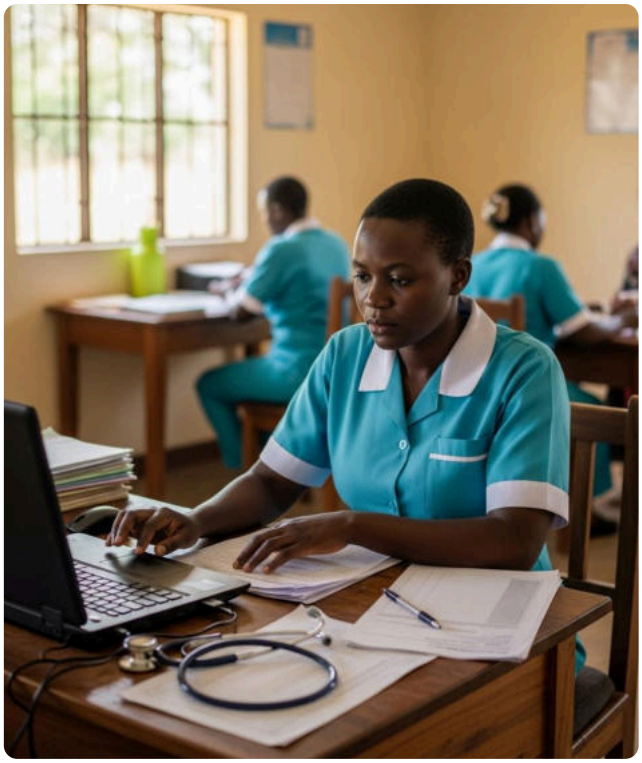
Maximizing Health Impact:

Not all WASH investments yield equivalent population-level health benefits. Using health outcome data and referencing the associated economic costs can support cost-benefit analyses, helping policymakers compare options by quantifying the value of the illnesses averted and the lives saved.

04

Sustaining Political And Financial Commitment:

The political will shown by governments, multilaterals, lenders, and donors is often unpredictable over time. This means that economic investments, once initiated, are not always maintained even when they are having a positive impact. Monitoring progress with respect to human health and well-being in association with changes in WASH access may thus help to preserve the political capital needed to sustain the inherently long-term investments required for WASH infrastructure.



World Bank, "Funding A Water-Secure Future: An Assessment of Public Spending Key Messages," Text/HTML, World Bank, accessed July 9, 2025, https://www.worldbank.org/en/topic/water/publication/funding-a-water-secure-future.

Later chapters will explore in detail the sources of WASH-relevant health, social, and behavioral data. Generally, health data is derived from population-level surveys, health information systems, hospital/clinic records, and civil registration and vital statistics (CRVS) systems, which record births, deaths, and causes of deaths. Here, we describe key ways that health data can be used to support WASH surveillance and performance monitoring. One important use of health data is to estimate the burden of disease attributable to unsafe WASH. This is a critical aspect of surveillance systems aimed at tracking illnesses linked to water quality, sanitation, and hygiene practices, as well as exposure to fecal matter. These burdens are characterized both by incidence (the number of new cases within a specified time period) and prevalence (the proportion of the population affected at a given time). Each metric serves a distinct purpose: incidence measures the flow of new cases and is helpful for assessing the effectiveness of interventions, while prevalence gives a snapshot of the overall disease burden, which is important for long-term planning. Both counts (total number of cases) and rates (cases per population) are used in health data reporting. For example, reporting diarrheal disease rates per 1,000 people helps to compare disease risks across different regions or population groups. These metrics are vital in informing public health priorities and policies, allowing for targeted interventions based on the severity and scope of WASH-related illnesses in specific populations. Health data can also help identify the geographic distribution of WASH-related illnesses, enabling targeted responses.

In addition to evaluating and comparing disease burdens, health data are critical in characterizing risk factors for WASH-related illness. Many countries routinely conduct population surveys that gather information on access to water, use of sanitation facilities, and key hygiene behaviors such as handwashing. This data can help validate the presence and quality of WASH infrastructure and services and provide deeper insight into behaviors that increase or decrease exposure to WASH- related risks. Stratifying this information by factors such as income, gender, age, ethnicity, population density (e.g., urban, peri-urban or rural), and regional characteristics reveals disparities in WASH access and health outcomes.

This equity perspective is essential for making informed decisions that address the needs of the most vulnerable, ensuring WASH interventions improve public health while reducing inequities within and between populations. For example, communities with high HIV prevalence face greater risks from waterborne illnesses, underscoring the need to prioritize WASH investments in these areas.

Health data also enable robust evaluation of the impacts and benefits of WASH-related improvements. Many countries track their progress toward SDG 6, which focuses on access to safe WASH. By integrating this information with disease outcome data, health systems can assess the direct impact of WASH interventions on health outcomes. Longitudinal evaluations of illness trends can highlight improvements over time, often through natural experiments in which some populations receive interventions before others. This type of impact analysis may also involve modeling expected benefits, such as estimating the reduction in disease burden following a major WASH intervention. For instance, if a population of 10,000 experiences a drop in diarrheal prevalence from 20% to 5% after the introduction of safe water systems, an estimated 1,500 fewer people would suffer from diarrhea annually. Such data not only demonstrate the health benefits of WASH improvements but also help prioritize future investments and policy changes by highlighting the populations likely to benefit most.

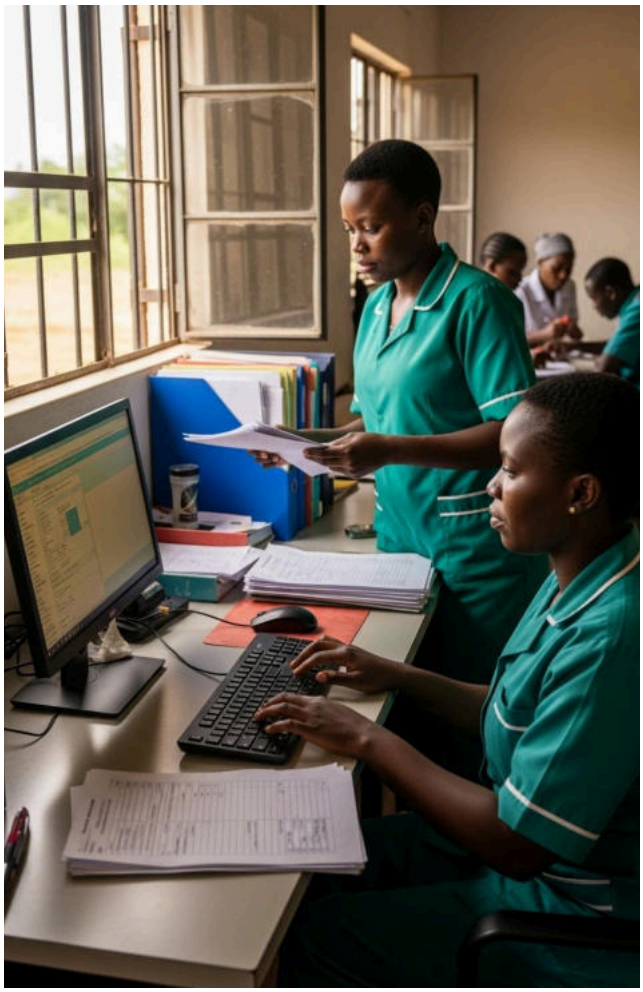
Economic cost evaluation is another vital function supported by health data in the context of WASH. These analyses calculate the economic burden of WASH-related illnesses, incorporating both direct costs (such as healthcare expenses, medical supplies, and labor) and indirect costs (like lost productivity and wages). In many countries, digital health information systems allow for detailed tracking of these costs, enabling more accurate economic valuations. For example, health data can help estimate the financial costs to a healthcare system associated with treating diarrheal disease caused by unsafe water, or the income lost to families affected by repeated illnesses.

Deaths related to WASH issues can also be included in economic evaluations by assigning a monetary value to life, with higher values typically placed on preventing premature deaths among younger populations. This type of data is critical for cost-benefit analyses (CBA), which assess the return on investment of WASH interventions. Such analyses can determine whether specific WASH investments are cost-effective, compare different intervention strategies, and assess whether the long-term economic benefits of an intervention exceed the initial costs. For example, a cost–benefit analysis may show that investing in safe water supplies reduces disease burden while also yielding substantial long-term savings for the health system.

By incorporating health data into these diverse analytical approaches, WASH programs can better understand and address the complex factors that influence public health. These data help in quantifying the burden of disease, identifying and addressing disparities, measuring the effectiveness of interventions, and calculating the economic benefits of improved WASH conditions. The resulting insights are crucial for guiding public health strategies, policy decisions, and investment in WASH infrastructure so as to maximize health outcomes and reduce inequities across populations.

The link between WASH and human health demonstrates the urgent need for comprehensive WASH surveillance systems that also incorporate health data. As discussed in this chapter, inadequate WASH infrastructure and poor sanitary practices remain major contributors to disease and health inequities, particularly in sub-Saharan Africa. The burden of WASH-related diseases makes it clear that investing in WASH is not just a development priority, but also a public health imperative. By addressing the multifaceted health impacts associated with unsafe water and poor sanitation, countries can reduce the incidence of preventable illness and death, particularly among vulnerable populations such as children and those in impoverished communities.

To ensure WASH interventions have maximum impact, it is essential to integrate health data into WASH monitoring and performance systems so that the myriad interactions among WASH conditions and health outcomes can be observed and acted upon. Using health metrics to guide decisions helps ensure investments and policies are evidence-based and targeted to where they are most needed. Demonstrating clear links between WASH conditions and health outcomes also strengthens the case for sustained funding, supports prioritization of interventions, and helps maintain the political will required for long-term improvements. Taking a health-based approach to WASH surveillance enhances understanding of these challenges and equips policymakers and practitioners with the insights needed to design effective, equitable programs that protect health and advance broader development goals.



UNICEF, Progress on Household Drinking Water, Sanitation and Hygiene 2000-2020: Five Years into the SDGs (JMP, 2021), https://www.unwater.org/publications/who/unicef-joint-monitoring-program-water-supply-sanitation-and-hygiene-jmp-progress-0. Thomas Wilkinson et al., A Framework for the Economic Evaluation of Digital Health Interventions, Policy Research Working Papers (The World Bank, 2023), https://doi.org/10.1596/1813-9450-10407.

CHAPTER 3:

HOW IMPROVEMENTS IN HEALTH ARE MEASURED AND TRACKED

Surveys and routine health data capture progress and risks

CHAPTER 3:
HOW IMPROVEMENTS IN HEALTH ARE MEASURED AND TRACKED

3.0

This chapter reviews key data sources used to measure and track health outcomes related to WASH. It provides an overview of major data collection initiatives—including national surveys, global monitoring programs, and healthcare utilization data—that are critical for monitoring WASH-related health impacts. The chapter examines the strengths and limitations of these data sources, giving readers a clear understanding of the tools available for tracking health and WASH metrics and their implications for public health policy and programming.

3.1 WASH-Specific Surveys

JOINT MONITORING PROGRAMME

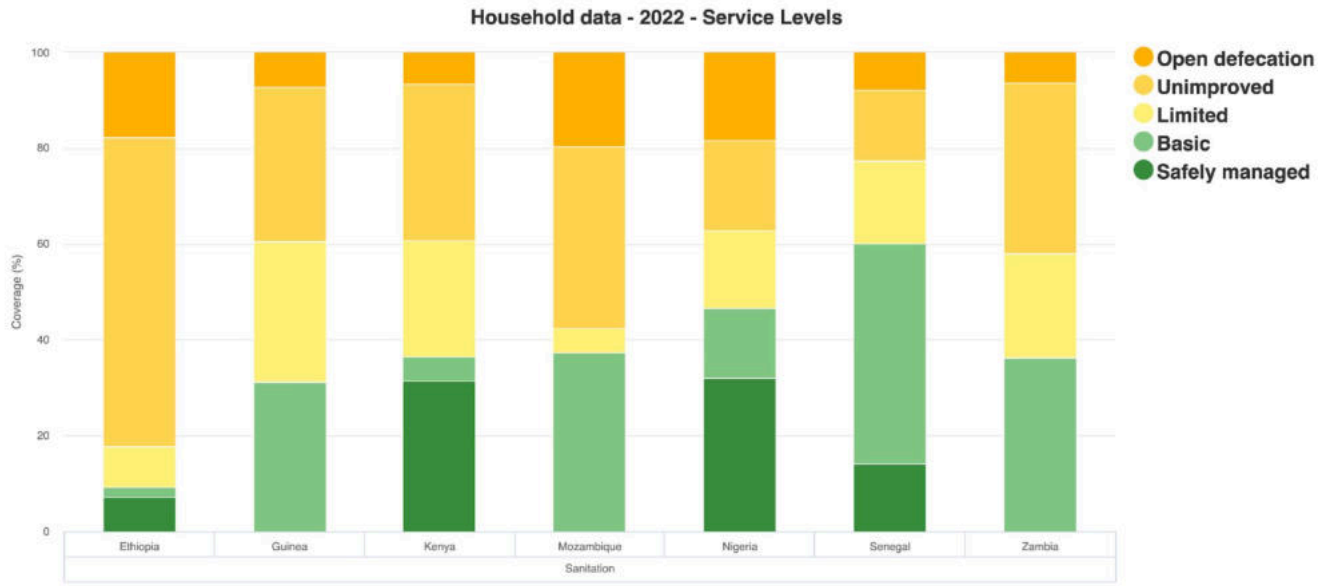
The Joint Monitoring Programme for Water Supply and Sanitation (JMP) is a collaborative initiative by WHO and UNICEF that tracks global progress on issues related to drinking water, sanitation, and hygiene. Established in 1990, the JMP provides comprehensive and reliable data essential for monitoring advancements toward international targets such as the Sustainable Development Goals (About the JMP, 2024). By offering standardized data, the JMP enables comparability across countries and time periods, supporting the consistent evaluation of global and regional trends in WASH access and quality. The JMP's five-year strategy, which extends through 2025, aims to enhance global monitoring of drinking water, sanitation, and hygiene. Its updated vision, aligned with the 2030 Agenda, aims to achieve the progressive realization of universal access to drinking water, sanitation, and hygiene, as well as the reduction of inequalities in service levels, by 2030.

The JMP's methodology involves the systematic collection and analysis of data from national surveys, censuses, and administrative records. This approach ensures a high level of accuracy and credibility in the reported figures. The JMP focuses on key indicators such as the proportion of the population using safely managed drinking water services, sanitation services, and basic hygiene facilities (see Figure 3). These indicators are crucial for assessing the health impacts of WASH and identifying areas in which improvements are needed. The data are presented in a user-friendly format, including the use of interactive dashboards and reports, making the information accessible to policymakers, researchers, and the public. The JMP also publishes longitudinal and regional reports, as well as summaries that highlight special issues such as gender.



"Progress on Household Drinking Water, Sanitation and Hygiene 2000-2022: Special Focus on Gender - UNICEF DATA," accessed July 15, 2024, https://data.unicef.org/resources/jmp-report-2023/; Progress on Sanitation and Hygiene in Africa 2000-2022 (JMP, 2023), https://washdata.org/reports/jmp-2023-progress-sanitation-and-hygiene-africa; UNICEF, Progress on Household Drinking Water, Sanitation and Hygiene 2000-2020: Five Years into the SDGs.

Figure 3: Household sanitation coverage in sub-Saharan Africa, JMP, 2022

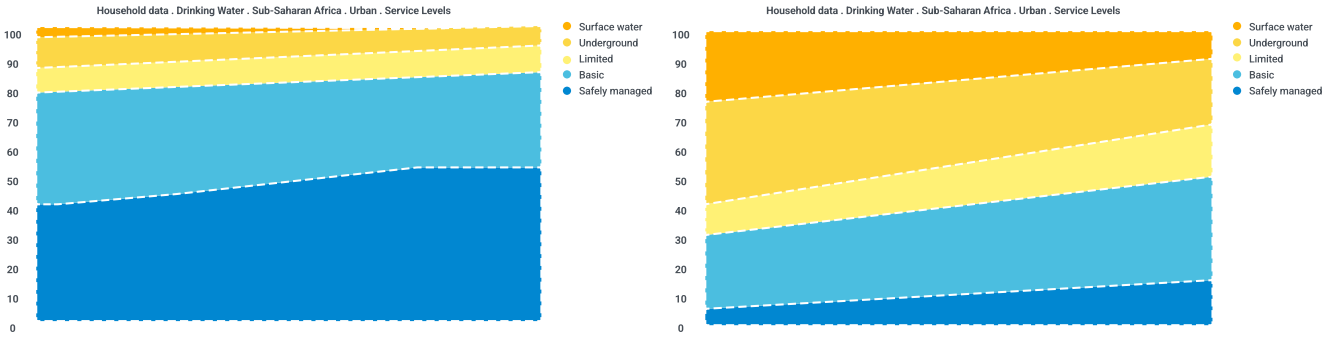


Source: JMP

One of the significant advantages of the JMP is its ability to highlight disparities in WASH access between different regions, countries, and population groups. By disaggregating data using factors such as urban vs. rural residence, socioeconomic status, or education level, the JMP reveals inequities that are often obscured in aggregate statistics. For example, Figure 4 illustrates the urban/rural divide with regard to access to safe drinking water in sub-Saharan Africa. Such stratification is essential for designing targeted interventions that address the specific needs of underserved and vulnerable populations. Additionally, the JMP's regular updates ensure that progress and challenges in achieving universal access to WASH are continuously monitored and addressed. However, there are limitations associated with JMP's reliance on data reported by countries themselves, which can vary in quality and completeness depending on the data source.

Differences in data collection methods, definitions, and reporting standards across countries can also affect the comparability of the data. Despite these challenges, the JMP remains a cornerstone of global WASH monitoring efforts. Its robust framework and comprehensive data collection provide a solid foundation for understanding and improving WASH conditions worldwide.

Figure 4: Rural vs. urban access to safe drinking water in sub-Saharan Africa, JMP, 2000-2022



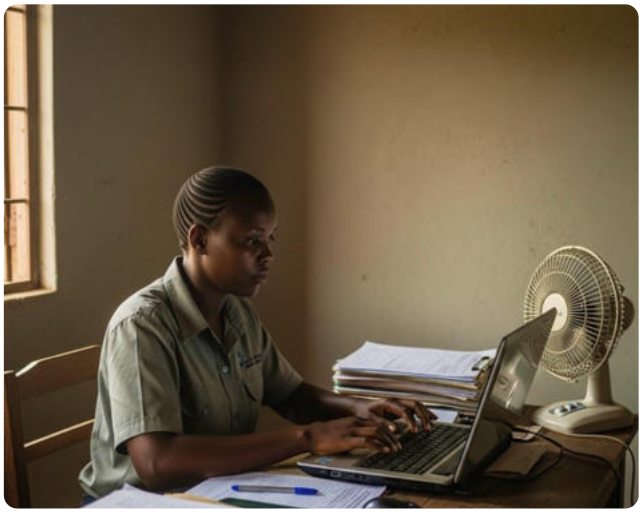
Source: JMP

GLOBAL ANALYSIS AND ASSESSMENT OF SANITATION AND DRINKING WATER

The Global Analysis and Assessment of Sanitation and Drinking Water (GLAAS) is a WHO-led initiative that monitors the inputs required to enhance and sustain WASH systems and services. Unlike other WASH monitoring programs that primarily track outcomes and coverage, GLAAS provides an in-depth analysis of the enabling environment that supports WASH services. This includes key factors such as financial investments, policies, human resources, and institutional capacity, all of which are essential for the long-term success and sustainability of WASH initiatives. GLAAS also monitors the means being employed to reach the SDG 6 implementation targets, such as expanding international cooperation, building capacity for water and sanitation programs in developing countries, and promoting the participation of local communities in improving water and sanitation management.

One key contribution made by GLAAS is its detailed assessment of financial flows and resource allocations within the WASH sector (see Figure 5).

By tracking funding from government budgets, international aid organizations, and sources of private investment, GLAAS identifies gaps and inefficiencies in financial support for WASH services. Although GLAAS does not include health outcome data, it is helpful for policymakers and development partners as it highlights areas in which additional resources are needed.



"JMP Dashboard."

World Health Organization, "UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS)," World Health Organization, 2024, https://www.who.int/teams/environment-climate-change-and-health/water-sanitation-and-health/monitoring-and-evidence/wash-systems-monitoring/un-water-global-analysis-and-assessment-of-sanitation-and-drinking-water.

Additionally, GLAAS examines the cost-effectiveness of different WASH interventions, providing insights that can guide strategic planning and prioritization. The 2022 report also included context illuminating important topics such as WASH-related COVID-19 response efforts and the climate resilience of WASH systems.

GLAAS further evaluates the policy and institutional frameworks that underpin WASH services. This includesan analysis of national policies, regulatory standards, and governance structures that influence the delivery and quality of WASH services. By identifying strengths and weaknesses in these areas, GLAAS supports countries in strengthening their institutional capacities and regulatory environments. This, in turn, fosters a more resilient and responsive WASH sector capable of adapting to challenges such as population growth, changes in national priorities due to external circumstances, and economic fluctuations.

By focusing on the enabling environment, GLAAS helps ensure that WASH services are effectively scaled and maintained in the long term.

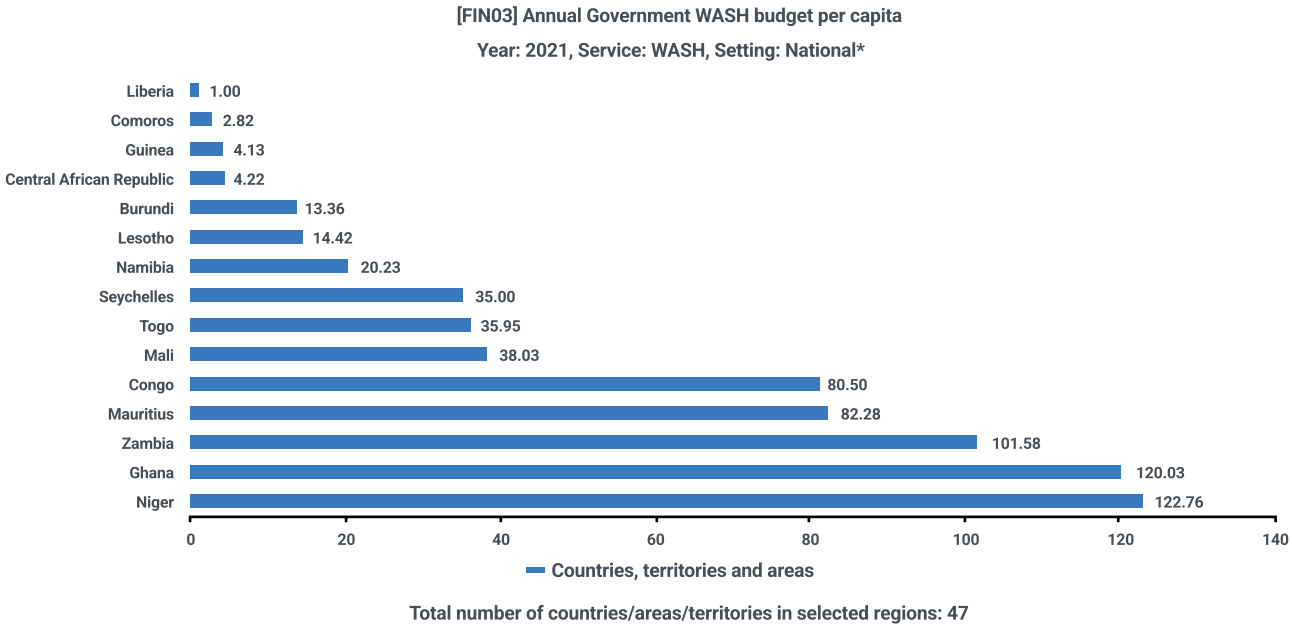
Despite its comprehensive approach, GLAAS faces certain challenges, particularly relating to the availability and reliability of data. The assessment relies heavily on self-reported information from countries, which can vary in accuracy and completeness. Additionally, the complexity of financial and policy environments means that the processes of data collection and analysis can be resource-intensive and time-consuming. However, the value of GLAAS lies in its ability to provide a holistic view of the factors influencing WASH sustainability. By addressing the foundational elements required for effective WASH systems, GLAAS plays a vital role in supporting global efforts to achieve universal access to safe water, sanitation, and hygiene.

Table 2: Advantages and disadvantages of selected WASH-specific surveys – JMP and GLAAS

Source	Advantages	Disadvantages
Joint Monitoring Programme	• Standardized indicators and reporting allow for comparisons across countries and over time • Disaggregates data by numerous important factors	• Relies on country-reported data, which can vary in quality, consistency, and completeness • Does not include subnational data • Largely redundant if DHS and MCIS are being used
Global Analysis and Assessment of Sanitation and Drinking Water (GLAAS)	Only systematic data source that focuses on the enabling environment for WASH, providing insights into the systemic factors influencing WASH outcomes	• Does not directly measure health outcomes, limiting its use • Relies on country-reported data, which can vary in quality, consistency, and completeness • Does not include subnational data

"GLAAS Data Portal," GLAAS Data Platform, accessed February 4, 2025, https://glaas.who.int/glaas/visualizations. Strong Systems and Sound Investments: Evidence on and Key Insights to Accelerating Progress on Sanitation, Drinking-Water, and Hygiene (WHO, 2022), https://iris.who.int/bitstream/handle/10665/365297/9789240065031-eng.pdf?sfvrsn=f6b6f522_13.

Figure 5: GLAAS Dashboard on annual government WASH budgets, in USD per capita, selected African countries, 2021



Source: GLAAS

3.2 Health-Related Surveys

NATIONAL SURVEYS

National surveys are fundamental tools in public health research, providing critical data that help shape policy and intervention strategies. Among these, the Demographic and Health Surveys (DHS) are particularly significant. Conducted in more than 90 countries, the DHS collects data on a wide range of health indicators, including those related to WASH. The eighth iteration of the DHS, known as DHS-8, is being implemented through 2025, and contains model questionnaires that can be submitted to men, women, households, fieldworkers, and other specific target populations.

These surveys include specific questions about access to clean water, the availability and quality of sanitation facilities, and the prevalence of diseases closely linked to poor WASH conditions. The comprehensive nature of the DHS allows for detailed analysis and comparison across different regions and time periods, making it an invaluable resource for monitoring progress and identifying areas in need of improvement. DHS data has been used by ministries and departments of health, academic researchers, civil society organizations, and other entitites to understand the effect of water and sanitation conditions on child morbidity and mortality. Researchers found that just a single round of DHS data collection was associated with the publication of more than 1,100 peer-reviewed journal articles. Furthermore, the consistency and quality of the data have facilitated the conduct of lengthy longitudinal studies.

"The DHS Program - Demographic and Health Survey (DHS)," 2024, https://dhsprogram.com/Methodology/Survey-Types/DHS.cfm. "Guide to DHS Statistics DHS-8," 2024, https://dhsprogram.com/data/Guide-to-DHS-Statistics/index.htm#t=Description_of_The_Demographic_and_Health_Surveys_Program.htm. Isabel Günther and Günther Fink, Water, Sanitation and Children's Health: Evidence from 172 DHS Surveys (SSRN, 2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1593423. Madeleine Short Fabic et al., "A Systematic Review of Demographic and Health Surveys: Data Availability and Utilization for Research," Bulletin of the World Health Organization 90, no. 8 (2012): 604–12, https://doi.org/10.2471/BLT.11.095513.

For example, a 23-year study on the association between child growth failures and household sanitation practices found that access to improved sanitation facilities is associated with a significant reduction in stunting. Other studies have used DHS data to examine the association between WASH and anemia and to assess how access to improved water and sanitation influences the utilization of maternal and child health services. A gender dashboard on health and wellness in Sierra Leone can be found below in **Figure 6.**

Figure 6: DHS Gender Dashboard, Sierra Leone, 2019



Source: DHS

Routine health surveys are typically conducted at regular intervals with the aim of collecting ongoing data on health indicators. These national and subnational surveys provide a continuous stream of information necessary for tracking trends and evaluating the impact of health interventions over time. In the context of WASH, routine health surveys can offer insights into the effectiveness of sanitation campaigns, water quality improvements, and hygiene education programs.

By consistently gathering data, these surveys help government ministries and other stakeholders ensure that public health strategies remain relevant and responsive to current conditions.

Both DHS and routine health surveys have their unique advantages and challenges. The DHS is renowned for its thoroughness and broad scope, consistently covering various demographic and health variables that provide a comprehensive picture of a population's health status. However, the extensive subjects covered by the DHS make it time-consuming and costly to conduct, often resulting in infrequent data collection.

For example, a recent iteration of the survey in Angola cost nearly USD 2 million. Furthermore, DHS studies are currently conducted around every five years, limiting the model's utility with regard to identifying shorter-term trends. Routine health surveys, while less comprehensive, offer the advantage of regular data updates, allowing for more timely assessments of health trends and the immediate impact of interventions. However, they may lack the depth and detail provided by larger surveys like the DHS.

These national surveys play a crucial role in informing public health initiatives and policies. By linking WASH resource and behavior questions with information on health behavior and outcomes at the individual or household level, they enable potential associations to be evaluated. They also generate data that enable the identification of gaps in WASH services, allow progress toward health goals to be tracked, and inform effective resource allocation. By leveraging the strengths of both DHS and routine health surveys, policymakers and health professionals can develop targeted strategies to improve WASH conditions and, ultimately, enhance the overall health and well-being of populations.

Günther Fink et al., "The Effect of Water and Sanitation on Child Health: Evidence from the Demographic and Health Surveys 1986–2007," International Journal of Epidemiology 40, no. 5 (2011), https://academic.oup.com/ije/article/40/5/1196/658066. Monica T Kothari et al., "Exploring Associations between Water, Sanitation, and Anemia through 47 Nationally Representative Demographic and Health Surveys," Annals of the New York Academy of Sciences, June 24, 2019, https://nyaspubs.onlinelibrary.wiley.com/doi/full/10.1111/nyas.14109. DHS, "The DHS Program - Gender Dashboard," 2024, https://dhsprogram.com/data/visualizations/gender-dashboard.cfm.



MULTIPLE INDICATOR CLUSTER SURVEYS (MICS)

The Multiple Indicator Cluster Surveys (MICS), supported by UNICEF and conducted in over 115 countries, are a critical component of global health data collection. MICS are designed to fill data gaps with regard to monitoring the status of children and women, covering a broad range of indicators relating to health, education, child protection, and water and sanitation. A phone-based longitudinal representative household version, MICS Plus, was also introduced in 2019. These surveys illuminate the living conditions and well-being of children and their families, supporting targeted interventions and policy decisions aimed at improving their quality of life.

One of the MICS program's key strengths is its comprehensive coverage of WASH-related indicators. MICS collects statistically sound, internationally comparable estimates of approximately 130 indicators, including 33 that support SDG monitoring. The surveys collect data on access to safe drinking water, the availability and quality of sanitation facilities, and hygiene practices within households. This detailed, disaggregated data enables governments and organizations to identify disparities and prioritize areas that require urgent action, thereby enhancing the effectiveness of WASH interventions.

MICS is notable for its methodological rigor and standardized approach, which allows for comparability across different countries and regions. The surveys are conducted every three to five years, providing periodic snapshots of the status of children and women.

The data generated by MICS are free to use, and access is provided for legitimate research purposes. As such, MICS is widely used by governments, international agencies, and non-governmental organizations to inform policy decisions, allocate resources, and design programs aimed at improving health and educational outcomes.

However, there are limitations. The three- to five-year interval between survey rounds means that short-term trends may not be adequately captured, potentially delaying the identification of emerging issues. Additionally, reliance on self-reported data can introduce biases, although rigorous training and quality-control measures are implemented so as to minimize the risk of biases affecting the results. Despite these challenges, MICS remains a vital tool for understanding the complex factors affecting child and maternal health, education, and WASH.

GLOBAL BURDEN OF DISEASE

The Global Burden of Disease (GBD) study is an expansive research program coordinated by the Institute for Health Metrics and Evaluation (IHME) at the University of Washington. It provides detailed assessments of morbidity and mortality across a wide range of diseases, injuries, and risk factors, including those related to WASH. GBD offers comprehensive data on health outcomes at the global, regional, and national levels, as well as at subnational levels for some countries. Using advanced statistical methods and data from numerous sources such as national health systems and peer-reviewed studies, GBD quantifies the burden of disease in order to help policymakers assess global health priorities.

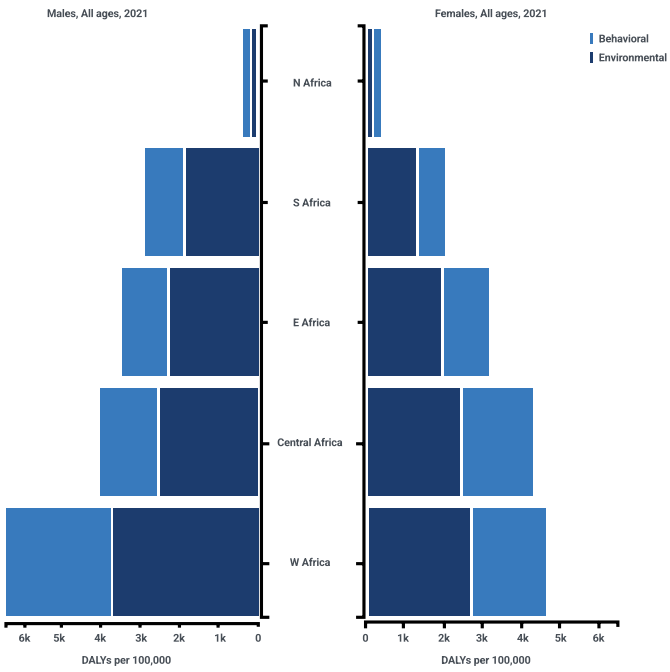
"Demographic and Health Survey - DHS 2020 | Fact Sheet | Angola," U.S. Agency for International Development, June 26, 2024, https://www.usaid.gov/fact-sheet/demographic-and-health-survey-dhs-2020. "UNICEF MICS," 2024, https://mics.unicef.org/.

In 2024, GBD used more than 607 billion standardized and comprehensive estimates measuring health outcomes and systems.65 GBD is the largest and most comprehensive effort to quantify health losses globally, and is produced through the active collaboration of more than 8,000 scientists from over 150 countries. The study integrates data from civil registration and vital statistics (CRVS) systems, health surveys, and epidemiological studies to create a detailed picture of health trends and patterns.

Where country-level data is insufficient or unavailable, GBD uses models to estimate indicator values based on factors that are predictive of these data points. This approach enables comparisons of health outcomes across regions and over time, providing a dynamic view of evolving health risks and disease burdens. GBD data is accessible to all, with datasets available for download after the creation of a free account. An example of the IHME's GBD dashboard is shown below in **Figure 7.**

GBD includes data on health outcomes related to WASH, such as the prevalence and incidence of diarrheal diseases. Importantly, GBD quantifies both risks and outcomes. This allows end users to identify which risk factors (e.g., unsafe water, unsafe sanitation) are associated with leading determinants of death and disability, including diarrheal diseases and lower respiratory infections.

Figure 7: IHME Global Burden of Disease Dashboard, African Union, 2021



Source: IHME, 2025

Despite its many strengths, the GBD faces challenges primarily related to the complexity of its methodology and user interface. The program relies on a vast array of data sources, which can vary in completeness and accuracy. Additionally, the sophisticated modeling techniques used to estimate disease burden require specialized knowledge to interpret and apply effectively. The GBD's estimation models undergo periodic revisions as new epidemiological findings occur and additional country-specific data sources are identified. The GBD project also back-calculates values for prior years based on the updated models, ensuring that longitudinal data remains interpretable.

"MICS Plus," UNICEF, 2024, https://mics.unicef.org/mics-plus/methodology-and-use. "MICS FAQ," UNICEF, 2024, https://mics.unicef.org/faq. Shane Khan and Attila Hancioglu, "Multiple Indicator Cluster Surveys: Delivering Robust Data on Children and Women across the Globe," Studies in Family Planning 50, no. 3 (2019): 279–86.

HEALTHCARE UTILIZATION DATA

Healthcare utilization data is a vital resource for tracking and understanding the prevalence and impact of WASH-related illnesses. This data encompasses records from health facilities, including hospital and clinic patient utilization records. While the original data includes confidential information that may not be released, data owners (typically ministries or departments of health) generally provide aggregated public-use or researcher-use datasets that can be used for the purposes of data analysis and summarization. By analyzing this information, researchers and policymakers can gain insights into the burden of diseases linked to inadequate water, sanitation, and hygiene conditions. Hospital records offer valuable data on severe cases of WASH-related illnesses, such as acute diarrheal diseases, severe dehydration, and other infections that require inpatient care.

Healthcare utilization data document patient diagnoses, treatments, and outcomes, enabling health professionals to monitor trends and identify patterns in disease occurrence. For example, temporal or geographic spikes in diarrheal diseases can signal outbreaks linked to contaminated water sources, which is especially useful in tracking and combating highly infectious diseases such as cholera, typhoid, or E. coli. By systematically collecting and analyzing this data, health authorities can respond more effectively to emerging health threats and allocate resources to the areas with the greatest need.

Together, outpatient and inpatient data provide a broad perspective on WASH-related disease trends. Outpatient data includes visits to clinics and health centers for less severe conditions that do not require hospitalization, or which precede hospitalization, offering insights into the more common and widespread impact of inadequate WASH. Inpatient data, on the other hand, focuses on more severe cases that necessitate extended medical care.

Together, these data help paint a comprehensive picture of the health burden associated with poor water, sanitation, and hygiene conditions, capturing both the immediate and long-term impacts on public health.

Healthcare utilization data are associated with various challenges, however. Variability in data quality and completeness across health facilities can affect the accuracy of the analysis. In many low- and middle-income countries, health facility data may be incomplete or inconsistently reported—especially when it is reported using paper-based systems—thus limiting its utility for comprehensive assessments. These data typically employ internationally standardized coding schemes for treatments, diagnoses, and outcomes, but these may be inconsistently applied owing to inadequate training, human error, and bias.

Additionally, healthcare utilization data typically capture only those who seek medical care, potentially missing a significant portion of the population who might not be sick enough to seek medical attention. Not capturing those who do not seek medical services may bias findings, as the analysis may thereby miss those who avoid care due to barriers such as lack of transportation, lack of insurance, high medical costs, or inability to cover childcare.

CIVIL REGISTRATION SYSTEMS

Civil registration systems are essential for the continuous, universal, permanent, and compulsory recording of vital events in a population such as births, deaths, and stillbirths. Registration serves as the legal foundation that provides individuals with important identity documents—including birth, marriage, and death certificates—that are essential for accessing health, education, and social services.

"Global Burden of Disease (GBD)," Institute for Health Metrics and Evaluation, 2024, https://www.healthdata.org/research-analysis/about-gbd. Christopher J. L. Murray, "The Global Burden of Disease Study at 30 Years," Nature Medicine 28, no. 10 (2022): 2019–26, https://doi.org/10.1038/s41591-022-01990-1. IHME, "GBD Dashboard," Institute for Health Metrics and Evaluation, accessed February 4, 2025, http://vizhub.healthdata.org/gbd-compare.

Civil registration systems, when fully functioning, ensure that every birth and death is recorded in a timely manner, enabling the collection and analysis of population data that supports effective public health strategies and resource allocation.

In the context of WASH, civil registration systems provide valuable data on how water quality, sanitation access, and hygiene practices influence population health. For instance, birth data linked to WASH quality data can highlight health disparities related to maternal care and neonatal outcomes in areas with poor WASH services. Similarly, death records can capture causes of death related to waterborne diseases, allowing health officials and WASH stakeholders to target interventions to the regions most affected by inadequate infrastructure and services. This linkage is vital particularly in LMICs, where health disparities are often exacerbated by poor access to clean water and sanitation.

The health sector plays a crucial role in notifying civil registration authorities of vital events. Births, deaths, and stillbirths that occur in healthcare facilities or under the supervision of healthcare workers are reported to civil registrars, who use the notification information to verify the facts and carry out the legal registration of the vital event. However, challenges persist in many LMICs, where out-of-hospital births and deaths may go unreported, leading to incomplete civil registration of events and their details (see Chapter 3.3 below, and its discussion of Colombia's experience). A 2017 World Bank report highlighted the importance and role of using civil registration data to monitor population outcomes measured via the SDGs. For example: SDG target 3.9 calls for reducing the number of deaths and illnesses caused by contaminated water. One of the indicators used to measure this target, the mortality rate attributed to unsafe WASH, derives from civil registration reporting.

A well-functioning civil registration system enables data stratification by demographic factors such as age, gender, and geographical location at the lowest administrative levels. By continuously collecting data, civil registration systems provide a valuable resource for policymakers, enabling them to identify trends, allocate resources, and implement targeted interventions to improve WASH services and overall public health outcomes.

VITAL STATISTICS DATA

Vital statistics data are derived from civil registration systems and supplemented by population surveys and other sources to provide essential insights into key demographic indicators, including births, deaths, and causes of death. This data serves as a cornerstone for public health monitoring, enabling governments and health agencies to assess fertility and population health statuses, track changes over time, and identify areas where interventions are needed. In relation to WASH, vital statistics data offer a unique perspective on the immediate outcomes and long-term health impacts of inadequate water, sanitation, and hygiene services.

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One of the most important uses of vital statistics data in the WASH sector is for monitoring morbidity and mortality rates associated with inadequate WASH services, for instance cholera, typhoid, and diarrheal illnesses.

Samuel Mills et al., "Civil Registration and Vital Statistics for Monitoring the Sustainable Development Goals," World Bank, Washington, DC, May 18, 2017, http://hdl.handle.net/10986/27533.

These conditions are often linked to poor water quality and sanitation, and understanding their incidence and prevalence is critical for designing effective public health interventions and improving WASH performance monitoring in order to strengthen service delivery. Vital statistics data can also be used to assess the burden of diseases over time; this information can in turn be used to pinpoint gaps in WASH services and provide evidence for planning effective interventions and guiding future policy decisions.

Vital statistics data, particularly data on deaths and causes of death, are essential for calculating key health indicators such as life expectancy and infant mortality rates.

These indicators can be used for WASH performance monitoring and to measure the success of WASH interventions, as improved access to clean water and sanitation can lead to reductions in infant mortality and increases in life expectancy. In addition, vital statistics data allow for the analysis of health disparities across different populations and geographies at the lowest administrative levels, highlighting the social and economic inequalities exacerbated by inadequate access to WASH services. By linking vital statistics data with other sources of health information, such as hospital records and population surveys, policymakers can gain a more comprehensive understanding of the health impacts of WASH services and prioritize investments that will have the greatest impact on public health.

Table 3: Advantages and disadvantages of selected health data sources

Source	Advantages	Disadvantages
National surveys	Regular updates lead to timely assessments. For example, the Nigeria National Nutrition and Health Survey (NNHS) is conducted yearly, allowing stakeholders to monitor nutrition and health trends closely and respond to issues promptly with targeted interventions.	Quality and comprehensiveness can vary
Demographic and Health Surveys	• Broad scope • Multiple end users • Comprehensive • High level of methodological rigor • Consistent questions and indicators allow for longitudinal comparisons • Ability to compare across countries or regions • Consistent questions and indicators allow for longitudinal comparisons • Align with SDG indicators • Ability to compare across countries or regions	• Costly • Time consuming • Limited frequency (typically conducted every five years) • Often dependent on foreign aid

UNICEF, "National Nutrition and Health Survey (NNHS)," June 1, 2018, https://www.unicef.org/nigeria/reports/national-nutrition-and-health-survey-nnhs-2018.

Global Burden of Disease study	• Largest and most detailed effort to quantify levels and trends in health • Comprehensive • Global scope • Includes a wide range of health outcomes and risk factors • Quantifies disability-adjusted life years (DALYs) to understand health impacts beyond mortality	• Complex methodology • Many indicators estimated based on global models
Healthcare utilization data	• Identifies community-based utilization • Linked to critical health outcomes • Contains process measurements	• Misses unreported cases, including people who do not seek care
Civil registration and vital statistics data (births, deaths, and causes of death)	• Continuous, stable, universal, and compulsory collection of data • Longitudinal • Enables burden of WASH-related disease analysis over life course • Can be basis for syndromic surveillance to identify outbreaks	• Many LMICs have weak CRVS systems and fail to capture timely and complete registration of vital events • Dependent on reporting quality • Variable quality in medical certification of cause of death and other vital statistics • Lags in data availability

UNICEF, "National Nutrition and Health Survey (NNHS)," June 1, 2018, https://www.unicef.org/nigeria/reports/national-nutrition-and-health-survey-nnhs-2018.

3.3 Case Study: Digital Innovations Transform Birth and Death Registration in Colombia

A robust CRVS system serves as the cornerstone of effective governance, underpinning legal identity, public health monitoring, and evidence-based policy development. Yet, in Colombia, rural, Indigenous, and conflict-affected communities have historically faced significant barriers to timely and accurate registration of births and deaths. Geographical isolation, cultural nuances, and logistical hurdles have contributed to chronic underreporting of vital events. To address these long-standing challenges, Colombia launched the Rural Vital Strategy (CRV)—an innovative initiative harnessing digital technology, community engagement, and strategic multistakeholder collaboration. Through mobile platforms, SMS-based reporting, and the implementation of verbal autopsy tools, Colombia successfully bridged crucial gaps in its CRVS system, enhancing both coverage and data quality in remote and marginalized regions.

Despite Colombia's national advancements, persistent disparities in birth and death registration remained starkly evident. Residents of rural communities faced prohibitive distances when traveling to centralized civil registry offices, making routine registration impractical. In 2015, around 87% of births and 83% of deaths were reported via the official CRVS system compared to 20% in rural municipalities. Indigenous and Afro-Colombian populations encountered further complications stemming from traditional naming practices and community rituals that often conflicted with formal registration requirements.

Moreover, remote regions saw a high incidence of unregistered deaths occurring outside formal healthcare settings, severely limiting the accuracy of medical cause-of-death certifications, and negatively impacting health surveillance and resource allocation.

To overcome these multifaceted challenges, Colombia implemented targeted digital strategies:

SMS-Based Reporting:
Digital technology was deployed in the form of SMS-based notification systems that enabled health workers at rural clinics and community health posts to promptly report births and deaths. These real-time notifications allowed civil registrars to create records proactively, significantly reducing registration delays and increasing the accuracy with which vital events could be tracked.

Mobile Registration Units:
Mobile units operated by civil registry officials regularly visited remote communities, issuing birth certificates directly on-site. This eliminated the arduous journey previously required for families to access distant registration offices, and thus significantly improved registration completeness.

Verbal Autopsy Implementation:
Adopting verbal autopsy methods provided a practical solution for documenting causes of death in remote locations. By training local health workers to conduct interviews and electronically report findings, health authorities were able to more reliably classify and monitor causes of death, particularly in the case of maternal, neonatal, and infectious diseases.

Integration With National CRVS Infrastructure:
Digital records generated through these innovations were systematically integrated with Colombia's existing national birth and death registry (RUAF-ND), ensuring consistency, timeliness, and accuracy of data across the national CRVS framework.

VItal Strategies, Colombia Rural Vital, Case Study (Vital Strategies, 2019), https://www.vitalstrategies.org/resources/colombia-rural-vital. VItal Strategies, Colombia Rural Vital.

The digital transformation undertaken by Colombia has significantly increased birth registration completeness and expedited the reporting and documentation of deaths, significantly enhancing the quality of mortality statistics and cause-of-death data.

In the municipalities targeted with these interventions, birth registration coverage increased by 8.9 percentage points in 2017 and another 8.2 points in 2018. Indigenous and conflict-affected areas, which are traditionally underrepresented in vital statistics, have experienced remarkable improvements, directly informing better health interventions and more equitable distribution of resources.

The following key recommendations, which can directly inform strategies for strengthening WASH data systems, can be derived from Colombia's experience:

Leverage Digital Technology To Overcome Accessibility Barriers: Deploying digital solutions, such as SMS-based reporting or mobile applications, can significantly improve data collection efficiency and accuracy in geographically isolated or resource-limited settings, helping organizations achieve timely and precise data reporting.

Use Mobile Teams To Improve Outreach: Establishing dedicated mobile units or teams to regularly collect and verify data on-site in remote or underserved areas helps bridge geographic gaps, improve community engagement, and ensure consistent data availability for planning and decision-making.

Implement Alternative Data Collection Methods: Employing innovative data collection approaches, such as community-based reporting methods or verbal surveys, can effectively overcome logistical, social, and resource barriers. These alternatives allow for accurate data collection in contexts where traditional methods are impractical or insufficient.

Integrate Data Systems To Enhance Decision-Making: Linking local-level data systems to broader national databases or statistical systems enables comprehensive, real-time data integration, facilitating improved monitoring, resource allocation, and coordinated interventions across multiple sectors, including WASH, health, and governance.

Strengthen Digital Infrastructure And Connectivity: Investments in digital infrastructure—including internet connectivity, mobile network coverage, and data management capacity—support effective data capture, transmission, and utilization, especially in geographically isolated or marginalized regions.

Prioritize Community Trust And Engagement: Effective data capture depends heavily on sustained community participation and trust. Strategies must include culturally sensitive approaches and robust community engagement efforts in order to encourage accurate data reporting, ownership, and long-term sustainability.

Incorporating these lessons learned can enhance the resilience, accessibility, and quality of data systems across diverse technical sectors and challenging operational environments.



VItal Strategies, Colombia Rural Vital.
VItal Strategies, Colombia Rural Vital.

CHAPTER 4:

DERIVING WASH-RELEVANT HEALTH INDICATORS FROM ROUTINELY COLLECTED DATA

Turning everyday health records into actionable WASH insights

CHAPTER 4:
DERIVING WASH-RELEVANT HEALTH INDICATORS FROM ROUTINELY COLLECTED DATA

4.0

Building a system for utilizing health-related data to support WASH monitoring and evaluation begins with the identification of core indicators from health-relevant data sources. This chapter builds on earlier chapters that described the relevance of health data to WASH systems, summarized health outcomes and behavioral characteristics that are influenced by the presence or absence of WASH systems, and inventoried routinely collected health-relevant data. Here, rather than proposing novel data collection processes or the creation of new data collection instruments, we explicitly strive to identify data elements derived from existing and largely routinely and near-universally collected datasets. For each of these data sources, we identify specific data elements of relevance, common codes that would make that data element valuable, and in some instances, methodological recommendations for the development of appropriate indicators.

Employing direct measures of health impacts enables far greater specification of the impact of WASH than does a reliance on proxies. For example, relying on the proxy impact indicator of the proportion of the population using safely managed drinking water systems cannot account for the relative effectiveness of that system, its episodic failures, or the actual use of the water. However, given that many national-level surveys lack direct health outcome indicators, these indicators of access and use of WASH services and behaviors can supplement traditional WASH facility performance measurement evaluations and current SDG tracking.

4.1 Health Information System Mortality Data

A health information system (HIS) can encompass a wide range of data collection mechanisms, including hospital records, outpatient data, vital statistics, and population surveys. These systems capture information on disease incidence, health outcomes, and healthcare utilization, offering valuable insights into how WASH-related factors impact public health.

A well-structured and functioning HIS enables the collection of data related both to acute and chronic conditions that are influenced by WASH. A digital HIS allows such diseases to be tracked in real time, providing essential data for rapid intervention and resource allocation.

MEASURE Evaluation, Health Information System Strengthening: Standards and Best Practices (MEASURE Evaluation, 2018), https://www.measureevaluation.org/resources/hisdatasourcesguide.html. "Health Information System Strengthening: Standards and Best Practices — MEASURE Evaluation," Page, accessed June 28, 2024, https://www.measureevaluation.org/resources/hisdatasourcesguide.html. James E. Harrison et al., "ICD-11: An International Classification of Diseases for the Twenty-First Century," BMC Medical Informatics and Decision Making 21, no. 6 (2021): 206, https://doi.org/10.1186/s12911-021-01534-6. "International Classification of Diseases (ICD)," accessed February 4, 2025, https://www.who.int/standards/classifications/classification-of-diseases. CDC, "International Classification of Diseases (ICD)," July 31, 2024, https://www.cdc.gov/nchs/hus/sources-definitions/icd.htm.

Additionally, a HIS can be used to monitor the long-term health impacts of WASH interventions, identifying effects such as reductions in the incidence of waterborne diseases and improvements in overall community health outcomes.

Most countries employ standardized methods of collecting information when a person is treated as an outpatient, by emergency care, or is hospitalized. Hospitalization often represents the most serious nonfatal (or in some cases pre-fatal) manifestation of an illness. Outpatient and hospitalization data typically record personal identifiers (e.g., age, sex, residence), cost information (e.g., source of payment, true or estimated costs), diagnoses, external causes of illness and injuries, and severity (e.g., length of stay, bounce-back/repeat visit). To varying degrees, all countries use the WHO's International Classification of Disease and Related Health Problems (ICD) standardized codes to classify diseases, their external causes, and causes of death.

The ICD system has served as the foundation for recording health data, standardizing disease statistics, and tracking mortality and morbidity trends across various healthcare settings for over a century. The use of the standardized ICD codes to express clinical terms is essential for health data collection, supporting areas such as healthcare payment systems, quality control, service planning, and large-scale medical research, as this helps to ensure data consistency and comparability across different regions and over time. The ICD is typically updated once per decade to keep it current with advances in medicine and emerging pathogens.

The most recently adopted version, ICD-11, came into effect in January 2022. As of May 2024, 132 member states were at different stages of implementing the new system, with 72 countries having already commenced the actual integration process.

Although these revisions are essential, the task of adopting new versions of the ICD is resource-intensive, requiring extensive training of coders and updates to HIS platforms, and can cause significant disruptions in the time series of mortality data. Many countries continue to use the ICD-10 classification, first adopted in 2007. For these reasons, we focus here on mapping ICD-10 codes to outcomes associated with WASH conditions. Furthermore, there have been few changes in the ICD-11 to the actual codes that are relevant in the WASH space.Critical diagnostic information can be obtained by mining HIS data, for instance by searching and filtering utilization data by a range of ICD codes. Often, health ministries and other public health organizations publish case and mortality rates based on one or all of the system's classifications. Depending on the temporality of reporting, and the ability to stratify case summaries and mortality frequencies and rates by relevant demographic and geographic factors, this may obviate the need for additional data mining and analysis.

The ICD codes associated with outcomes described in Chapter 2 and their overall contributions to the burden of disease are listed below in **tables 4-6**. Note that a single given disease as classified by ICD may be attributable to more than one WASH-related domain.

UNICEF, Progress on Household Drinking Water, Sanitation and Hygiene 2000-2020: Five Years into the SDGs (JMP, 2021), https://www.unwater.org/publications/who/unicef-joint-monitoring-program-water-supply-sanitation-and-hygiene-jmp-progress-0. Thomas Wilkinson et al., A Framework for the Economic Evaluation of Digital Health Interventions, Policy Research Working Papers (The World Bank, 2023), https://doi.org/10.1596/1813-9450-10407.

Table 4: Mortality from diseases attributable to inadequate safe drinking water

Disease category	Disease	Subclassification	ICD-10 code
Waterborne diseases	Cholera		A00
	Typhoid fever		A01.0
	Dysentery	Bacillary (Shigellosis)	A03
		Amoebic	A06
	Leptospirosis		A27
	Hepatitis	Hepatitis A	B15
		Hepatitis E	B17.2
Parasitic infections	Giardiasis		A07.1
	Cryptosporidiosis		A07.2
	Schistosomiasis		B65

Harrison et al., "ICD-11." World Health Organization, "ICD-10 Version:2019," 2019, https://icd.who.int/browse10/2019/en.

Table 5: Mortality from diseases attributable to inadequate sanitation and hygiene

Disease category	Disease	Subclassification	ICD-10 code
Soil-transmitted helminths	Hookworm infection		B76
	Ascariasis		B77
	Trichuriasis		B79
Fecal-oral disease	Bacterial diarrhea		A04
	Viral diarrhea		A08
	Protozoal diarrhea		A07
	Polio		A80

Table 6: Mortality from diseases attributable to inadequate solid waste management

Disease category	Disease	Subclassification	ICD-10 code
Vector-borne Diseases	Dengue	Dengue fever	A90
		Dengue hemorrhagic fever	A91
	Zika		A92.5
	Malaria		B50-B54
Respiratory illness	Chronic bronchitis		J42
	Asthma		J45

World Health Organization, "ICD-10 Version:2019.

Inadequate hygiene; inadequate access to safe, potable water; vector-borne and infectious diseases; and chronic smoke inhalation from indoor fuel use and waste burning have all been associated with increased risks of negative birth outcomes.

Tracking trends in these outcomes may be valuable, especially to the extent that an attributable risk can be identified from adequate measurement of exposures. See **Table 7** for more information.

Table 7: Maternal and birth outcomes related to WASH

Disease category	Disease	Subclassification	ICD-10 code
Birth outcomes (coded to newborns)	Newborn small for gestational age		P05.1
	Low birth weight		P07.0 – P07.1
	Stillbirth		P95
	Neonatal sepsis		P36
	Other congenital infections	Other specified congenital infectious and parasitic diseases	P37.8
		Congenital infectious or parasitic disease, unspecified	P39
Pregnancy, childbirth, and the puerperium	Puerperal sepsis		O85
	Maternal infectious or parasitic diseases classifiable elsewhere but complicating pregnancy, childbirth and the puerperium		O98
	Other maternal diseases classifiable elsewhere but complicating pregnancy, childbirth and the puerperium		O99

World Health Organization, "ICD-10 Version:2019."

Often, but not always, health records include an external cause of illness or injury. These describe what the physician or other healthcare professional determines to be the likely source of exposure or activity that resulted in the seeking of healthcare.

This is most commonly used to characterize the cause of injuries, although it may also be used to describe the cause of an exposure that resulted in illness. Where available, there is independent value in utilizing these external causes. Those that are most relevant to WASH domains are described below in **Table 8** and **Table 9.**

Table 8: Exposures from inadequate WASH

Exposure category	External cause	Subclassification	ICD-10 code
Waterborne diseases	Accidental drowning and submersion while in natural water		W74
	Drowning and submersion while in natural water		W69
	Contact with heat and hot substances, including exposure to hot water		X10-X19
	Contact with contaminated water or environments	Exposure to other and unspecified environmental factors	W64

Table 9: Exposure from wastewater or inadequate solid waste management

Exposure category	External cause	Subclassification	ICD-10 code
Exposure to contaminated environments or water bodies	Exposure to other and unspecified environmental factors		W64
Exposure to disease vectors, habitats or bites	Bitten or stung by nonvenomous insect and other nonvenomous arthropods		W57

World Health Organization, "ICD-10 Version:2019."

Exposure to smoke, fire, and flames	Exposure to uncontrolled fire, not in building or structure		X01
	Exposure to controlled fire, not in building or structure		X03

4.2 National Health and Household Surveys

Nations use a variety of survey instruments and platforms to evaluate a range of conditions in the home, the behaviors of household members, and family economic and educational conditions and attainments. Here, we summarize the most commonly used survey instruments in LMICs on the basis of their data's relevance to WASH. More information about the specific surveys can be found in Chapter 3.

In general, these surveys provide useful data for the construction of WASH outcome and behavior indicators. Due to small sample sizes, they may not provide provincial or sub provincial estimates. Nonetheless, national-level indicators are still valuable for characterizing trends, estimating burdens and their costs, and driving prioritization and investment decisions. We concentrate on data specifically related to WASH, though it is worth noting that other variables from the questionnaires—in particular those addressing demographic and geographic factors—are valuable for stratifying and specifying the indicators.

Questions among these surveys exhibit a high degree of overlap. Indeed, many use identical wordings. However, they differ in country coverage, ability to estimate subnational findings, and the year(s) in which they are or have been administered. Included here are surveys that have been administered in large numbers of countries since 2020.

WORLD HEALTH SURVEY PLUS

The World Health Survey Plus (WHS+) includes an individual and a household questionnaire, each administered in person and divided into sections.

The individual-level questionnaire does not provide sufficiently detailed information about care-seeking behavior or experience of illness to provide valuable data regarding health outcomes.

Household survey sections relevant for WASH include Section 0500 (Water, Sanitation, Hygiene) and Section 0800 (Household Expenditure and Household Expenditure Expanded). The following questions outlined in **Table 10** below are valuable for characterizing household access, behavior, and expenditures related to WASH. WHS+ involves complex skip patterns depending on earlier responses.



"World Health Survey Plus - WHO," accessed November 3, 2024, https://www.who.int/data/data-collection-tools/world-health-survey-plus.

Table 10: WHS+ questions to characterize WASH-related household access, behavior, and expenditures

Topic	Question Number	Text	Relevance and use	Example indicators derived from question
Drinking water	Q0505	What is the main source of drinking water for members of your household?	Differentiates public, private, treated, untreated sources. Recoding enables indicator development	% and population using well, piped, protected / unprotected spring, untreated surface, bottled water
	Q0506	What is the main source of water used by members of your household for other purposes, such as cooking and hand washing?		
	Q0508	How long does it take to go there, get water, and come back?	For surface-water drinkers, enables characterization of burden and human capital lost to water collection	Person-days/years spent collecting water
	Q0509	Who usually goes to this source to fetch water for your household?	Women's and children's safety is compromised by water retrieval	Number/% women and children with elevated risk of injury from water retrieval
Sanitation	Q0512	Number of E. coli detected in 100 mL sample. Source water test.	Primary drinking water source's bacterial contamination	Number/% of water samples exceeding guidance for E. coli
	Q0513	Number of E. coli detected in 100 mL sample. Drinking water glass.	Primary consumed drinking water source's bacterial contamination	Number/% of water samples exceeding guidance for E. coli
	Q0514	What kind of toilet facility do members of your household usually use?	Differentiates plumbed, flush, pit and other toilets, including none	Number/% using different toilet

"World Health Survey Plus - WHO," accessed November 3, 2024, https://www.who.int/data/data-collection-tools/world-health-survey-plus.

Handwashing	Q0519	Can you please show me where members of your household most often wash their hands?		
	Q0521	Observe availability of soap or detergent at the place for handwashing		
	Q0522	Does this household have a bath or shower with running water on premises?		
Consumption	Q0801 (01.2)	During the last week, how much did your household spent to purchase water and nonalcoholic beverages?	When stratified by primary drinking water, and coupled with household income, enables characterization of economic burden of safe water	% of income spent on purchasing water

DEMOGRAPHIC AND HEALTH SURVEY (DHS)

Until February 2025, DHS was funded and supported by USAID and administered in nearly all countries in Africa. Though its future is uncertain, data from past surveys remains available. The DHS household module provides some relevant data that may serve as proxies for several WASH-related health risks. **Table 11** below summarizes these.

World Health Organization, WHS Instrument – Household Questionnaire (World Health Organization, 2024), https://cdn.who.int/media/docs/default-source/world-health-data-platform/whs--instrument---household-questionnaire.pdf.

Table 11: Relevant DHS household questionnaire data

Topic	Question Number	Text	Relevance and use	Example indicators derived from question
Drinking water	101	What is the main source of drinking water for members of your household?	Differentiates public, private, treated, untreated sources. Recoding enables indicator development	% and population using well, piped, protected / unprotected spring, untreated surface, bottled water
	102	What is the main source of water used by members of your household for other purposes, such as cooking and hand washing?		
	104*	How long does it take to go there, get water, and come back?	For surface-water drinkers, enables characterization of burden and human capital lost to water collection	Person-days/years spent collecting water
	105*	Who usually goes to this source to fetch water for your household?	When linked to the annumerated household members, may provide sex/age	Number/% women and children with elevated risk of injury from water retrieval
	107, 108	Do you do anything to the water to make it safer to drink? What do you usually do to make the water safer to drink?	Characterizes household's ability to treat unprotected water	Number/% of households and household population unable to treat, or treat inadequately
Sanitation and hygiene	109	What kind of toilet facility do members of your household usually use?	Differentiates plumbed, flush, pit and other toilets, including none	Number/% using different toilet types
	151	Observe presence of soap, detergent, or other cleansing agent at the place of handwashing	Determines whether households have ability to properly handwash	Number/% using soap/detergent for handwashing

World Health Organization, WHS Instrument – Household Questionnaire (World Health Organization, 2024), https://cdn.who.int/media/docs/default-source/world-health-data-platform/whs--instrument---household-questionnaire.pdf.

MULTIPLE INDICATOR CLUSTER SURVEYS (MICS)

UNICEF collaborates with more than 100 countries to administer the MICS, including 10 in sub- Saharan Africa since 2020 that have been completed or remain underway. The MICS program has published many survey reports, both regional and country-specific, on the issues of water and sanitation. The MICS itself consists of multiple surveys, conducted in person. Those that yield data of relevance to WASH health and behavior include its Base Household Questionnaire, the Water Quality Testing Form, and its Base Questionnaire for Children Under 5. The questions of greatest relevance to WASH are summarized in **Table 12** below.

Table 12: MICS questions relevant to WASH Questionnaire

Topic	Question Number	Text	Relevance and use	Example indicators derived from question
Base Household / Drinking Water	WS1	What is the main source of drinking water used by members of your household?	Differentiates public, private, treated, untreated sources. Recoding enables indicator development	% and population using well, piped, protected / unprotected spring, untreated surface, bottled water
	WS2	What is the main source of water used by members of your household for other purposes, such as cooking and hand washing?		
	WS4	How long does it take for members of your household to go there, get water, and come back?	For surface-water drinkers, enables characterization of burden and human capital lost to water collection	Person-days/years spent collecting water
	WS5, WS6	Who usually goes to this source to collect the water for your household? Since last (day of week) how many times has this person collected water?	When linked to the annumerated household members, may provide sex/age	Number/% women and children with elevated risk of injury from water retrieval

Shane M. Khan et al., "Optimizing Household Survey Methods to Monitor the Sustainable Development Goals Targets 6.1 and 6.2 on Drinking Water, Sanitation and Hygiene: A Mixed-Methods Field-Test in Belize," PloS One 12, no. 12 (2017): e0189089, https://doi.org/10.1371/journal.pone.0189089.

	WS7	In the last month, has there been any time when your household did not have sufficient quantities of drinking water?	Indicator of water shortage, with implications for health, handwashing	Number/% of households without adequate drinking water
	WS8	The last time this happened, what was the main reason that your household was not able to access sufficient drinking water?	Indicates whether the water shortage was related to source or cost	Number/% of households reporting drinking water shortage due to cost, accessibility
	WS9, WS10	Do you or any other member of this household do anything to the water to make the water safer to drink? What do you usually do to make the water safer to drink?	Characterizes household's ability to treat unprotected water	Number/% of households and household population unable to treat or treat inadequately
	WS10C	What is the main source of drinking water in the wet season?	Characterizes whether climate influences drinking water supply	Number/% of households that resort to less or more safe water during wet season
Base Household / Sanitation	WS11	What kind of toilet facility do members of your household usually use?	Differentiates plumbed, flush, pit and other toilets, including none	Number/% using different toilet types
	WS12, WS13	Does your (toilet type) have an outlet pipe for liquid waste? Where does this pipe go?	Characterizes direct household risk from lack of safe sewage drainage	Number/% of households with sewage draining to open drain or source
	WS11D	In the last year, have excreta from your (answer from WS11) been released to the surface and surroundings due to any of the following events?	Direct evidence of exposure potential to untreated waste at household level	Number/% households experiencing human waste overflows or floods

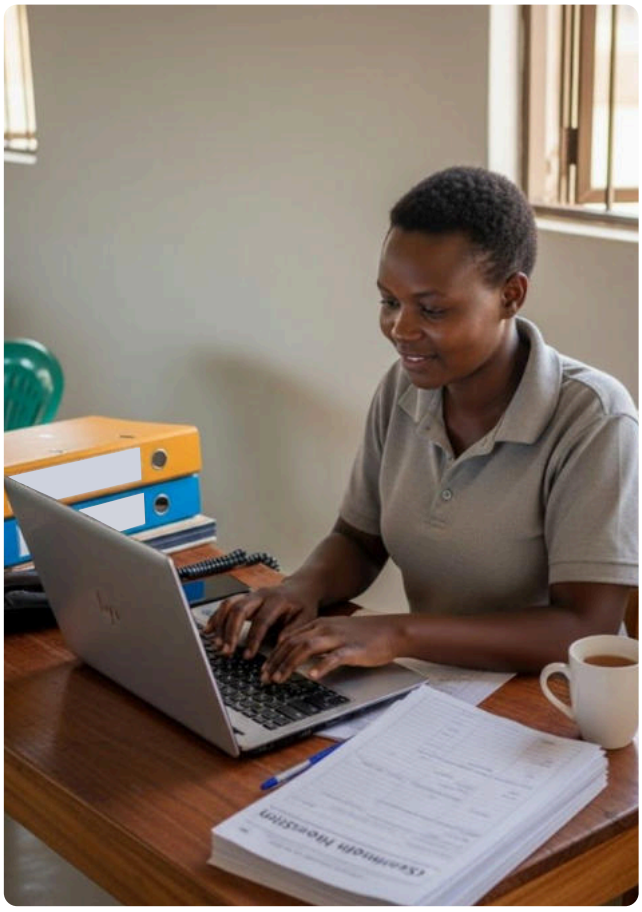
Base Household / Hygiene	HW1, HW2, HW3	What do members of your household most often use to wash their hands? Observe presence of water. Observe presence of soap, detergent, ash/mud/ sand.	Detects presence or absence of handwashing in dwelling, and whether water/soap is available	• Number/% of households without handwashing at home • Number/% who wash with soap
Water Quality Testing Form	WQ11, W17	Could you please provide me with a glass of the water that members of your household usually drink? What source was this water collected from?	Yields valid responses to where drinking water is actually sourced	Number/% of households with drinking water from different sources
	WQ14, WQ15	Have you or any other member of this household done anything to this water to make it safer drink?	Yields findings on bacterial contaminant levels	Number/% of households with drinking water exceeding bacterial contaminant levels

4.3 Global Burden of Disease

The GBD study is an international collaboration managed by the University of Washington's Institute for Health Metrics and Evaluation (IHME). Synthesizing data from national surveys, global public health research, and internationally reported data, GBD is a comprehensive regional and global research program that assesses mortality and disability from major diseases, injuries, and risk factors. By employing statistical modeling, GBD reports and estimates the causes of and contributors to disability and mortality across countries, time, age and sex, even where data are incomplete or unavailable. GBD uses disability-adjusted life years, or DALYs, as a primary metric, combining years of life lost (YLLs) due to premature mortality and years lived with disability (YLDs).

GBD provides data via a visualization hub that enables users to report national and regional (and for some countries, subnational) health burden data associated with WASH risk factors. The GBD hub requires users to select among several methods of characterizing the data desired. For each, GBD provides numbers, percent, and rates of DALYS and deaths, years of life lost, and years lived with disability. The results can be reported for any combination of countries, regions, age groups, sex, and year. These selection choices are as follows:

1. **Cause Of Death Or Injury:** These largely mirror the ICD-10 classification system. Recalling the section above related to health utilization data, those of greatest relevance to WASH include:
   - Enteric diseases, which may be further specified as diarrheal diseases, typhoid and paratyphoid, and other intestinal diseases.
   - Neglected tropical diseases, which may be further specified as malaria, schistosomiasis, dengue, yellow fever and zika.
   - Chronic respiratory diseases, specifically asthma.
   - Other infectious diseases, specifically acute Hepatitis A and Hepatitis E.
2. **Risk Factor:** When selecting a risk factor, either "all causes" or a cause of illness must also be selected. These causes are curated and limited to those for which there is a clear epidemiologic relationship that has been observed. These causes include:
   - Unsafe water, sanitation, and handwashing, specifiable as unsafe water source, unsafe sanitation, or no access to handwashing facility.
   - Air pollution, specifically particulate matter.
   - Low birth weight and short gestation.



Michael Brauer et al., "Global Burden and Strength of Evidence for 88 Risk Factors in 204 Countries and 811 Subnational Locations, 1990–2021: A Systematic Analysis for the Global Burden of Disease Study 2021," The Lancet 403, no. 10440 (2024): 2162–203, https://doi.org/10.1016/S0140-6736(24)00933-4.

CHAPTER 5:

USING WASH-RELATED HEALTH DATA TO DRIVE POLICY

Evidence-based decisions for sustainable water and sanitation

CHAPTER 5:
USING WASH-RELATED HEALTH DATA TO DRIVE POLICY

5.0

Earlier chapters have made the case for the incorporation of health-based indicators into WASH surveillance systems, as well as into summarized key international, national, and subnational sources of data that describe health outcomes known to be associated with inadequate WASH; assess behaviors that moderate or exacerbate exposures to unsafe water, sewage, and waste; and include demographic and contextual data that help identify vulnerable populations. Here, we describe how these data can be interpreted into work products used to inform stakeholders and drive decision-making about WASH performance and investment.

5.1 Leveraging Integrated WASH and Health Data for Decision-Makers

This report presents an aspirational vision for the integration of WASH and health data—one that is not yet widely implemented at the national level but is informed by lessons from other health and environmental data integration efforts, as well as research studies. These insights offer a foundation for designing narrative approaches, analytical methods, and visualization tools that can enhance decision-making in WASH programming.

A key advantage of linking well-defined indicators relating both to WASH and health is the ability to support hypothesis testing and more sophisticated quantitative analysis. Sharing health indicators with WASH stakeholders can elevate awareness of the burden of illness that both drives their interventions and could potentially be alleviated by their actions. For example, by incorporating population characteristics and social vulnerability measures into their analyses, WASH stakeholders can refine their prioritization schemes, ensuring that services are directed toward the communities at greatest risk.

Additionally, integrating health indicators with WASH service delivery data allows for more effective performance management at the subnational and local levels, enabling targeted improvements in service provision.

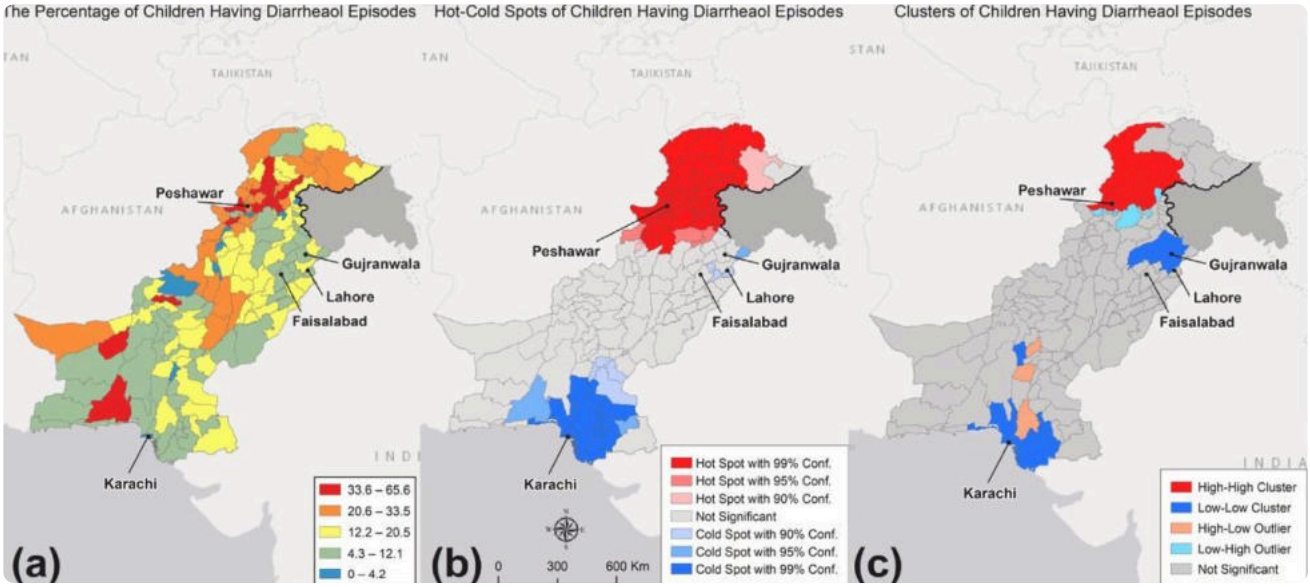
The use of real-time health data further strengthens this integration by enabling syndromic surveillance—detecting unexpected increases in WASH-related illnesses and triggering alerts that inform WASH service providers and health practitioners alike. Such alerts can help service providers respond more proactively to disease outbreaks and identify performance gaps that may contribute to adverse health outcomes. Beyond immediate response efforts, linking WASH and health data facilitates broader epidemiological analysis, for instance making it possible to estimate ecological and temporal associations between health outcomes and WASH indicators. Similarly, longitudinal trend analysis provides valuable insights into progress toward established WASH and health goals, helping to assess the impact of interventions over time.

Magdalena Berger et al., "Review of Syndromic Surveillance: Implications for Waterborne Disease Detection," Journal of Epidemiology and Community Health 60, no. 6 (2006): 543–50, https://doi.org/10.1136/jech.2005.038539

One particularly powerful application of integrated data is "hot-spot" analysis, which overlays areas of inadequate WASH services with maps depicting geographical distributions of high disease burden and population vulnerability. An example of a hot-spot analysis for diarrheal disease in Pakistan can be seen in **Figure 8.**

Figure 8: Geographic distribution of childhood diarrhea cases by district in Pakistan

Analyses of this kind can inform localized response plans, ensuring that vulnerable populations are appropriately prioritized. Moreover, examining measures of association—particularly those that account for lagged effects—provides a deeper understanding of the delayed but significant impact that WASH improvements can have on health outcomes. By leveraging these approaches, WASH and health stakeholders can move toward a more data-driven, responsive, and effective system for improving health outcomes and achieving WASH-related goals.



Source: Fatima and Ünsal, 2024

5.2 Identifying Appropriate Target Audiences

The integration of WASH and health data can generate critical insights for a range of stakeholders engaged in policy development, service delivery, program evaluation, and advocacy. These audiences rely on structured data products—such as routine monitoring reports, geospatial mapping, syndromic surveillance alerts, and data dashboards—to improve their decision-making and enable them to allocate resources effectively.

01

Government Agencies And Policymakers

National and subnational government agencies responsible for public health, water and sanitation, and environmental protection depend on integrated WASH and health data to inform regulatory frameworks, funding allocation decisions, and the development of programmatic priorities.

By linking information on health outcomes with WASH service data, policymakers can:

Munazza Fatima and Ömer Ünsal, "Geospatial Analysis of Diarrhoea Determinants among Children under Five in Pakistan Using Multiscale Geographically Weighted Regression (MGWR)," Applied Geography 172 (November 2024): 103434, https://doi.org/10.1016/j.apgeog.2024.103434. Fatima and Ünsal, "Geospatial Analysis of Diarrhoea Determinants among Children under Five in Pakistan Using Multiscale Geographically Weighted Regression (MGWR)."

- Identify geographic areas where inadequate WASH services are contributing to high disease burdens. For example, in Ethiopia, the Federal Ministry of Health used health surveillance data and WASH coverage indicators to identify districts with high rates of diarrheal diseases and poor WASH access. These "hot-spot woredas" were prioritized under the One WASH National Program (OWNP) for targeted interventions, including water infrastructure and sanitation facility improvements and hygiene promotion. This geographic targeting led to reductions in diarrheal disease burden and improved inter-ministerial coordination on issues relating to WASH service delivery.
- Justify investments in infrastructure improvements using hot-spot analysis and longitudinal health trends. Implement targeted interventions, such as prioritizing districts with recurring disease outbreaks linked to WASH deficiencies.

02

Public Health And WASH Practitioners

Epidemiologists, public health officials, and water and sanitation practitioners require real-time and longitudinal data in order to detect, respond to, and mitigate public health risks. Integrated data products—such as syndromic surveillance alerts, wastewater surveillance, and water-quality monitoring reports—enable these stakeholders to:

- Detect early warning signs of disease outbreaks related to waterborne pathogens. For example, the World Health Organization (WHO), through the Global Task Force on Cholera Control (GTFCC), uses epidemiological surveillance data alongside WASH vulnerability assessments to identify and prioritize cholera "hot spots" for targeted interventions. In countries such as Malawi and Mozambique, which have faced severe outbreaks, this hot-spot analysis guides the deployment of oral cholera vaccine (OCV) stockpiles and is used to direct long-term investments in water and sanitation infrastructure with the goal of preventing future epidemics. This integrated approach ensures that immediate health responses are linked to sustainable WASH solutions.
- Evaluate the effectiveness of WASH service improvements by analyzing temporal associations between infrastructure upgrades and health outcomes.
- Refine service delivery strategies by integrating social vulnerability indicators, enabling high-risk populations to be targeted.

03

Multilateral Organizations And Development Partners

International agencies (e.g., WHO, UNICEF, World Bank) and philanthropic donors use integrated WASH-health data to:

- Monitor national progress toward the Sustainable Development Goals (SDGs), particularly SDG 6 (clean water and sanitation) and SDG 3 (good health and well-being).
- Allocate funding to countries or regions based on data-driven evidence of need and impact.

Provide technical assistance on integrating data from WASH and health systems, supporting governments in refining data collection and analysis methodologies. For example, the JMP provides technical assistance to governments seeking to monitor WASH conditions in their healthcare facilities. This guidance helps countries adopt standardized survey questions that directly link infrastructure data to the core public health goal of patient safety.

04

Research Institutions And Data Analysts

Universities, research institutions, and data science teams play a key role in refining analytic methods for integrating WASH and health data. By developing models for longitudinal analysis, spatial correlation studies, and predictive analytics, researchers help to:

- Quantify the delayed impacts of WASH investments on health outcomes.

One WASH Nation Program (OWNP): A Multi-Sector SWAP (2018), https://www.unicef.org/ethiopia/media/1041/file/ONE%20WASH%20NATIONAL%20PROGRAM%20%28OWNP%29%20.pdf.

- Evaluate the effectiveness of interventions, such as assessing whether improved sanitation reduces diarrheal disease over time.
- Improve data visualization techniques, ensuring that stakeholders can interpret complex datasets effectively.

05

Civil Society, Advocacy Groups, And Media

Non-governmental organizations (NGOs), public interest groups, and media outlets leverage integrated WASH-health data in order to:

- Hold policymakers accountable by tracking disparities between populations with regard to WASH service delivery quality and public health outcomes.
- Advocate for increased investment in WASH infrastructure, particularly in under-served communities identified through data-driven assessments.
- Communicate public health risks to communities by translating technical findings into accessible narratives and visualizations.

By ensuring that data products are tailored to the needs of these diverse audiences, WASH and health stakeholders can drive more evidence-based decision-making, improve accountability, and enhance the effectiveness of interventions aimed at reducing WASH-related health risks.



Audiences rely on structured data products

5.3 Developing Data-Driven Products from WASH and Health Integration

ROUTINE MONITORING VIA MONTHLY DATA REPORTS

Monthly data reports can provide real-time insights into the ongoing progress of WASH-related service delivery. These reports typically offer a snapshot of key performance indicators such as access to clean drinking water and the prevalence of waterborne illnesses like diarrhea. Monitoring tends to focus on process and outcome indicators rather than impact indicators, though impact measurement may be ascertained after a longitudinal analysis. By compiling data at regular intervals, monthly reports enable WASH program managers and health practitioners to monitor trends and identify issues as they arise, allowing for a more timely response. For example, if there is a sudden increase in reported cases of cholera, the monthly data report would highlight this, enabling rapid action to address the outbreak.

An increase in the incidence of diarrhea at hospitals or health facilities could also prompt relevant authorities to assess WASH service quality and continuity in a particular area, allowing them to institute corrective measures to aver a larger disease outbreak. Increasingly, routine wastewater surveillance is also used to monitor the likely spread of infectious diseases like COVID-19—especially as populations have diminishing access to testing services or engage in self-tests less frequently, and as many government agencies no longer report laboratory-confirmed case counts.

Moreover, monthly reports serve as feedback mechanisms that keep stakeholders informed and engaged. Regular reporting ensures that any challenges, such as disruptions in water supply or damage to critical infrastructure, are quickly communicated to relevant authorities.

Global Task Force on Cholera Control, Report of the 9th Annual Meeting of the Global Task Force on Cholera Control (GTFCC) (Global Task Force on Cholera Control, 2023), https://www.gtfcc.org/wp-content/uploads/2025/03/9th-annual-meeting-gtfcc-2022-report.pdf. "Progress on Household Drinking Water, Sanitation and Hygiene 2000-2022: Special Focus on Gender - UNICEF DATA," 2000–2022.

This short-term monitoring also helps maintain accountability, ensuring that programs stay on track and meet their objectives. By keeping program managers and policymakers consistently informed, monthly data reports help justify the human resource costs associated with their preparation, while also facilitating a proactive approach to improving WASH outcomes and mitigating risks associated with water and sanitation deficiencies.

ANNUAL REPORTS WITH TREND ANALYSES

Monthly reports provide a short-term view of program activities. By contrast, annual reports, especially those enriched with longitudinal data analysis, offer a broader and more useful overview of trends. These reports consolidate data from the entire year and present it in a way that highlights long-term patterns and progress by comparing the data to predetermined goals or standards. For example, the JMP 2022 Annual Report integrates multiyear data on WASH coverage, spotlighting long-term trends such as the global increase in safely managed drinking water coverage and highlighting that progress in urban and rural areas is taking place at different rates. These annual reports help stakeholders assess whether policies or programs are achieving their intended outcomes and whether certain strategies should be continued, scaled up, or revised.

Many sources of health data derive from episodic surveys—some annual, some biennial or triennial. The resource-intensive analytic process of manipulating administrative health data to produce summary indicators may be conducted only after a year has concluded, and there may be significant lags between the collection of a specific year's data and its availability for a public-use dataset. In these circumstances, some reporting cannot realistically be published more than once per year.

Nonetheless, annual reports serve as a critical tool for strategic planning, providing a comprehensive view of WASH-related health data over time and offering an evidence base for future programmatic decisions. Importantly, by highlighting the strengths of certain interventions or the limitations of service delivery in particular underserved communities, they can also be used to advocate for additional funding or resource allocation.

MAPPING KEY INDICATORS

Geospatial mapping of key indicators is an important visual tool for presenting WASH-related data in a way that highlights geographical variations in health outcomes and service delivery. By plotting data on a map, stakeholders can quickly identify areas with poor access to clean water or sanitation facilities, or where there is a greater prevalence of WASH-related illnesses. This information can be especially useful when employing visual representations such as choropleth (color coding based on varying rates) or dot density mapping as a means of plotting events. Geospatial analyses can help stakeholders make targeted interventions by clearly showing which communities or regions have both WASH and health needs.

In addition to pinpointing areas of high need, mapping also facilitates the comparison of WASH performance across different regions. This geographic analysis can help national governments, NGOs, and international agencies allocate resources more equitably and efficiently, ensuring that interventions are directed to the regions with the greatest health risks. Furthermore, mapping key indicators can be used to track the geographic impact of WASH interventions over time, offering visual evidence of progress in regions where new water or sanitation projects have been implemented.

JMP, "JMP 2022 Annual Report," 2022, https://washdata.org/reports/jmp-2022-annual-report "Mapping WASH-Related Disease Risk: A Review of Risk Concepts and Methods - World | ReliefWeb," December 20, 2021, https://reliefweb.int/report/world/mapping-wash-related-disease-risk-review-risk-concepts-and-methods. CDC, "Maps: Visual Representation of Data by Location," September 16, 2022, https://www.cdc.gov/epiinfo/user-guide/maps/createmaps.html.

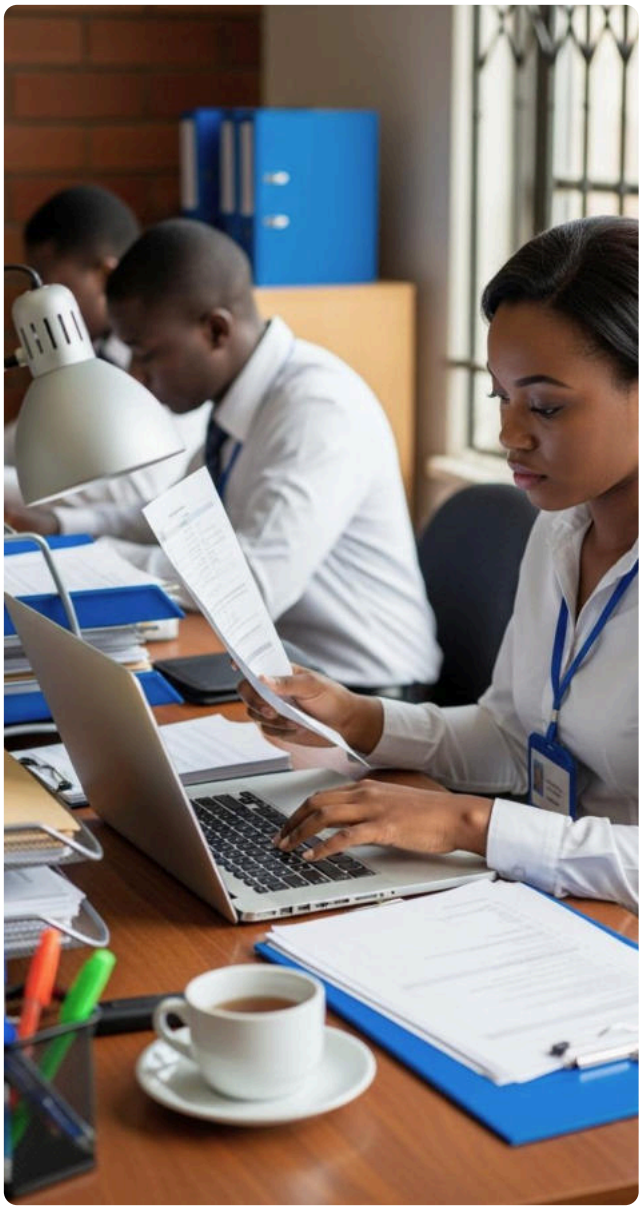
DATA DASHBOARDS

Data dashboards are tools designed to provide interactive access to data, enabling users to quickly assess the status of key performance indicators and customize their presentation. These dashboards typically present data through visualizations such as graphs, charts, tables, and maps, which together make complex information more accessible to a wide range of stakeholders. By integrating data from various sources, such as healthcare facilities, national surveys, and routine monitoring systems, dashboards can offer a holistic view of WASH-related service delivery and health outcomes. For instance, a dashboard could display current statistics on water access, sanitation coverage, and the incidence of WASH-related illnesses, allowing decision-makers to monitor trends and identify areas needing immediate attention.

One example of a global public-facing WASH dashboard is the Global WASH Cluster Humanitarian Response Plan dashboard hosted by UNICEF. This data dashboard highlights response progress by country, while also displaying the WASH funding gap and the amount of funding requested. However, it does not integrate health outcomes or social and economic disparities.

One of the key benefits of data dashboards is their flexibility and user-friendliness. They allow stakeholders, including program managers, policymakers, and donors, to filter and customize the data they view according to their specific needs. This means that users can focus on particular indicators, regions, or timeframes to get a more tailored understanding of WASH sector performance. For example, some allow users to visualize and analyze simple measures of association among indicators via map overlays, scatterplots, and regression analysis tools. Dashboards also help streamline decision-making processes by providing up-to-date information in real time.

This makes them an indispensable tool for performance monitoring, enabling quick responses to emerging WASH-related health issues. Importantly, many data dashboards have a public-facing component that presents simplified data analyses and descriptions for general use. This can empower local communities by providing them with access to high-quality and trusted information.



"Global WASH Cluster," 2024, https://app.powerbi.com/view r=eyJrIjoiZjYyMGJiZGUtZGVhNS00ZDEzLWIxOWYtOTc2MTlmOTgwNmIxIiwidCI6Ijc3NDEwMTk1LTE0ZTEtNGZiOC05MDRiLWFiMTg5MjAyMzY2NyIsImMiOjh9.

CHAPTER 6:

ENGAGING HEALTH SYSTEMS TO DELIVER WASH-RELATED DATA

The Role of Healthcare in Water, Sanitation, and Hygiene Data Collection

CHAPTER 6:
ENGAGING HEALTH SYSTEMS TO DELIVER WASH-RELATED DATA

6.0

Timely access to health data is of fundamental importance for designing and evaluating effective WASH interventions. Public health systems routinely collect data on adverse health outcomes that are directly influenced by water, sanitation, and hygiene conditions, including diarrheal diseases, cholera, and respiratory infections. However, in many cases, these data remain siloed within the health sector, limiting their application in shaping WASH-related policies and interventions.

Integrating health and WASH data has the potential to drive more effective interventions by offering a holistic view of the environmental determinants of health. As one example, linking disease surveillance data with information on water quality and sanitation coverage allows interventions to be targeted more precisely, for instance though sanitation improvements in areas with high incidences of waterborne diseases. Beyond intervention planning, the integration of these data systems also enables real-time decision-making in response to outbreaks, fosters cross-sectoral collaboration, and strengthens evidence-based policymaking at both the national and local levels.

Despite these evident benefits, the integration of public health and WASH data remains a challenge due to governance, technical, and institutional barriers. Addressing these challenges requires a structured approach that both strengthens data systems and fosters collaboration among the stakeholders in each sector. This chapter explores the key challenges hindering effective data sharing between the public health and WASH sectors, including issues related to data governance, interoperability, and institutional siloing. It also outlines practical strategies for overcoming these barriers, such as the development of standardized data frameworks, the use of digital health platforms, and the establishment of multisectoral partnerships. By addressing these challenges and proposing solutions, the chapter aims to provide a roadmap for enhancing data integration and utilization, with the goal of improving WASH interventions and health outcomes.



6.1 Leveraging Integrated WASH and Health Data for Decision-Makers

FRAGMENTED GOVERNANCE STRUCTURES

Governance fragmentation is one of the most significant barriers to integrating health and WASH data. At national levels, health data is often collected and managed by ministries of health or public health agencies, while WASH-related data falls under the purview of WASH regulatory agencies and ministries of water, environment, or infrastructure. The lack of coordination among these entities can result in parallel data collection efforts that do not intersect, making cross-sectoral analysis difficult.

Additionally, within decentralized governance structures, data management authority is often distributed across the different levels of government, which can lead to inconsistencies in data availability and reporting mechanisms. In many countries, health data is typically collected at the facility level and aggregated at the national or regional level before being shared with policymakers. At subnational levels, on the other hand, WASH data may be collected by municipal agencies, NGOs, or private/public utilities, each with distinct reporting frameworks.

In the absence of standardized protocols for data exchange, these datasets remain isolated, limiting their utility for integrated planning. Moreover, legal and regulatory constraints can further complicate data sharing efforts. Health data, particularly disease surveillance and patient records, are often subject to strict privacy protections and confidentiality agreements, making it difficult to share even anonymized data across sectors. Similarly, WASH data collected by private service providers or implementing agencies such as international non-governmental organizations (INGOs) may be considered proprietary, limiting accessibility for the purposes of public health planning and decision-making.

The frequent lack of clear guidelines regarding data ownership, sharing agreements, and security protocols exacerbates these challenges, creating an environment in which even well-intentioned stakeholders hesitate to collaborate due to legal uncertainties.



Health data, particularly disease surveillance and patient records, are often subject to strict privacy protections and confidentiality agreements, making it difficult to share even anonymized data across sectors.

INCONSISTENT DATA STANDARDS AND INTEROPERABILITY ISSUES

Another major barrier to integrating health and WASH data is the lack of standardized data formats, coding systems, and interoperability protocols. Health information systems often use internationally recognized classifications such as the ICD, while WASH data may rely on entirely different frameworks, such as water quality parameters set by national environmental agencies or U.N. agencies. In some cases, the geographic boundaries used to summarize data differ among health, environmental, and other ministries.

This divergence makes it difficult to align datasets for comparative or time series analysis or for joint reporting. Interoperability challenges are exacerbated by differences in data storage and management systems. Health data is frequently housed using paper or electronic health records and national health information systems, whereas WASH data may be stored in sector-specific databases, spreadsheets, or paper-based reports. Many low-resource settings still rely on non-digital record-keeping systems, further complicating integration efforts and introducing lags in the ability to use the data to inform decision-making.

For example, the WHO/UNICEF JMP for Water Supply, Sanitation, and Hygiene tracks global progress on WASH conditions using specific indicators such as safely managed drinking water and basic sanitation services. Meanwhile, for coding morbidity and mortality data, ministries of health often rely on the WHO's ICD system, which does not explicitly link health outcomes to WASH conditions.

Similarly, environmental monitoring agencies may use national water quality standards that differ from WHO's drinking water guidelines, creating discrepancies in how water safety is assessed across sectors. A health ministry may make aggregate data indicators available at the level of health districts, whose boundaries may differ from the jurisdictional boundaries of water authorities.

These variations in data classification and reporting structures make it difficult to establish direct connections between WASH conditions and health outcomes, hindering comprehensive analysis and evidence-based policy development.

Addressing these inconsistencies may require harmonization of data collection methodologies, reanalysis of locational data, cross-sectoral training on standardized indicators, and the adoption of integrated digital platforms to bridge gaps between existing information systems.



WASH data may be stored in sector-specific databases, spreadsheets, or paper-based reports.

DATA QUALITY AND ACCURACY

Data quality and completeness remain significant challenges in both the health and WASH sectors. In many low-resource settings, a lack of standardized data collection protocols and inadequate training for data collectors contribute to errors and inconsistencies. Health data may be affected by misclassification or underreporting due to limited interoperability between health information systems, while WASH data can suffer from inconsistencies caused by irregular data collection cycles and insufficient coordination between local and national monitoring agencies.

Furthermore, inconsistencies in data collection methodologies—such as differing survey intervals, geographic coverage, and definitions—can lead to misalignment between datasets. For example, while health data may be collected continuously through facility-based surveillance systems, WASH indicators may be updated only periodically, leading to temporal mismatches in the data available for analysis.

Quality assurance (QA) and quality control (QC) procedures are essential when integrating health and WASH data, particularly when transferring paper-based records into digital systems. Without proper validation steps, manual data entry can introduce errors such as duplicate records, misclassified data, and missing or accidentally added values, which can distort analysis and decision-making. Standardized data verification processes, including double data entry, automated error detection algorithms, and routine data audits, can help mitigate these risks. Additionally, capacity-building efforts should focus on training data managers at both the local and national levels to ensure consistency in data processing and reporting.

Another critical issue is the reliance on often minimally trained community health volunteers (CHVs) for data collection, particularly in rural or underserved areas. While CHVs play a vital role in bridging health and WASH sectors by gathering information on household sanitation practices, water access, and disease prevalence, their limited training and often high levels of turnover can lead to inconsistent or inaccurate reporting. The use of standardized data collection tools, mobile-based reporting applications, and regular supervisory oversight can improve the reliability of data gathered by CHVs. Investing in training programs that equip volunteers with basic data literacy skills and standardized reporting protocols can further enhance data accuracy and ensure that health and WASH data are comparable across regions and time periods.

PRIVACY AND SECURITY CONCERNS

Concerns over data privacy and security present another significant challenge. Health data is often subject to stringent data protection laws, particularly when it contains personally identifiable information (PII). While WASH data is generally less sensitive, its integration with health data raises privacy concerns, particularly if linked to specific communities or households. In some cases, the reluctance to share data stems from concerns over potential misuse or misinterpretation. Health officials may be wary of allowing external access to disease surveillance data without adequate safeguards to prevent a misrepresentation of findings. Similarly, WASH authorities may hesitate to share data that could expose service gaps or infrastructure deficiencies.

Unfortunately, many African countries lack comprehensive legal frameworks governing health data privacy, leaving sensitive patient information vulnerable to breaches and unauthorized access. While some nations have enacted data protection laws modeled after international standards such as the European Union's General Data Protection Regulation (GDPR) or the African Union's Convention on Cyber Security and Personal Data Protection (Malabo Convention), enforcement remains inconsistent in many countries. In settings where digital infrastructure is weak, health records are often stored in unsecured formats such as paper-based logs or unencrypted databases, increasing the risk of data leaks and misuse.

Challenges also arise with regard to cross-sectoral data sharing between health and WASH sectors. Here, too, privacy concerns may hinder efforts to integrate datasets. For instance, disease surveillance data containing PII must be anonymized before being linked with WASH indicators, yet many national health information systems lack standardized protocols for de-identification. Additionally, limited trust between communities and governments can further complicate data collection and sharing efforts,

MEASURE Evaluation, "Data Quality Review Toolkit — MEASURE Evaluation," Page, accessed July 9, 2025, https://www.measureevaluation.org/our-work/data-quality/data-quality-review.html.

particularly in contexts where historical misuse of personal data has led to concerns about surveillance and discrimination. Strengthening legal protections, investing in secure digital platforms, and fostering transparency through community engagement are essential steps in ensuring that health data is both protected and effectively utilized to improve public health outcomes in Africa.

6.2 Recommendations for Enhancing Data Integration

01

Enhance Data Interoperability Across Sectors

Investing in interoperable digital platforms and standardized protocols facilitates seamless data exchange between the health and WASH sectors. Utilizing common data standards such as those endorsed by the WHO/UNICEF JMP, as well as national health information systems such as District Health Information Software (DHIS2), can significantly enhance interoperability. Countries should consider developing unified indicator frameworks that align health and WASH monitoring efforts.

ACTION STEPS:

- Develop cross-sectoral indicator standards.
- Implement interoperability guidelines to ensure smooth data exchange.
- Promote technical collaboration between health and WASH information system developers.
- Develop integrated WASH management systems (comparable to HIMS/DHIS in the health sector) at the national level that are linked to subnational levels. Systems of this kind can be housed at the ministry level or with the national WASH regulatory agency.

02

Strengthen Data Quality And Enhance Data Collection Capacities

Ensuring that both the WASH and health sectors are collecting high-quality data requires robust validation and verification processes. Investing in continuous capacity-building, particularly for local personnel involved in data collection and management, is critical in order to maintain accuracy and reliability. Additionally, integrating data from multiple sources—such as facility-based surveillance systems, household surveys, and remote sensing technologies—can help fill gaps and improve the granularity of datasets used for decision-making. Standardized digital tools can reduce human error and improve efficiency in data collection, validation, and reporting.

ACTION STEPS:

- Conduct regular capacity-building programs focusing on standardized data collection and verification processes.
- Institutionalize data quality assurance measures such as double data entry processes or automated validation checks.
- Expand the use of digital tools and platforms, particularly in remote regions.

03

Invest In Infrastructure And Connectivity

Reliable digital infrastructure is necessary for effective data sharing and communication between the public health and WASH sectors. Governments must prioritize investments aimed at expanding digital and mobile network coverage, especially in rural or underserved regions. This will facilitate consistent and real-time data flows. Enhancing this infrastructure will enable timely decision-making and rapid response capabilities.

ACTION STEPS:

- Prioritize investments in digital and telecommunication infrastructure, especially in underserved regions.
- Enhance network coverage to ensure consistent access to real-time data collection platforms.

04

Promote Community Engagement And Participation

Building trust and active participation among communities is essential to sustainable data integration efforts. Community involvement can improve data completeness and create a sense of ownership. This ensures that data collection initiatives are responsive to local contexts, particularly those with marginalized populations. Effective engagement strategies include culturally sensitive communication, participatory data collection processes, and regular stakeholder consultations.

ACTION STEPS:

- Engage local leaders and community representatives in designing and implementing data collection initiatives.
- Tailor communication strategies to local cultures and practices, thereby promoting voluntary compliance and ownership.

05

Strengthen Institutional And Legal Frameworks

To enable sustainable data sharing between sectors, robust institutional frameworks and clear legal guidelines are critical. Clarifying data ownership, establishing secure data-sharing agreements, and ensuring strict adherence to data privacy and confidentiality standards can significantly enhance trust and collaboration between the health and WASH sectors.

ACTION STEPS:

- Develop and enforce clear regulations on data sharing, privacy, and confidentiality.
- Establish formal interagency agreements that clearly outline responsibilities and protocols for data exchange.

The strategic integration of public health and WASH data holds immense promise for improving health outcomes and service delivery. By addressing governance challenges, harmonizing technical standards, investing in infrastructure, and strengthening community engagement, governments and partners can significantly enhance the timeliness, accuracy, and utility of vital data. Colombia's experience (see case study, Chapter 3.3) underscores the value of leveraging digital solutions and engaging in multisector collaboration in order to bridge persistent data gaps. These insights and associated recommendations provide a valuable blueprint, applicable globally, for countries aiming to build resilient, integrated, and responsive WASH and health information systems.

Table 13: Suggested actions to enhance data integration

Improvement Category	Suggested actions
Enhancing governance and coordination	• Establish formal interministerial working groups or task forces that bring together key stakeholders from the health and WASH sectors to promote alignment in data collection, analysis, and utilization. • Develop national and/or subnational data sharing policies that outline standardized protocols for data integration, governance responsibilities, and mechanisms for dispute resolution. • Encourage the use of memoranda of understanding (MOUs) among ministries, NGOs, and private sector actors to formalize data sharing agreements and clarify roles and responsibilities.
Standardizing data collection and improving interoperability	• Align health and WASH data standards by adopting international classification frameworks such as ICD for health data and WHO/UNICEF JMP indicators for WASH data. • Develop common data dictionaries and metadata standards to ensure consistency in variable definitions, units of measurement, and reporting timelines. • Promote the use of open-source and interoperable digital platforms that facilitate data exchange between different sectors and levels of governance.
Improving data quality	• Implement capacity-strengthening programs for data collectors, including health workers, WASH service providers, and community health volunteers, with the goal of ensuring accurate and consistent data entry. • Strengthen quality assurance and quality control (QA/QC) measures, such as double data entry verification, automated error-checking algorithms, and routine data audits. • Expand the use of mobile data collection tools to reduce manual errors and improve the timeliness of reporting, particularly in remote or resource-limited settings.
Addressing privacy concerns	• Strengthen legal frameworks for health and WASH data protection, ensuring compliance with international standards such as GDPR or the Malabo Convention. • Implement data anonymization techniques before sharing datasets across sectors to protect personally identifiable information (PII) and reduce privacy risks. • Develop community engagement strategies that promote transparency and trust in data collection and sharing efforts, ensuring that data is used ethically and for public benefit.

6.3 Case Study: Multisectoral Collaboration in Mozambique's Cholera Response

Mozambique is a country particularly susceptible to cholera outbreaks, especially during the rainy season, due to its inadequate WASH infrastructure and frequent natural disasters. In 2019, Cyclone Idai's devastation exacerbated these vulnerabilities and led to a significant cholera outbreak in two provinces. The country's response to the crisis led to a dramatic decline in the number of cases. Mozambique's response provides a compelling example of effective multisectoral collaboration between the health and WASH sectors.

MOZAMBIQUE'S RESPONSE

STAKEHOLDER COLLABORATION

The cholera outbreak response involved a coordinated effort among various governmental and non-governmental stakeholders. The Ministry of Health (MoH) led the overall response, overseeing case management, surveillance, and coordination with partners. The National Institute of Health (INS) played a crucial role in conducting the health surveillance, data collection, and analysis that informed the country's response strategies. At the provincial level, provincial health directorates implemented health policies and managed the local health facilities. The National Directorate of Water Supply and Sanitation (DNAAS) oversaw water supply services and sanitation infrastructure, seeking to ensure access to safe water and sanitation. Meanwhile, the National Institute of Disaster Management (INGC) coordinated disaster preparedness and response efforts with a particular focus on the health emergencies exacerbated by the natural disaster.

Additionally, international organizations and NGOs—including WHO, UNICEF, Médecins Sans Frontières (MSF), and the U.S. Centers for Disease Control and Prevention (CDC)—provided technical support, resources, and expertise that helped strengthen the response efforts.

This multisectoral approach involving governmental agencies, international organizations, and NGOs offers a useful example of how collaboration can be leveraged to integrate health surveillance, case management, WASH services, and disaster response efforts.

DATA SHARING AND INTEGRATION

Mozambique used real-time surveillance data on cholera cases collected by the INS from health facilities nationwide. This data was continuously shared with the MoH and other stakeholders to monitor the outbreak's progression, ensure early detection, plan and carry out rapid response measures, and inform decision-making. The INS also collaborated with partners to establish a "virtual control room" in which diverse data sources were integrated into a central platform. This integrated information system facilitated real-time data analysis and informed decision-making. As another essential component of this collaboration, WASH sector partners conducted assessments of water quality, sanitation facilities, and hygiene practices in affected communities. These findings were shared with health authorities and used to identify potential sources of contamination so that corrective measures could be implemented.

Cynthia Semá Baltazar et al., "Conditions to Eliminate Cholera in Mozambique - the Pathway for the Development of the National Cholera Plan," The Pan African Medical Journal 42 (August 2022): 279, https://doi.org/10.11604/pamj.2022.42.279.36368. Joaquim Domingos Lequechane et al., "Mozambique's Response to Cyclone Idai: How Collaboration and Surveillance with Water, Sanitation and Hygiene (WASH) Interventions Were Used to Control a Cholera Epidemic," Infectious Diseases of Poverty 9, no. 1 (2020): 68, https://doi.org/10.1186/s40249-020-00692-5.

DECISION-MAKING BASED ON INTEGRATED DATA

The integration of health and WASH data in Mozambique enhanced decision-making processes, defined by resource allocation, public health interventions, and policy development. By analyzing the combined data, authorities were able to identify hot spots with high transmission rates, and consequently directed resources such as medical supplies, clean water, and sanitation facilities to these areas. The integrated data informed the implementation of public health measures including vaccination campaigns, the distribution of water purification tablets, and hygiene promotion activities. Insights gained from data integration supported the development of policies aimed at strengthening WASH infrastructure and improving health outcomes.

CHALLENGES AND LESSONS LEARNED

Despite immense progress, several challenges were identified both during and after the cholera outbreak. Data quality and timeliness were significant obstacles, particularly in ensuring the accuracy of data and faciliting prompt sharing between sectors. Additionally, limited technical capacities within local institutions hindered not only effective data analysis, but also the implementation of timely and evidence-based responses. Logistical constraints, including resource limitations and infrastructure gaps, further complicated coordination efforts. Finally, sustainability was identified as a significant challenge. To achieve conditions of long-term resilience, it is necessary to maintain these types of collaborative efforts and integrated systems beyond the immediate response period. Addressing these challenges requires ongoing investment in capacity-building, infrastructure development, and the establishment of formalized data sharing agreements to strengthen cross-sectoral coordination and response effectiveness.



Lequechane et al., "Mozambique's Response to Cyclone Idai." Zenysis, "Mozambique's Cholera Response," Zenysis, n.d., accessed February 13, 2025, https://www.zenysis.com/case-study/mozambiques-cholera-response/. CDC, "CDC Enhances Mozambique's Capacity for Cholera Response," Global Health Protection, September 4, 2024, https://www.cdc.gov/global-health-protection/php/stories-from-the-field/cdc-enhances-mozambiques-capacity-for-cholera-response.html. Baltazar et al., "Conditions to Eliminate Cholera in Mozambique - the Pathway for the Development of the National Cholera Plan." Lequechane et al., "Mozambique's Response to Cyclone Idai."

CONCLUSION

Health-driven data integration accelerates progress toward safe water and sanitation for all

CONCLUSION:
ADVANCING WASH PERFORMANCE THROUGH HEALTH-DRIVEN DATA INTEGRATION

Achieving universal access to safe WASH requires more than just infrastructure investment alone—it demands smarter systems designed to measure needs, evaluate progress, and ensure accountability. This report demonstrates that integrating health data into WASH decision-making processes is both essential and feasible. Health outcomes are among the most direct and measurable consequences of inadequate WASH services, yet data on these outcomes remain underutilized as stakeholders engage in routine performance monitoring, planning, and investment prioritization. By linking WASH infrastructure and service indicators to information on health behaviors, disease burdens, and population vulnerabilities, stakeholders can more effectively target interventions, justify funding, and assess the real-world impact of service improvements.

Despite strong conceptual alignment, the integration of WASH and health data remains limited due to fragmented governance, data siloing, inconsistent standards, and under resourced data systems. Overcoming these barriers requires coordinated action across five dimensions: interoperability, data quality, digital infrastructure, community engagement, and legal frameworks. Efforts to standardize indicators, develop joint data platforms, and institutionalize cross-sectoral partnerships are already underway in several countries, and offer promising models for replication and scaling.

As governments, utilities, development partners, and civil society actors look to accelerate progress on SDGs 3 and 6, the integration of health data into WASH systems offers a high-impact, cost-effective opportunity to drive improvements in both sectors.

By embedding health-informed performance measures into routine planning and reporting cycles, countries can make WASH investments more equitable, efficient, and resilient. To advance this agenda, national leaders and their partners should:

- Prioritize policy reforms and institutional arrangements that support data exchange between the WASH and health sectors.
- Invest in workforce capacities and digital tools that support the collection and analysis of integrated data, allowing stakeholders to act more effectively.
- Leverage existing health and administrative data systems to minimize duplication and reduce costs.
- Strengthen accountability mechanisms by making health-linked WASH performance metrics transparent and accessible to the public.

Ultimately, integrating health data into WASH systems is not just a technical exercise—it is a strategic imperative for safeguarding public health, reducing inequalities, and realizing the full promise of sustainable development.



Efforts to standardize indicators, develop joint data platforms, and institutionalize cross-sectoral partnerships are already underway in several countries, and offer promising models for replication and scaling.

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