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THE MEASUREMENT AND MONITORING OF WATER SUPPLY, SANITATION AND HYGIENE (WASH) AFFORDABILITY

A MISSING ELEMENT OF MONITORING OF SUSTAINABLE DEVELOPMENT GOAL (SDG) TARGETS 6.1 AND 6.2

A collaboration of the WHO-UNICEF Joint Monitoring Programme (JMP), the UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) and an Expert Group on WASH Affordability

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Data Streamers	Publication design	

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Foreword

Djibouti, February 06, 2018
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Today, many countries are unable to provide safe drinking water and sanitation services to their populations – the challenge and cost of scaling up the infrastructure required, as well as operational and maintenance costs, are too great. Yet despite these challenges, in the past many countries that were not economically developed were able to ensure access to safe drinking water for everyone. How? The strategy was to guarantee, above all, a free, safe, public water supply, close to everyone's home, in the square of each town and each neighbourhood.

When I say this, questions are often asked about free water at public fountains – won't people over extract these water resources? My answer is always the same: "don't worry, no one will take a litre more of the water they need at home from the public fountain; it is too heavy."

Supposing you were the one who had to fetch water for your family every day. How much water would you carry from a public source? The benchmark for minimum needs is usually 50 litres per person per day. In such a case, if five people live in your household, we would be talking about 250 litres of water. Would you carry more water because the water is free?

No one drinks a sip more than they need, just as no one breathes a cubic centimetre more air than they need, even if water and air are free. And as for other uses of water for hygiene or cooking, equally necessary but potentially requiring greater quantities than water for drinking, the tremendous effort of carrying water will prevent any waste. An effort that, by the way, often falls on women and children.

The key to ensuring drinking water for all has always been to guarantee its priority in all senses. Priority in the event of shortages due to drought, priority in terms of quality over any other use, and even budgetary priority for the free public drinking fountain in the square – before paving streets or installing lighting.

Sanitation, on the other hand, has in many countries been left for the household to decide what type of toilet they want, and make the investment themselves. While sanitation is in many senses a very private issue, the consequences of not having safe sanitation are of a highly public nature. Hundreds of millions of people continue to suffer the daily indignity of defecating in the open, a practice which is especially shameful for women. Even when a toilet is used, the vast majority of the waste is not managed safely, thus threatening the health and damaging the environment of much larger populations.

Today, however, in the 21st century, an estimated 2.2 billion people in the world do not have access to safe drinking water and 4.2 billion people do not have access to safe sanitation. The reasons are diverse and depend on multiple factors and circumstances. In extreme semi-arid territories, subject to climatic changes that threaten their habitability, the problems are most often due to physical water shortages. However, the vast majority of these 2.2 billion people are not thirsty people without water in their living environments, but impoverished people living next to rivers or on polluted aquifers. The shameful global water crisis we face is rooted in the confluence of two major structural flaws:

> One, the flaw of inequity and poverty that °generate profoundly unequal and unsupportive socio-economic systems.
>
> Two, the flaw of unsustainability that we have caused in our aquatic ecosystems, transforming water, which has always been the key to life, into the most dangerous vector of disease and death that humanity has ever known.

As the pressure of tariffs to finance the growing costs of water and sanitation services increases, we must reflect on the strategy to guarantee safe drinking water to those 2.2 billion people and safe sanitation to those 4.2 billion people, and sustain services for those already enjoying safe water and sanitation.

Today we have sophisticated technologies, such as reverse osmosis with semi-permeable membranes, which would make it possible to purify water contaminated by all kinds of pollutants. We can also make water transfers from remote places where we still have quality water. But the costs of these options could not be paid by those who live in conditions of extreme vulnerability. Only if we make serious progress in restoring the health of the rivers and aquifers on which these people depend, then we will make definitive progress in achieving effective and universal access to safe water, thus fulfilling not only the human rights to safe drinking water and sanitation, but interrelated human rights as well such as education, health, food and housing.

We cannot stop at strategic reflections, however important they may be. We must promote urgent measures to achieve the progressive fulfilment of the human rights at stake. As water and sanitation services are delivered, we must ensure they are affordable to the individuals, communities and groups in the most vulnerable situations.

This report, released by UNICEF and WHO, with the collaboration of a prestigious team of experts and on the basis of a broad and in-depth study of socio-economic realities, offers ways to assess, evaluate and monitor the affordability of WASH services. It seeks to establish not only conceptual rigour but also flexibility to integrate the diversity of existing contexts and circumstances. It provides concrete guidelines and recommendations to make the obligation of providing affordable access to water and sanitation services a key objective.

Achieving targets 6.1 and 6.2 of SDG 6 will hardly progress if we are not able to identify households and populations with payment difficulties and if we are not able to assess non-compliance with the affordability principle as one of the key causes of failure of the human rights to safe drinking water and sanitation.

With the analysis and recommendations found in this report, countries will have a clearer benchmark and information to promote and guarantee the human rights to water and sanitation, particularly regarding affordable access to drinking water and sanitation services and prohibition of disconnecting those services in case of incapacity to pay. But above all, this report will ultimately be used to empower those who suffer the harshest situations of poverty and vulnerability to meet their rights.

For these reasons, as the UN Special Rapporteur on the human rights to safe drinking water and sanitation, I welcome this report.

Pedro Arrojo Agudo

Special Rapporteur on the human rights
to safe drinking water and sanitation

Summary

Affordability is an essential consideration for improving the population's access to water, sanitation and hygiene (WASH) products and services.

The cost of access can be a significant barrier to WASH services, whether it is a monthly water bill, an investment in water or sanitation infrastructure or regular spending on hygiene products. Safe drinking-water and sanitation have both been recognised as human rights, and affordability has been included as one of five normative criteria. Consequently 'affordable' water is included in Sustainable Development Goal (SDG) target 6.1, while target 6.2 explicitly requires equitable access to sanitation and hygiene, and paying special attention to the needs of women and girls and those in vulnerable situations.

Until now there has been no major evidence-based initiative assessing the affordability of WASH services in low- and middle-income countries. However, SDG targets 6.1 and 6.2 will not be reached unless affordability can be measured and monitored to identify precisely which population groups and households do not have access to WASH services or face other barriers to WASH services resulting from vulnerability or discrimination, and ultimately, and ultimately to inform policy and programmatic responses to unaffordable services.

A multi-stakeholder group of experts and organizations was convened by WHO and UNICEF to address WASH affordability, under the umbrella of the WHO/UNICEF Joint Monitoring Programme and the UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS). The initiative was designed to answer key questions: first, how can affordability be concretely defined; second, how can WASH affordability be practically measured using available data; and third, how can WASH affordability be monitored both nationally and globally?

Drawing on ways in which WASH affordability has been understood in the past, there are two main approaches that have been conceptualised and applied: (a) the Human Rights perspective and (b) the comparison of WASH expenditure with total income.

Earlier human rights literature focused on the principle of Equity. The General Comment 15 stated in 2003 that *"Any payment for water services has to be based on the principle of equity, ensuring that these services, whether privately or publicly provided, are affordable for all, including socially disadvantaged groups. Equity demands that poorer households should not be disproportionately burdened with water expenses as compared to richer households."* (para 27, United Nations). This was echoed by the Independent Expert on the Human Right to Safe Drinking Water and Sanitation in preparing for the 65th Session of the UN General Assembly in 2010 *"Services must be affordable. Access to water and sanitation must not compromise the ability to pay for other essential needs guaranteed by human rights such as food, housing and health care."* [1]However, neither the General Comment 15 nor the Resolution 18/1 provided any quantitative metric in determining what is affordable.

Until now, the main practical methodology used to measure affordability has been to compare a household's expenditure on water and wastewater as a proportion of annual income, and compare the ratio with an affordability 'threshold'. Expenditure above the threshold would therefore render a service 'unaffordable'. However, different methodologies, data sets and cost components have been used in the studies conducted to date, and there is no international agreement on the appropriate value for the affordability threshold. Indeed, defining a single threshold value nationally or even globally has severe limitations in pronouncing services as affordable or unaffordable as recommended by the Special Rapporteur on the Human Rights to Drinking-Water and Sanitation, affordability standards should be defined by a participatory process at national and/or local level (Heller, 2015), involving poor and marginalized people. Furthermore, these studies have tended to include costs of the levels of WASH services that households currently use and in many cases, these service levels do not meet the minimum national standards or the normative criteria of the human rights; therefore, the studies do not say whether paying the costs to meet these required service levels would be affordable for households.

In the proposal put forward by the Expert Group, WASH affordability depends on the interrelation between three key variables, or dimensions, at the household level:

[1] Human rights obligations related to access to safe drinking water and sanitation.

1. **The price of the WASH services (paid by the household), including the time cost of accessing WASH services,**

2. **The overall spending power and time budget of the household, and**

3. **The competing nature of different household needs,[2] and the spending required by households to meet those needs.**

What the absolute levels of these variables are, and how households behave in relation to each of them, will lead to decisions on what level and type of WASH service they will demand and the associated behaviours they will adopt.

Five distinct approaches are identified that provide insights into WASH affordability:

How people behave with respect to WASH expenditure and service levels, and whether it is observable that poor households do not demand expensive but essential WASH services, or they cut back on essential WASH services when the prices of those services rise or household income drops. These are called 'revealed preference' studies in economics. Local (small area) data sets are commonly available to measure these, but they are not available at large scale or nationally representative. Significant additional efforts are therefore required to conduct affordability analyses and compile data sets across jurisdictions or countries. Hence, this methodology can be used for localized assessments that can feed as illustrative case studies into a national assessment, but they are not currently suitable for global monitoring of affordability.

What people say about their preferences on WASH expenditure and service levels. These are called 'stated preference' studies in economics. They can include surveys that determine households' willingness to pay (WTP) for WASH services, or they can involve questions about how affordable current or future WASH prices are and how prices affect their consumption levels. WTP surveys are quite a common research methodology used by both WASH suppliers and by academics to help determine market prices and needs for subsidies to increase consumption of poor households. However, as survey techniques are research intensive the populations these studies cover are limited in size, and they are not conducted regularly to enable affordability monitoring at national level. On the other hand, simple questions exploring WASH affordability can be incorporated into existing surveys, as has been done in a few cases to date.

How WASH expenditures compare to an agreed benchmark on WASH spending as a percent of overall household income or expenditure. This indicator has considerable potential for national and global monitoring, due to the availability of nationally-representative income and expenditure survey data sets in a large number of countries. However, as well as examining current WASH costs, it is important to focus on estimating the additional costs needed to raise each household to (at least) the minimum service standards for WASH. This can be either the national minimum service level, or the SDG 6 'safely managed' service standard. By applying this approach, it ensures that subsidy schemes can be targeted at poor households who are unlikely to be able to afford these additional costs. Costs should include both investment and operations and maintenance costs, to ensure all financial bottlenecks are addressed. Non-financial costs such as access time should also be incorporated, to avoid the selection of technology options with a low financial cost per capita but might involve long journey or waiting times to obtain services, which tends to fall on female household members and children.

What is a household's poverty status, which indicates deservingness for supportive measures to ensure WASH services are affordable. The use of poverty lines to define population groups that are least likely to afford WASH is potentially a very neat and simple approach, and can be based on either national or community assessments. If a household is poor, they are likely to be the most deserving of assistance to help them achieve or sustain the minimum WASH standard. The advantage of the poverty line is that it considers the costs of meeting other essential needs, and therefore might be seen as most within the spirit of the human rights to safe drinking water and sanitation. It is most appropriate when there is a reliable and regularly updated national inventory of poor households,

[2] The latter point does not necessarily cover those needs that are considered 'essential', as the latter is very hard to define precisely, and it is ultimately the household's choice as to how spending is balanced between the 'more essential' and the 'less essential' needs.

otherwise a mis-categorization of households will occur and subsidies will be distributed to the wrong households.

What measures already are in place to ensure the poor and vulnerable can afford WASH services. Overall, enabling environment indicators are predictive of whether services are likely to be affordable, being based on the underlying policy frameworks, programming approaches, market attributes, sector intelligence, financing mechanisms and flows, as well as indicators such as the rates of water disconnection and bill collection. However, these indicators say little about the prices paid and their actual affordability. For this reason, they will not themselves be sufficient, but rather they will provide important additional information for a fuller interpretation of the other affordability indicators covered earlier. They will also help guide the appropriate responses based on what is already being done to improve affordability.

Based on the assessment described in this report, the following recommendations are made for future monitoring of WASH affordability:

Strengthen data sets and data analyses of income and expenditure surveys, to provide initial affordability assessments in over 50 countries for which these surveys are available in the past 5 years;

Build and strengthen global databases of WASH tariffs and costs, to enable affordability assessments that incorporate the current prices of WASH goods and services for achieving the national minimum services levels or the "safely managed" standard, aligned with the progressive realization of the rights to water and sanitation;

Strengthen the use of the UN-Water GLAAS survey to collect and analyse policy indicators relevant for affordability assessment, for triangulation with expenditure data and to help determine future policy and programmatic responses to unaffordable WASH services;

Reach a broad consensus on comparative expenditure requirements for households to meet multiple essential household needs, leading to the setting of a threshold (or threshold range) of WASH expenditure required as a proportion of total expenditure for an affordable WASH service; and

Conduct further in-depth country case studies to explore how WASH affordability can be better understood using available data sets, and further enhanced through additional data collection, thus contributing to the implementation of enhanced national policies to make WASH services affordable for all.

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Burundi, September 27, 2019
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01 Introduction

Affordability is an essential consideration for improving the population's access to water, sanitation and hygiene (WASH) products and services. The cost of access, whether it is a monthly bill or an investment in household infrastructure, can be a significant barrier to improved access. Household budgets may only allow for access to water sources that meet the national minimum standard, and therefore the sources may be far from the home, at risk of contamination, or provide an insufficient quantity of water. In the future, how people source their water supply will be impacted: a growing proportion of the world's population live in areas that are defined as water scarce, hence being exposed to seasonal shortages and longer-term climate shifts which threaten the quantity and quality of water supply.

Limited access to credit or ability to save may hinder construction of quality household latrines. Lack of funds and willingness to pay may also prevent proper treatment of different waste streams before disposal into the environment.

Therefore, economic access – ensuring that the costs paid by households and communities for WASH services are affordable – is a necessary condition for improving the quality of WASH services.

Affordability is writ large across the Sustainable Development Agenda, but not yet monitored. The word 'affordable' features in 10 targets across six Sustainable Development Goals (SDGs) (UN General Assembly, 2015),[3] underlining the widespread recognition that the achievement of the Sustainable Development Agenda is heavily reliant on goods and services being affordable to populations, especially the poor. However, when the SDG targets were set in the year 2015, there was neither a definition provided nor an established methodology for measuring affordability. Furthermore, only two SDG indicators – both in SDG 3 on health – explicitly require affordability to be monitored (UN General Assembly, 2019).[4] Hence, to date, there has been limited progress on monitoring affordability within the Sustainable Development Agenda.

Little has been done to track WASH affordability at the global scale to date. No single indicator nor set of indicators have been adopted in order to understand the relationship between policies, programmes and household costs for WASH. While the word 'affordability' is repeatedly used when talking about providing populations with quality WASH services, there are few examples of affordability analyses in low- and middle-income countries leading to concrete conclusions.

Several Human Rights emphasize the importance of economic accessibility, or affordability. Affordability is featured in many economic, social and cultural human rights passed by the UN Human Rights Council, under the term 'economic accessibility'. Common across several human rights (housing, food, water) is the requirement that prices are commensurate with income levels, and that individuals (or households) should be able to afford

[3] SDG targets with explicit references to affordability of goods and services include: SDG 3.8: Affordable essential medicines and vaccines for all; SDG 3.b: Affordable essential medicines & vaccines; SDG 4.3: Affordable education; SDG 6.1: Affordable drinking water; SDG 7.1: Affordable energy services; SDG 9.1: Affordable infrastructure; SDG 9.3: Affordable credit; SDG 9.c: Affordable internet access; SDG 11.1: Affordable housing and basic services; SDG 11.2: Affordable transport systems.

[4] Indicator 3.8.2 "Proportion of population with large household expenditures on health as a share of total household expenditure or income" and Indicator 3.b.2 "Proportion of health facilities that have a core set of relevant essential medicines available and affordable on a sustainable basis"

these goods without compromising on any other basic needs (see Annex A). Implicit in these human rights texts is the recognition that poor households' limited income should be spent in a balanced way in order to meet all the basic human needs. The principle of equity mentioned in several human rights texts demands that poorer households should not be disproportionately burdened with the costs of meeting basic needs as compared to richer households. Hence, while these human rights have been adopted individually, they are understood to be interrelated.

Human rights principles are cross-cutting dimensions that form part of each human right, including the rights to drinking water and sanitation. There are reflected in the Sustainable Development Goals and Agenda 2030, also by using the terminology of "leave no-one behind" (LNOB). These human rights principles must inform the respective policy and programmatic responses to ensure affordable services to all.

Human Rights put the onus on States as duty bearers in resolving affordability issues. The resolution 18/1 on the Human Rights to Safe Drinking Water and Sanitation (HRWS) calls upon States to "continuously monitor and regularly analyse the status of the realization of the right to safe drinking water and sanitation on the basis of the criteria of availability, quality, acceptability, accessibility and affordability" and it refers to States' responsibility to establish mechanisms to provide protection for poor and vulnerable populations when costs of meeting human rights are high. To ensure that water is affordable, General Comment 15 expands: *"State parties must adopt the necessary measures that may include, inter alia: (a) use of a range of appropriate low-cost techniques and technologies; (b) appropriate pricing policies such as free or low-cost water; and (c) income supplements.'*

Guiding texts in the human rights literature fails to define how economic accessibility can be measured or monitored at a global scale. While different Human Rights refer to economic accessibility, there is no clear benchmark or methodology provided for defining what expenditure should be made on achieving each human right. Indeed, any global blueprint would be too restrictive given the very different economic levels as well as different political economies of UN Member States. "In a 2014 report by the Special Rapporteur on the Human Rights to Drinking-Water and Sanitation [5], some indicators were proposed, but no methodology, data sources or threshold values for interpreting affordability were provided. These indicators were:

- Date and entry into force and coverage of national action plan on affordability of water and sanitation services
- Proportion of households disconnected from the water supply due to bills not met within X working days
- Proportion of households' requests for financial support to pay their water bill or sanitation costs met during the period
- Proportion of households spending more than X % of expenditure or income on water and sanitation

Hence States have significant flexibility in defining economic access to basic goods and services. In practice, many economically poorer countries face significant challenges in meeting all the human rights due to the limited household incomes and state resources. Thus, trade-offs must be made and this potentially leads to one human right being met at the expense of other human rights.

Pre-dating most of the economic, social and cultural human rights is the use of the poverty line to define who is deserving of State support. These days, most States define a poverty line and take measures to support those living below the poverty line to enable them to access basic goods and services. The World Bank estimates in 2015 that 736 million people, or 10% of the world's population, were living in extreme poverty (below US$ 1.90 per person per day). This population group will be severely challenged to meet all their human rights based on the expenditures they would need to make. It is likely that hundreds of million more people are living near the extreme poverty line and are thus at risk of falling into poverty.

[5] Human Rights Council. Report of the Special Rapporteur on the human right to safe drinking water and sanitation, Catarina de Albuquerque. Common violations of the human rights to water and sanitation. A/HRC/27/55.

Hence well over a billion people worldwide are likely to have severe challenges in meeting all their economic and social rights.[6]

Planning to meet human rights – and leave no-one behind – requires a concrete assessment of what service is needed, what is the cost and what is the appropriate financing mix. When planning how to provide each basic good or service, the cost needs to be known for achieving (at least the) the minimum standard. Once this is known, a financing assessment is needed using the 3 'T's (taxes, transfers and tariffs) to assess what minimum cost could be covered by the individual or household, and how that can be supplemented by public funds or other sources. In determining what tariff can be paid by poor households for WASH products and services, it requires clarity on what proportion of household income should be reserved for other human and child rights, such as health, education, social protection and food. This point defines the very heart of the affordability issue, as different goods and services should not be dealt with in isolation.

In a world heavily impacted by the COVID-19 pandemic, the affordability and accessibility of all basic services comes to the fore as a priority issue, with implications for government budgets and official development assistance to subsidise WASH services and the consequences of the lockdown measures on the employment status and incomes of the population, especially the poor and vulnerable.

A multi-stakeholder group of experts and organizations has been convened to address WASH affordability. It is with this backdrop that WHO and UNICEF convened an expert group and conducted country case studies[7] to explore the ways in which affordability of water, sanitation and hygiene services can be understood, in relation not only to a household's income or means at its disposal, but also in relation to other basic human rights or needs. The initiative was driven by four main questions:

1. How can affordability be concretely defined so that a judgement can be made on whether the price paid by a household on WASH services is 'affordable' or 'not affordable'? This is addressed in Chapter 2.
2. Based on the definitions, how can WASH affordability be measured using available data? This is addressed in Chapter 3.
3. How can WASH affordability be monitored globally and nationally, using existing or future data sets? This is addressed in Chapter 4.
4. What are the options for different stakeholders to respond when it is found that WASH is not affordable to (certain) households? And how do these options perform in relation to making WASH services more affordable to the target households? This is addressed in separate publications, given it is outside the direct issue of affordability monitoring.

This report explores these questions one by one in the following chapters; it then conducts a comparative assessment of alternative approaches in Chapter 5; and concludes by making proposed recommendations for global and national monitoring of WASH affordability in Chapter 6. Further reading material and references are provided.

Annex A provides affordability definitions for different basic needs.
Annex B gives a synthesis of findings from six country case studies.
Annex C details the protocol for extraction and analysis of data from the income and expenditure surveys in the country case studies.
Annex D gives an indicative list of income and expenditure surveys in low- and middle-income countries since 2014.

[6] Specifically, those human rights requiring household expenditure such as for food, housing, education, health and WASH

[7] Cambodia, Ghana, Mexico, Pakistan, Uganda, and Zambia. Annex B provides synthesis results from these case studies. Separate reports are available per country.

Congo, 17 September 2019
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02 Understanding affordability

Prior to measuring and monitoring WASH affordability, it is critical to have a clear understanding of what affordability is, and what it is not. Past studies that have assessed affordability of water services have had many weaknesses, which has made it difficult to pass valid judgements about which populations are deserving of public subsidies due to affordability concerns (covered in more detail in Chapter 3). Despite growing attention to the affordability of WASH services, the understanding of what it is and how it can be measured has varied. Hence, this chapter explores the various dimensions of affordability.

2.1 Previous approaches

Drawing on ways in which WASH affordability has been understood in the past, there are two main sources: (a) the Human Rights literature and (b) the common practice of countries, service providers and international agencies.

Earlier human rights literature focused on the principle of Equity. Neither the General Comment 15 nor the Resolution 18/1 provide any quantitative metric in determining what is affordable. The General Comment did, however, state in 2003 that:

"Any payment for water services has to be based on the principle of equity, ensuring that these services, whether privately or publicly provided, are affordable for all, including socially disadvantaged groups. Equity demands that poorer households should not be disproportionately burdened with water expenses as compared to richer households." (para 27, United Nations).

In preparing for the 65th Session of the UNGA in 2010, the Independent Expert on the Human Right to Safe Drinking Water and Sanitation underlined the importance of making progress on affordability:

"Services must be affordable. Access to water and sanitation must not compromise the ability to pay for other essential needs guaranteed by human rights such as food, housing and health care" [8]

The language 'not compromising other human rights' is echoed in other, earlier, human rights such as housing and food. However, no human rights resolutions or international treaties define clear methodologies, indicators and data sources for how to measure the affordability of meeting human rights, including the human rights to drinking-water and sanitation.

Until now, the main way to measure affordability has been a household's expenditure on water and wastewater as a proportion of annual income. Due to its simplicity and the availability of data, the current practice of measuring affordability has focused on measuring WASH (or water) expenditure as a proportion of total expenditure or income, and comparing it with an 'affordability threshold'. Expenditure above the threshold would therefore render a service 'unaffordable'. Henri Smets reports significant inter-country differences in affordability thresholds (Smets, 2012). For example, for water supply the threshold varies between 2% in the USA and 4% in Indonesia and Mongolia. For both water and sanitation, the threshold varies between 2% in Lithuania and 6% in Mongolia. Likewise, multilateral development banks and the OECD have defined thresholds of between 3% and 5%.

However, defining a single threshold value nationally or even globally has severe limitations in pronouncing services as affordable or unaffordable. As stated by Andres et al (2020) *"Thus, threshold values are often selected in a short-sighted manner, without a significant investigation of the income required to afford all essential expenditures. In light of this, it may not be surprising that there is no consensus on how the threshold value should be determined."* (page 8).

As stated by Heller (2015), thresholds should be set nationally and/or locally, based on a participatory process, involving in particular people living in poverty and other marginalized and disadvantaged individuals and groups, that consider all costs associated with water, sanitation and hygiene.

[8] Human rights obligations related to access to safe drinking water and sanitation.

2.2 Developing the concept

While equity and fairness arguments are important in the debate on affordability, they are relative and do not give absolute judgements on what is affordable and what is not. Hence, in order to formulate a metric for affordability, the key building blocks of affordability need to be understood.

In the proposal put forward by the Expert Group (see Acknowledgements), WASH affordability depends on the interrelation between three key variables, or dimensions:

1. **The price of the WASH services (paid by the household), including the time cost of accessing WASH services,**
2. **The overall spending power and time budget of the household, and**
3. **The competing nature of different needs[9], and the spending required to meet those needs.**

What the absolute level of these are, and how households behave in relation to these, will lead to decisions on what level and type of WASH service or behaviour they will adopt. Who within the household has access to the household budget and what has been agreed to use it for, will also be an important determining factor for household and individual decisions on WASH. The type and intensity of need – such as the sickness, age or disability of household members – will also be determining factors. Each one is described in more detail below.

1

The price or cost related to WASH services at the household level will vary depending on geographical and climatic context, the nature of the service provider (public or private), service provider efficiency, market competition, and levels of corruption or leakage. The ownership of assets, the public-private mix and the regulatory context will all play a role in determining the extent to which production costs differ from the prices charged. If there are public subsidies or cross-subsidies between consumers, the price will be below the total cost of the product or service. If the regulatory context allows for private ownership and profit-making, or else some other type of margin (e.g. surplus in a public provider), then prices to the consumer will be above the total cost of the product or service.

As well as the above considerations, an understanding of affordability requires a distinction between financial and economic costs:

- **Financial cost – cash outlay for the service itself.**
- **Economic cost – includes financial outlay plus:**
  - Other non-financial costs to obtain a service such as unpaid time spent developing or accessing the service.
  - Non-financial and financial consequences of consuming a less-than-ideal level of service.

Thus, the policy maker should consider what 'free' resources a household might make available to enable access to a service, and the consequences of consuming a below standard service, which can impact the household severely and even cause it even higher financial outlays, such as the health consequences of drinking polluted water or unsafe sanitation or hygiene practices.

[9] The latter point does not necessarily cover those needs that are considered 'essential', as the latter is very hard to define precisely, and it is ultimately the household's choice as to how spending is balanced between the 'more essential' and the 'less essential' needs.

2

The spending power of the household is derived from the resources at hand, including asset ownership, property, wealth, income and savings. The monthly cash income, after taxes, is typically the most important consideration when paying for a regular service. However, property, wealth and other assets are also important in determining affordability, as they can be sold or traded to increase expenditures or consumption or used to invest in capital items. Government resources paid directly to households, such as a government pension system or welfare payments, will also affect a household's cash situation.

A further element of the price of the service is the timing of when it should be paid, and hence whether the payment schedule suits the income patterns of the household. This raises the question of the ability or willingness of the household to borrow, or the willingness of the service provider to allow a customer to go into payment arrears. This issue can be broken into payments for capital items and payment for recurrent items:

- **Payment for capital items: borrowing money to pay for a capital item has been normalized in most countries, though the high interest rates and borrowing conditions can constrain households from taking a loan.[10]**
- **Payment for recurrent items: some households may, for example, go into short-term debt to pay for services in periods of the year when there is limited or no income. This may not be ideal as it usually incurs interest charges. If the supplier grants households additional time to make a payment, this can be highly beneficial for a poor household with irregular income. On the other hand, the risk is that (poorer) households build up debts to service providers that they cannot easily repay, hence putting them in a permanent cycle of debt.**

3

The price or cost of meeting other household needs must be weighed against the costs of WASH. Assets and property owned by a household can enable households to afford more services as it frees up what might have otherwise been spent on rent. Likewise, when public transportation, health care or education are (partially) subsidized by the welfare state, it means a lower burden on a household's limited cash income. However, the reach of the welfare state varies significantly by country and by rural/urban location. Therefore, at the household level, the affordability of WASH services is, in part, determined by the total expenditures required to meet other basic needs. These aspects are key to understanding whether WASH expenditure is affecting a household's ability to meet other basic needs.

Why these three dimensions? The reason why each of these dimensions is essential to understanding affordability is that if only one or two of these dimensions are considered, it is not enough to determine that a household can or cannot afford WASH products and services. A household might be challenged to pay for WASH either (a) when WASH tariffs are high, which might be due to a high level of service on offer; (b) when income is low; and/or (c) when the household has many other essential needs which also require expenditure such as healthcare, education, housing, clothing and food. However, if one of these dimensions is favourable and the other two less favourable, WASH services might still be affordable.

[10] With competitive interest rates, households can borrow to attain a higher level of service (or maintain an existing one), which can avert health costs and lead to access time gains. It might also reduce their operating or recurrent month-to-month costs. However, when interest rates are high, it becomes less attractive for households. For poorer households with no guarantees, the lender might not be willing to lend (even at higher interest rates).

The triple consequences of highly priced WASH services that might lead to a judgement of them being 'unaffordable' is that households might:

a. **go into debt by consuming a WASH service level above what they can pay from their cash resources, and/or**

b. **reduce expenditure on other essential items, and/or**

c. **cut back on WASH consumption, thereby resulting in other negative consequences for themselves as well as for others (e.g. adverse health outcomes).**

A categorical conclusion on affordability is rarely possible when there are no numbers to back it up. The judgement about affordability is highly context-specific and dependent on where the household falls with respect to the three dimensions. The interplay between the three dimensions is depicted at a very simple level in Table 1. For example, the most vulnerable household where WASH services are least affordable is one which is poor, and/or faces high WASH prices and/or does not have state support for other social services. Naturally there will be ranges in income, price levels and spending required on other essential services which gives rise to a 3-dimensional space where cut-offs will be needed in order to categorise households. In addition, a time dimension may be needed in contexts where there is seasonality in water availability, seasonality in income, or irregular work patterns, which means some populations may be moving between these categories several times in one year. Also, vulnerability is a relative concept; hence there will be many degrees of vulnerability not reflected in the 3-way classification in Table 1. Furthermore, while a welfare state may exist, many of the most excluded may have little or no access to it – such as unregistered citizens, migrants, those living in temporary accommodation, those with no legal land tenure or no registered address, and ethnic groups.

For example, in a scenario where WASH prices are high and spending power is low, this clearly makes a household vulnerable. However, if that household has few other competing needs because they are in good health and have no children, and/or public services are free, then that household is in a better position to pay for WASH expenses. On the other hand, if the household has sick people that need out-of-pocket payments for regular treatment, or there are several children with education costs, it will be harder to afford highly priced WASH services. If on the other hand there is a welfare state that covers health and education costs, then that same household is more likely to have spare income to cover their WASH expenses. This demonstrates that there is an interplay between these three dimensions which determines whether a household can afford WASH services.

In conclusion, to make a valid judgement about affordability requires data on the three dimensions of affordability as well as a defined threshold or rule of thumb for an affordability frontier (i.e. different combinations of the three dimensions). A time dimension should also be considered in some contexts.

Table 1.
Degree of vulnerability resulting from three dimensions of WASH affordability

Matrix	Welfare state or other source covers health, education, housing & pension		Welfare state or other source do not cover health, education, housing & pension	
	WASH prices low	WASH prices high	WASH prices low	WASH prices high
Low income	**Less vulnerable**	More vulnerable	More vulnerable	**Most vulnerable**
Median income	**Less vulnerable**	**Less vulnerable**	**Less vulnerable**	More vulnerable

2.3 Threshold approach to make judgements on affordability

One issue with the current approach to measuring the current household spending on WASH is that it does not typically allow explicit assessment of the costs against a specified level of service. Such an assessment works well when it is known that all households consume at least the national minimum level of WASH services in a specified service area. However, in the developing world the majority of households still do not consume safely managed water and sanitation services, and still many live without a basic level of WASH service. Hence, a distinction of WASH expenditure by service level is important. The key question then becomes: "what would a household have to spend in order to reach (at least) the national minimum standard of WASH?" Note also that some national minimum standards might not be sufficient to meet the human rights, and hence further examination of these standards is necessary.

In a recent book on achieving equitable WASH services, a chapter on the costs and benefits of achieving equitable WASH defines four potential outcomes for a household according to whether they are connected to a (minimum) service or not, and whether the service is affordable or not (Hutton and Andres, 2018), shown in Figure 1. As noted above, with seasonal or other variations, households might move in and out of different vulnerability categories (Table 1) and quadrants (Figure 1) over time.

Figure 1.
Populations fall into four affordability quadrants depending on whether they access a targeted minimum level of service and whether the service is affordable or not

Figure 1 Source: Hutton and Andres (2018)

This framework leads to potentially three 'unaffordability' situations, as follows:

QUADRANT **#1: Households consume the minimum service level but pay too much.** Although these households are served, the level of water service is judged to be unaffordable.

QUADRANT **#2: Households do not consume the minimum service level, but still pay too much.** This outcome is quite common in urban areas, where households do not have access to utility services and pay considerable sums for water supply, or where they have access to poor quality utility services and pay high tariffs for it, without any kind of subsidy or social protection. There are many examples of this happening but there is limited capture of this phenomenon from nationally representative surveys. Households that pay high sums for vendor-supplied water might be under-sampled in national household surveys, and also their expenses might not be captured well in the survey questions, given the variability in expenditure from day to day and from month to month. Second, for households with utility services, the issue of low service level is not well picked up. In a household survey they would be assumed to have an adequate service, as data are not often collected on continuity (e.g. hours per day, days per week) or quality of water supply. Hence, in order to understand more about populations falling into Quadrant #2, more in-depth data on WASH expenditure is needed, as well as deeper analysis of available data sets.

QUADRANT **#3: Households do not consume the minimum service level, and they incur low or zero expenditure.** This situation is very common, especially for poor and vulnerable households and remote communities. While their current expenditure indicates they have affordable WASH, the fact that the service level is below the minimum standard may suggest that they would face affordability constraints in paying for a higher service level. Furthermore, there are considerable hidden costs associated with their low level of service, such as (a) the amount of time taken to collect water or travel to a place of open defecation, time which could be used for productive purposes; and (b) the health consequences of lower service levels (i.e. that are not safely managed), due to contamination of water at the source or while transporting home; and the spread of disease from open defecation and non-safe management of human excreta from pit latrine, septic tank and untreated sewage. Hence, while households might have 'affordable' services according to a proxy that is based on current expenditure, the negative consequences of this service level should also be considered.

In both Quadrants #2 and #3, it is important to assess what a minimum service level would cost and assess the consequences of households paying this cost on their spending on other essential items, or their debt levels. This understanding translates into a concrete proposal to measure an indicator that includes the full costs a household needs to pay to reach a minimum service level (see Chapter 3).

The key question remains: what are the quantitative cut-offs between these four quadrants? As stated earlier, there is no international consensus around what level of expenditure on WASH services is affordable or unaffordable, and the threshold that defines these. The United Nations Development Programme (UNDP), the World Bank, the Organization for Economic Cooperation and Development (OECD), the European Commission and the African Development Bank have all defined a threshold of expenditure as a proportion of income (or expenditure) for water to be affordable, all lying between 3% and 5%.[11] However, in most cases it is not clear how this threshold was reached. Even if some empirically based threshold was proposed, it would be questionable whether such a threshold can apply across different countries or across households with very different capacities and needs. Therefore, such an exercise is both ethically and empirically very challenging. It is picked up again in the recommendations in Chapter 6.

[11] Not all of these thresholds by international organizations are official releases, or do they apply organization-wide.

03 Measuring affordability

3.1 Approaches to measuring affordability

The concepts described in the previous chapter have provided signposts as to how affordability might be measured, but they have not provided actual methods or measurable indicators that allow a concrete judgement about the extent of affordability or unaffordability of a WASH service.

Following the work of the JMP/GLAAS Expert Group on WASH Affordability, five distinct approaches were agreed that provide insights into WASH affordability:

1. ***How people behave*** with respect to WASH expenditure and service levels;
2. ***What people say*** about their preferences on WASH expenditure and service levels;
3. ***How WASH expenditures compare to an agreed benchmark*** on WASH spending as a percent of overall household income or expenditure;
4. ***What is a household's poverty status,*** based on either national or community assessments, which indicates deservingness for supportive measures to be provided with affordable WASH services; and
5. ***What measures already are in place*** to ensure the poor and vulnerable have economic access to WASH services.

These approaches require specific methodologies and indicators for empirical analysis, which enables a distinction between those for whom WASH services are 'affordable', 'less affordable' or 'unaffordable'. Note that they are not mutually exclusive analyses – and that implementing these approaches together can shine a light on affordability from different angles and thus enhance understanding.

3.1.1 How people behave ('revealed preference')

What WASH services people consume depends on a variety of factors, including availability, physical accessibility, acceptability, quality and economic accessibility, which mirror the normative criteria of the human rights to safe drinking-water and sanitation. Economic accessibility includes the three dimensions of affordability covered in chapter 2 and could also incorporate the capacity to take on debt. In making the decision on service level they consume, households will compare the different options available, often trading off the normative criteria against each other, especially when their willingness or ability to pay for these services is low.

One approach that can shed some light on WASH affordability is how households respond to the prices of WASH services, either comparing different populations or the same populations over time, or both. This approach is termed in economics 'revealed preference'.

1. Comparing different populations that face the same or different prices of WASH services. For example, comparing households in different economic strata and what they spend on WASH can reveal the sensitivity of poorer households to WASH prices.

2. Observing the same population over time and measuring how their demand changes when WASH prices change. For example, if there is an increase in WASH prices then household consumption levels can be observed for how they adapt to the price change. This allows a 'price elasticity of demand' for WASH to be estimated – an economic term which calculates how much demand changes when price changes. Household response will depend on a number of factors, such as the alternative WASH sources available, whether the household has spare income, and whether the household consumes above or below the minimum level covering essential needs.

If some population groups are seen to be consuming below the minimum service level, and appear to be sensitive to price, then this implicit choice of households highlights a potential affordability problem. High or increased prices might lead them to taking measures that put them at risk (e.g. unprotected water sources) or lead to a reduction in water demand below their basic needs. On the other hand, households might accept and pay high WASH prices that threaten their enjoyment of other human rights, indicating they are willing to pay and willing to trade off their fulfilment of other basic needs. Such an outcome would indicate unaffordable water and sanitation services as interpreted in the Human Rights to Drinking-Water and Sanitation.

Guinea-Bissau, January 18, 2020
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3.1.2 What people say ('stated preference')

A second approach asks populations directly what they would be willing to pay for an improved service, or willing to accept for a reduced service. It can also reveal if, and why, they are consuming below a given service level. Because these answers are obtained from an interview with users of services, the approach is termed in economics 'stated preference'. The willingness to pay estimates obtained from the user survey can be compared with their income levels to enable conclusions about whether households might be able to pay these amounts. Comparing willingness to pay with the actual price of the service also indicates financial viability of the service, and whether a subsidy might be needed to make it financially viable. From these analyses, conclusions can be made about whether the current or future price of services appear to be affordable or not.

Even when household behaviour is known, interviews can also reveal additional information that was not evident from their behaviours. For example, if a household states it cannot afford a service, questions can explore why they feel this is the case. Questions can also examine issues such as unfairness in pricing such as when discriminatory pricing occurs.[12]

The problem with getting households to state their preferences through question and answer is that it is subjective. Respondents will consider many different aspects in their reply, and they may omit others; and this will vary from one to another respondent. Also, the individual respondent might not be reflecting all the views and preferences in a household. For example, access time for a distant water source or place of open defecation might not be explicitly considered if the respondent is not the one who spends their time in that activity.

In economics, direct observation or statement of household preferences are considered the appropriate values to use for assessing population welfare, as they are said to reveal directly how households make decisions under resource constraints. Hence these values tend to be preferred when analysing population welfare and formulating a policy response. However, they too have their weaknesses, as described above; hence other approaches need to be explored.

3.1.3 How expenditure compares to an agreed benchmark ('expenditure threshold approach')

Given the lack of clarity on how to directly measure household welfare and how they make consumption decisions, alternative measures have been popular with international and national WASH agencies and WASH service providers to make conclusions about affordability (see Chapter 2.1). Over recent decades, the popularity of a proxy indicator for affordability has emerged that seeks to answer: "what percentage of income would it be reasonable to expect a (poor) household to pay?" Most applications of this indicator use actual (measured) WASH expenditure in the numerator. It is commonplace for only water expenditure to be included.

In some instances, the required cost for a household to reach a given WASH consumption level is used instead of the actual consumption levels and expenditures. The World Bank's International Benchmark on Water Utilities (IBNET), for example, requires utilities to estimate the cost of consuming 6m^3 of (piped) water, and this allows easy comparison with the poverty income or median income. This quantity of water is assumed to be the lifeline amount for an average household. Any consumption above that minimum level is assumed to be excess to their minimum needs and is therefore a discretionary decision for the household to make, based on their needs and their willingness to pay for additional water. However, a common criticism of assigning a single lifeline value for all households is that it is insufficient for large families or households sharing a water connection, who are often poorer.

[12] Price discrimination is a selling strategy that charges customers different prices for the same product or service based on what the seller thinks they can get the customer to agree to. For example, a water vendor might not have documented prices hence can change the price from day to day or from customer to customer.

3.1.4 Poverty status

Poverty is a state or condition in which a person, household or community lacks the financial resources and essentials for a minimum standard of living. It implicitly requires a threshold for defining those living above or below the poverty line. Some countries and agencies use two lines for categorizing the poor and the extremely poor. The term 'near poor' is also being increasingly used to identify households at risk of slipping into poverty if an economic shock were to occur such as a sudden price rise or loss of income. While literature on the poverty line commonly refers to the ability to pay for a defined 'basket of goods', data deficiencies in this approach means that countries and international agencies more commonly use benchmarks of income to estimate the poverty line, or multiples of food expenditure requirements to sustain an adult. This suggests a high degree of uncertainty over whether households are correctly classified as living in poverty, and what financial amount might be reserved for WASH expenditure.

The implication of defining a poverty line is that anyone living in a household with household income less than the defined poverty line (on a per capita basis for the entire household) means that their ability to cover the costs of meeting essential needs has been compromised. While the essential needs related to water and sanitation are implied in the poverty line, they are not explicitly included. This makes it difficult to quantify what WASH costs are reasonable for poor households to pay, whether they are on or below the poverty line. As a result, it is difficult to quantify what subsidy should be provided to those living on or below the poverty line to cover their essential WASH needs.

Policies based on the poverty line will help push public funds in the right direction, but it will not guarantee that subsidies are used fairly. For example, the Government of India under the Swachh Bharat Mission provided sanitation subsidies to all 'below poverty line' (BPL) households, which in theory would have left those households living just above the poverty line without any support.[13]

An alternative approach is a more detailed analysis of the WASH component of the poverty line. If a poor household has an income that is 40% of the median income, then when applying a fairness principle, it implies that their expenditure on WASH should also be less than the WASH expenditure of a median income household. This would therefore require a government or WASH provider to provide additional support to households defined as very poor or extremely poor.

One final consideration is needed in the context of the broader SDG agenda. Picking up on the points in Chapter 1 on the importance of an integrated assessment of the costs (and affordability) of meeting different basic needs, it might require a new look at how poverty assessments are conducted. It would need the following question to be answered: "What would it cost for a household to meet all the needs implied in the SDG targets, plus any other basic needs or rights that have been omitted?" Indeed, if households are to meet all these costs themselves, it is likely that the poverty line would need to be raised considerably in all countries to accommodate all the expenditure required to meet the long list of basic needs and rights. On the other hand, if the prices of basic services are heavily subsidized by the government or donors, then it implies that lower expenditures need to be made by the household.

3.1.5 What measures are in place to protect the poor and vulnerable ('response measures')

A final approach looks at what measures are being taken to make service more affordable. The 'enabling environment' is used as a broad, catch-all phrase that can include legal instruments, citizen voice, policies and programmatic measures. Essentially, these measures protect the poor from the high cost of WASH services either directly or indirectly. The impact of these measures is to either lower the costs of WASH (or other) services for households or to increase household income to pay for WASH and other essential services. In analyzing data from household expenditure surveys, it is important to know to what extent WASH services are currently being subsidized. This will require some matching of different data sets (e.g. utility data, government data and household survey data) to understand which households have benefited from these measures, and by how much.

[13] In practice, subsidies were available to many more households than those defined as BPL.

3.2 Options for empirical assessment

These five approaches will now be further detailed in terms of the different ways to measure and analyse them empirically. The threshold expenditure approach is covered first, as this is the focus of the empirical work in the country case studies (Annex B). Indeed, it is noted that the piloting of each approach using country case studies will depend on the availability of data for each approach.

3.2.1 Expenditure threshold approach

This approach requires three pieces of information:

1. WASH expenditure – either by household or average for specific population groups;
2. Total expenditure or total income – either by household or average for specific population groups;
3. Threshold level for WASH expenditure as a percentage of total expenditure (or income), above which WASH expenditure would be deemed 'unaffordable'.

1. WASH expenditure

As described by WHO/UNICEF Joint monitoring Programme report in 2017, there are many types of WASH expenditure. Table 2 presents a matrix of the type of service (water, sanitation or hygiene) and the type of cost (financial recurrent, financial capital or non-financial). The negative impacts of these choices, such as health and environmental impacts hpersonal security concerns and psycho-social distress, are not included as these are covered in separate types of economic analysis (e.g. damage cost studies[14]). However, while conducted separately, the different types of analysis should be linked.

It is difficult to conduct a comprehensive cost assessment, as data are rarely collected on all these categories of expenditure. Hence, to be consistent with the data availability and cost sub-type, Figure 2 proposes a pyramid of costs to be compiled, to aid formulation of indicators for the expenditure threshold approach.

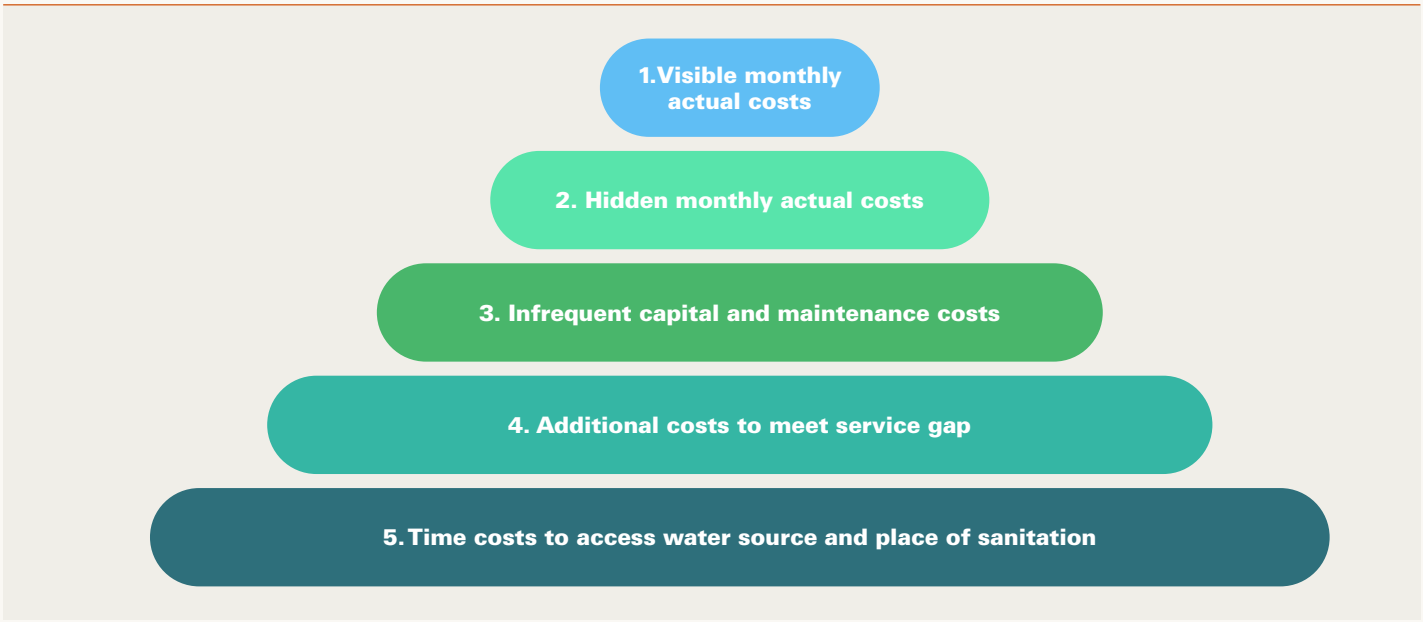
[14] https://www.wsp.org/content/economic-impacts-sanitation

Table 2.
Different types of cost for water, sanitation and hygiene

SERVICE	RECURRENT COSTS	CAPITAL COSTS	NON-FINANCIAL COSTS
Water	• Water tariff or use fee • Bottled or vendor water • Maintenance fees	• Piped network connection • Water supply construction	• Collection time for water
Sanitation	• Wastewater tariff • Public toilet user fees • Maintenance costs	• Toilet construction • Sewer network connection	• Travel time to communiity facility or open defecation
Hygiene	• Purchase of soap • Menstrual hygiene materials • Maintenance costs	• Handwashing station • Bins for menstrual materials	• Collection of water for handwashing and anal cleansing

Table 2 Source: WHO/UNICEF Joint Monitoring Programme (2017).

Figure 2.
Pyramid of costs to be included in the numerator of the expenditure threshold approach



The tip of the pyramid in Figure 2 represents those costs that are most visible, because they are collected by national surveys that capture WASH expenditure, or utility financial data. The second level, hidden monthly actual costs, include items that are likely to be included in reporting expenditure such as when bottled water is reported within 'other drinks' category, and when sanitary cleaning materials and personal care such as soap and menstrual hygiene pads are hidden in broader hygiene categories. These items are difficult to separate from other items, and hence typically are not included in analyses of WASH expenditure.

The third level, capital and maintenance costs for WASH infrastructure, are either omitted from expenditure surveys or they are included in broader maintenance or house improvement categories; hence they cannot be extracted separately from surveys. Danert and Hutton (2020) argue that self-investment by households is largely omitted from financing assessments using the 3 'T's (tariffs, taxes and transfers) as they are not charged for in the tariff of the service provider. The fourth level, additional costs to meet the service gap, are what the household is currently not spending, but would need to spend in order to meet the national minimum service level.

The fifth level, the time cost, is collected routinely by some national surveys either as distance or roundtrip to the water source. However, time spent for accessing sanitation is not included in these surveys. To date, the potential value of time savings from closer water and sanitation facilities has received limited attention from global or national monitoring, although it is included in previous cost-benefit analyses (World Health Organization, 2004, 2012). That said, the time needed to access a water source is now recognized in the categorization of a household's water access – where an improved water source that is >30 minutes roundtrip is classified as 'limited' access, and an improved water source that is <30 minutes roundtrip is classified as 'basic' access. From the perspective of the human rights to water and sanitation, personal security is one of the components that should be ensured even in the minimum level of service.

From the pyramid in Figure 2, the following list shows different indicator options that include different cost categories in the numerator. This list is represented in Table 3.

1. **Full actual expenditure – includes**
   a. Option 1.1: includes 1 and 2 in Figure 2
   b. Option 1.2: includes 1, 2 and 5 in Figure 2
   c. Option 1.3: includes 3 in Figure 2
   d. Option 1.4: includes 1, 2 and 3 (annualized) in Figure 2
   e. Option 1.5: includes 1, 2, 3 (annualized) and 5 in Figure 2

2. **Partial actual expenditure – includes**
   a. Option 2.1: includes 1 in Figure 2
   b. Option 2.2: includes 1 and 5 in Figure 2
   c. Option 2.3: includes 3 in Figure 2
   d. Option 2.4: includes 1 and 3 (annualized) in Figure 2
   e. Option 2.5: includes 1, 3 (annualized) and 5 in Figure 2

3. **Required costs of a minimum WASH service**
   a. Option 3.1: includes 1, 2 and 4 in Figure 2
   b. Option 3.2: includes 1, 2, 4 and 5 in Figure 2
   c. Option 3.3: includes 3 and 4 in Figure 2
   d. Option 3.4: includes 1, 2, 3 (annualized) and 4 in Figure 2
   e. Option 3.5: includes 1, 2, 3 (annualized), 4 and 5 in Figure 2

Table 3.
Summary of expenditure or cost items included in each indicator

INDICATOR OPTIONS	ACTUAL EXPENDITURE ON WASH						REQUIRED EXPENDITURE ON WASH			
	ALL O&M	PARTIAL O&M	ALL CAPITAL	PARTIAL CAPITAL	ANNUAL CAPITAL	TIME COSTS	O&M	CAPITAL	ANNUAL CAPITAL	TIME COSTS
Option 1: full actual expenditure										
OPTION 1.1	●									
OPTION 1.2	●					●				
OPTION 1.3			●							
OPTION 1.4	●				●					
OPTION 1.5	●				●	●				
Option 2: partial actual expenditure										
OPTION 2.1		●								
OPTION 2.2		●				●				
OPTION 2.3				●						
OPTION 2.4		●			●					
OPTION 2.5		●			●	●				
Option 3: full required expenditure										
OPTION 3.1							●			
OPTION 3.2							●			●
OPTION 3.3								●		
OPTION 3.4							●		●	
OPTION 3.5							●		●	●

To implement these indicators, several decisions need to be made on methodology:

First, how are capital and capital maintenance captured? These expenditures are dealt with in one of two ways:

1. Include full capital and maintenance costs in options 1.3, 2.3 and 3.3. This includes multi-year costs relating to the type and life span of the infrastructure. When making a judgement about affordability, a different threshold would be needed than the one referring to percent of annual expenditure.

2. Convert the full capital and maintenance costs to annual values, as done in options 1.4, 1.5 2.4, 2.5, 3.4 and 3.5. To calculate annual equivalent values, the lifespan of the capital items is needed, as well as a value for the Social Discount Rate for the depreciation of assets.

Second, how is the value of time costs estimated? In the ratio estimation, the value of time cost is simply added to the financial cost in the numerator, in indicator options 1.2, 1.5, 2.2, 2.5, 3.2 and 3.5. The value can either be derived from the income of the working household members, or as an average across an entire population or sub-population. The former is difficult to do, as a specific individual would need to be chosen from the household to represent time value.

Also, in terms of the economic value or 'opportunity cost' of this time, the questions should be asked whether the time spent collecting water or finding a place for sanitation is worth the same as working time. Whittington and Cook (2019) reviewed eleven studies on the value of time spent in non-market activities in low- and middle-income countries. The evidence suggests time spent collecting water or walking to a defecation site should be valued at less than working time. Nine of the eleven studies report mean estimates that fall in the range of 25%-75% of some measure of household income or wage rate. One study found mean estimates near zero, and only one found the value of time approximately equal to market wages.

As time is being valued in the numerator, it could be argued that the value of time of all non-paid time should also be included in the denominator. This is most easily seen through an extreme example. Suppose a rural household relies on subsistence farming and has virtually no cash income or cash expenditures. The household's key resource is time and they must allocate it towards farming, firewood collection, water collection, home care, maintaining social networks, and so on. Calculating WASH affordability with monetized collection time expenditures in the numerator but only cash expenditures in the denominator would paint a picture of highly unaffordable WASH (because the denominator is near zero). The correct interpretation of affordability would therefore be the percent of all the household's economic resources spent in collecting water. In this case it would essentially be the percent of time spent collecting water divided by the total amount of waking hours of all working age family members. This would lead to an estimate of total monetized value of water collection time divided by the monetized value of all available time.

In reality, however, many households in rural areas will have some family members working for cash wages as well as doing non-market work such as household chores. Other family members, such as teenage children, may attend school but collect water or firewood in the mornings or evenings. If one includes cash income or expenditures in the denominator (discussed below), then information is needed on time spent in market and non-market activities for all household members. Otherwise, valuing all time available in the denominator will double count hours spent working for wages. Although many countries have completed detailed time use surveys (e.g. Ghana 2009[15]), these data collection efforts are far from universal and not currently conducted routinely to enable incorporation into global monitoring of affordability. Income and expenditure surveys do attempt to monetise non-market work in the income estimations, and therefore may partially address the above issue for some household members.

This leaves two approaches. The first is to value time in the numerator but not the denominator, which is the main approach used in this report. It is recognized, however, that this will bias affordability to make it appear worse than it is. The second, explored only as a sensitivity analysis for Ghana, is to value all household members' time in the denominator but omit data on actual income or expenditures to avoid double-counting. This is undoubtedly less accurate, particularly for urban households that may spend less time collecting water, but it illustrates the importance of how time is treated in affordability calculations.

[15] https://www2.statsghana.gov.gh/nada/index.php/catalog/53/related_materials

Total expenditure or total income

Several options exist for estimating the denominator. Some of the main options are described below:

OPTION A: **Total annual income**

This option would be the ideal one for assessing affordability, including salary and non-salary income. However, it is not used in this study because the household surveys on which it is based typically do not provide reliable estimates. Instead, the proxy (Option B) can be more accurate.

OPTION B: **Total annual expenditure**

Given the weaknesses of Option A, Option B is commonly used as a proxy for income, being used in food poverty assessments. A comprehensive questionnaire that includes all possible spending categories is applied at household level. Questions must be phrased in a way that avoids overlap and double counting (e.g. if a household consumes bottled water then it might be captured both in monthly water costs and in bottled drinks category).

OPTION C: **Annual expenditure available for discretional items**

This variable represents household expenditure after tax, rent and other fixed or essential expenditure items have been deducted. The logic of using this variable to measure WASH affordability is that households do not have discretion over all their expenditures. Households may pay income or property tax, and there are regular fixed costs such as rent and discretionary but essential items such as essential food, education, clothing, health insurance and healthcare. This denominator therefore takes out of the equation some of the costs that can vary significantly from one household to another, making it easier to determine a threshold that applies to the majority of (poor) households.

However, even with very detailed income and expenditure surveys there are significant empirical challenges in defining what is the minimum essential level of all of these costs for each household, taking into account the needs of each household member. Instead, comparative assessment of

Sudan, November 04, 2019

average household costs of major spending categories has been done for Ghana, and available in the poverty chapter of the Ghana report (Hutton et al 2019).

OPTION D: **Minimum wage rate**

This option calculates how many hours a poor household would have to work at the minimum wage to pay for their monthly water (and sanitation and hygiene) expenses. The advantage of this indicator is that it is simple to tabulate and to understand and enables comparison of a household's ability to pay WASH expenses between different geographic areas. On the other hand, not every poor household might have access to a job offering the minimum wage, and their time might only be sold in the informal market which provides variable income (and might be below the minimum wage rate). Hence applying a national wage rate will lead to inaccuracies in many areas where labour cannot be sold for the wage rate assumed by the analysis. Also, many countries do not have minimum wage rates, or annually updated minimum wage rates that keep pace with inflation.

Threshold level for WASH expenditure as a percentage of total expenditure (or income)

Any interpretation of the indicator generated from the above variables requires a threshold value to be defined – i.e. a percentage above which WASH expenditure would become 'unaffordable' for the household. It is also feasible to set more than one threshold, with gradations of degree of affordability (e.g. affordable, potentially unaffordable and unaffordable).

The threshold value depends on which expenditures and incomes are included in the denominator and numerator, as described earlier in this chapter. Once the threshold is set, the quadrant approach (Figure 1) can be used to categorise households, with specific policy and programming implications for each one (see Chapter 2).

The threshold might be set based on several factors:

1. The proportion of a poor household's income likely to be available for spending on WASH. This must take into account spending required for other essential items.

2. The number or proportion of households expected to spend above the threshold. This is relevant for policy makers as it has implications for how many households would need to be subsidized.

3. The extent of subsidies within the current WASH prices. If a subsidy is already provided, the threshold might be lower than otherwise.

The most important of these is number 1, but the other factors might influence setting of a threshold. To determine point 1, it is necessary to conduct a complete household expenditure analysis with a focus on poorer households.

Mali, July 09, 2012
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3.2.2 Revealed preferences

One approach to measure revealed preferences is to examine a one-point-in-time snapshot of a sample of households. This requires information on WASH prices, the existing WASH service levels per household, and the opportunities available for consuming higher service levels. In particular the focus is on (a) those who are consuming below the minimum service level, and the extent to which the service prices explain their consumption level; (b) those consuming at or just above the minimum service level, and whether price fluctuations put their service level at risk.

A second approach is to examine how consumers react to price changes. This requires information before and after a price change. Such information is available in abundance for many goods and services, and it can be used to estimate the price elasticity of demand (PED). The PED is a measure used in economics to show the responsiveness, or elasticity, of the quantity demanded of a good or service to a change in its price when nothing but the price changes. More precisely, it gives the percentage change in quantity demanded in response to a one percent change in price. Given the law of demand – that typically demand of a good reduces when prices increase – the PED is negative for most goods and products.

When the PED is below between 0.0 and -1.0 it is said to be inelastic because the % change in price has led to a correspondingly lower % change in demand. Demand from a given water source is likely to show this property when the quantity consumed is for mainly essential needs and there are no other viable sources, and for better off households. However, water demand can be 'elastic' when water is being used for non-essential needs and when there are other lower cost water sources. Demand is likely to be more 'elastic' for poorer households than richer ones. In poorer communities in Kenya, for example, the REACH consortium has shown how seasonal availability of water (and how recently it rained) determines demand for paying water services in any given month (Hoque and Hope, 2018). Also, increasing water prices can lead to water saving measures such as less-water-use flush toilets, economical shower systems, or drip irrigation. In Bangladesh, the same authors find that behavioural dynamics on water sourcing and payment are shaped by several environmental, infrastructure and cultural factors; and where household wealth is found to be a weak indicator of behaviour (Hoque and Hope, 2019). The authors conclude that affordability measures should recognize the quality of service available and chosen by users across seasons, rather than being fixated on income or expenditure ratios for a single main water source.

As suggested above, changes in consumer behaviour can be related to availability of competitors' goods and services as well as the price changes. For water it is a simple case when there is a monopoly provider (such as a water utility) and there are limited alternative water sources. Even if there are other water sources, market data over time can indicate how sensitive households are to price changes, depending on what other water sources there are. For example, the Safe Water Network in Ghana has analysed impacts of water price changes on connection rates and water consumption, with a view to increasing cost recovery rates to make water stations more financially viable[16]. The study found that average monthly sales volumes decreased by 12% in the 15 months after the price increase, compared with the 15 months preceding the price increase, and poor households were most affected (decrease in demand by 26%).

[16] 'Price change and station performance in Ghana.' Safe Water Network. 2017.

The PED refers to the change in demand resulting from changes in their own price (called 'own-price elasticity of demand'). Another measure is the 'cross-price elasticity of demand', which, in the case of water, is the elasticity of demand for a given water source with respect to the change in the price of water from another water source. It can be used to assess substitution between two water sources and the factors that explain it.

3.2.3 Stated preferences

There are two main indicators or measurements in this category. The first of these is the willingness to pay (WTP) of households for a given service or product using the contingent valuation method, which refers to the fact that consumers are asked about their WTP rather than observe it. Willingness to pay is a methodology used by economists, firms and sometimes government agencies to assess potential market size, to set prices, and to measure consumer surplus (those who paid less for a good or service than they were willing to pay). A WTP survey is often conducted for a product, service type or service level that is not yet available in the market. Its main purpose is to provide information from potential consumers on what their demand will be and it helps set a market entry price. WTP studies are most commonly conducted by marketing companies for a range of consumer products, but there is also some experience in the field of water and sanitation, in particular around their perceived benefits (such as time and health savings). Willingness to accept (WTA) is an alternative methodology to assess the value a household has for a service by asking them what they should be remunerated if they were to lose access to the good or service.

The second indicator is one that asks directly about household perceptions of WASH affordability. Such questions examine why households do not use minimum service levels, and whether higher prices explain their decisions. For example, an analysis by JMP of 20 recent MICS[17] asked households the question "In the last month, has there been any time when your household did not have sufficient quantities of drinking water?" and for those answering 'yes' in 16 countries they were asked the main reason for drinking water being unavailable. Among the reasons were 'Water not available from source', 'Water too expensive', 'Source not accessible', and 'Other'.

[17] Unpublished

Nigeria, April 21, 2013
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3.2.4 Poverty status

Three ways of measuring WASH affordability are identified in relation to poverty status and the poverty line. The first approach is a simple categorization of households by their income and poverty status. There might be other measures of vulnerability, such as female-headed households, ethnic group or high-risk communities, that governments use to target subsidized or free services.

The second approach is measurement of the WASH component of the poverty basket, such that:

If actual spending on WASH **>** *the WASH component of the poverty basket, then WASH is unaffordable*

This might need to be prorated if the household is living below the poverty line, given that they will have even less to spend on WASH. If this is done, it needs to be decided if the prorating is done using a linear or non-linear adjustment. However, as stated in section 3.1.4, poverty lines are rarely calculated using a full basket of goods that includes WASH.

The third approach is to conduct a detailed analysis of expenditure profiles across different sub-populations (e.g. income deciles), comparing WASH, other essential and non-essential items, to explain WASH consumption levels. In cases where WASH spending is low or zero, and the service levels are below the national minimum standard, it might also be concluded that WASH spending is compromised by the many other needs for household spending. This approach is the most difficult to implement, given that household consumption choices are difficult to explain: every household has different needs and opportunities, and their responses to the offer and prices of WASH services will vary, as well as the resultant impact on demand for other services. This makes it extremely challenging to quantify any relationships. Furthermore, what constitutes an essential need and the consumption amount is difficult to define. A benchmark might be defined to fit the average household, but it does not account for variation in household composition and needs, such as spending on education, healthcare and food.

India, October 28, 2018
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3.2.5 Response measures

A range of different indicators have already been formulated by the biannual UN-Water GLAAS survey for different aspects of the enabling environment. As no single indicator can predict whether a WASH service is affordable or not, these indicators should be looked at in combination and triangulated with indicators covered earlier in this chapter. Indicators included in the GLAAS survey are listed in Chapter 4.3, but they include:

- Legal instruments, such as the human rights to water and sanitation being explicitly recognized in the constitution and thereby citizens exercising their legal right to demand government action under specific accountable mechanisms created for this purpose;
- Policies recognizing the need to target specific population groups with lower cost WASH services on a non-discriminatory basis, especially for disadvantaged and marginalized groups[18];
- Availability of earmarked budgets that target populations with public funds;
- Monitoring systems that track the impact of those funds and other measures, such as through benefit-incidence analysis (an approach that identifies which population groups benefit from public subsidies);
- Service-level pricing models such as tariff structure or solidarity funds that lower the price and hence encourage consumption by specific population groups;
- Regulations on tariff setting that must be followed utilities in serving poor and vulnerable households;
- WASH service payment options that enable vulnerable households' flexibility in bill payment;
- Disconnection rates (or laws protecting from disconnection) and reconnection fees;
- The availability of affordable financing options for one-time capital expenses such as micro-loans;
- Community participation in service management;
- The stimulation of the market for low-cost designs for the bottom of the pyramid population groups;
- Measures to reduce corruption;
- Measures to enhance competition and hence reduce prices faced by the user.

Many of these indicators can be measured from utility or local-area level up to national level.

[18] General Observation 15, para 37, b) (core obligations)

04
Data for monitoring affordability

Ultimately, the ability to monitor the indicators covered in Section 3 will depend on the availability of data. In the short-term, global monitoring will rely heavily on data that are already collected, while in the longer term there will be additional sources of data. The findings and recommendations from this current initiative should be used to influence existing surveys and promote new data sources on WASH expenditure and affordability indicators.

To monitor WASH affordability, data sources fall into one of three main categories, covered in the following sections:

1. Survey data from nationally representative household surveys;
2. Surveys and assessments conducted as part of research studies that are not representative of the national level; and
3. Administrative data or policy surveys that are compiled from local and national governments, utilities, providers and regulators. When aggregated, and if at large enough scale, these data can be nationally representative.

This chapter presents each of these data sources in terms of their:

- **Content and degree of standardization**
- **Representation, quality and disaggregation**
- **Frequency and global coverage**
- **Access to data (public or limited availability; procedure and cost to extract data)**
- **Implications for national monitoring**
- **Implications for global monitoring**
- **Potential future data sources**

4.1 Nationally representative surveys

Introduction

Nationally representative surveys are the most important data source for global monitoring during the SDG period in low- and middle-income countries. These surveys tend to be largely standardized across countries and their sampling methodology ensures national representation. International agencies produce modules with core questions for different topics, which countries draw on and adapt for their own purposes.

As shown in a previous report on WASH affordability (Hutton, 2012), there are many types of household survey. These surveys are catalogued for non-OECD countries by the International Household Survey Network[19] (after 1981) and classified under 18 different categories of survey. For the purposes of this study, nine relevant survey categories are highlighted and listed in Table 4[20].

Table 4.
Key data available from most relevant categories of household survey[1]

SURVEY INSTRUMENT	DATA PRESENTED ON:			
	POVERTY STATUS	QUINTILLES	WATER SOURCE[3]	SANITATION ACCESS
Core Welfare Indicators Questionnaire (CWIQ)	Yes	Income	Yes	Yes
Demographic and Health Survey (DHS)	No	Wealth[2]	Yes	Yes
Income and Expenditure Surveys (IES)	Yes	Income	Yes	Yes
Integrated Surveys (non-LSMS)	Yes	Income	Yes	Yes
Living Standards Measurement Survey (LSMS)	Yes	Income	Yes	Yes
Multiple Indicator Cluster Survey (MICS)	No	Wealth[2]	Yes	Yes
Population and Housing Census (PHC)	No	Wealth[2]	Yes	Yes
Priority Surveys (World Bank)	Yes	Income	Yes	Yes
Socio-Economic Monitoring Survey (SEMS)	Yes	Income	Yes	Yes

Table 4. Key:

[1] Covers mainly countries of the developing world, although some countries belonging to the European region are included (e.g. Croatia, Hungary, Poland).

[2] Based largely on durable goods and housing characteristics; includes source of water and type of sanitation.

[3] In addition to the main source for drinking purposes, some surveys ask questions on other or secondary sources of water, and/or divide questions on water source for drinking purposes and water sources for other purposes[21] .

[19] http://www.internationalsurveynetwork.org/

[20] Other surveys deemed to be non-relevant are: 1-2-3 surveys, agricultural surveys, labour surveys, the World Health Survey and the World Fertility Survey.

[21] Drinking water covers for drinking purposes, food preparation or personal hygiene https://washdata.org/sites/default/files/documents/reports/2019-03/JMP-2018-core-questions-for-household-surveys.pdf

Content. Table 5 presents a summary of the types of data available from national household surveys that are relevant for the calculation of WASH financial expenditure and access time costs. These include annual expenditure as well as capital expenditures on new systems or repairs.

The most complete and robust data source on WASH expenditure is the income and expenditure survey (IES). It should be noted, however, that there is some country variation in the questions included. In the European Union, the household budget survey captures water supply, refuse collection and sewerage costs (in the standard forms, section HE04.4). Also, over time, surveys tend to become more detailed and specific. Surveys which capture water and wastewater costs alone are the Living Standards Measurement Survey (LSMS), Socio-Economic Monitoring Survey (SEMS) and Integrated Surveys (non-LSMS). The Core Welfare Indicators Questionnaire (CWIQ) survey only captures major categories of household spending, hence it is not possible to extract water and sanitation costs from these. The Demographic and Health Survey (DHS), Multiple Indicator Cluster Survey (MICS), Census and Priority Surveys do not collect WASH expenditure data.

Across all these surveys, expenditure items with very limited data are (1) capital expenditure, which is usually mixed with housing expenditure, if collected at all; and (2) maintenance expenditure, which is usually mixed with general maintenance, if included at all.

Source: Hutton (2012). Notes:

[1] A question on number of trips was more recently introduced into the MICS survey – WS6 http://mics.unicef.org/tools?round=mics6

Table 5.
Sources of data on WASH expenditure from nationally-representative surveys

SURVEY INSTRUMENT	MONTHLY OR ANNUAL EXPENDITURE			OTHER EXPENDITURES			WATER TREATMENT			WATER ACCESS		
	Water	**Sanitation**	**Hygiene**	**Fixed tariff**	**Capital items**	**House repairs**	**% House-holds**	**Treatment method**	**Capital cost**	**One trip**	**Daily trips**	**Water hauler**
CWIQ	Only part of 'Fuel, lighting, other utilities'	No	Only part of "Miscellaneous" expenses	No	No	No	No	No	No	Time	No	No
DHS	No	No	No	No	No	No	Yes	Yes	Only hardware type	Time	No	Yes
IES	Sometimes water bill separate, sometimes mixed with housing and utility	Sometimes stated as 'mixed sanitary fittings', or part of total water bill	Somtimes specified, or part of mixed hygiene products	No	Mixed with housing costs	Sometimes plumbing cost	No	No	Water dispenser sometimes	Metres	No	No
Integrated Surveys	Yes (varies between survey)	Yes (varies between survey)	No	No	No	No	Yes, usually	Yes, somtimes	Not specified	Metres (usually)	Yes, sometimes	Yes, sometimes
LSMS	Yes	Sewerage together with water cost	Personal care products or toilet soap	No	Home improve-ments	Repair and maintenance	Sometimes	Sometimes asked if they boil water	Sometimes water boiler	Sometimes metres	No	No
MICS	No	No	No	No	No	No	Yes	Yes	Only hard-ware type	Time	Yes[1]	Yes
Census	No	No	No	No	No	No	No	No	No	No	No	No
Priority Surveys	No	No	No	No	No	Part of rent, repair and maintenance	No	No	No	Sometimes metres	No	Yes, sometimes
SEMS	Yes (varies between survey)	Yes (varies between survey)	No	No	No	No	Yes, usually	Yes, sometimes	Not specified	Metres (usually)	Yes, sometimes	Yes, sometimes

The surveys best capturing variables to estimate the costs of water treatment or water collection, including the identity of the water hauler, are the MICS, DHS, Integrated Survey, LSMS and SEMS. However, there is some variation in the specific questions in each of these surveys. The MICS and DHS are generally more standardised and consistent between countries. Over time, additional questions and specification have been added to both these surveys. Of the five survey types that ask about whether the household treats its drinking water or not, most also ask what water treatment method is used. The capital cost of water treatment methods (e.g. water boiler, filter) is sometimes identified in expenditure surveys.

In addition, as stated in section 3.2.2, in response to the requirements for SDG monitoring, MICS is increasingly asking questions around water availability and reasons for non-availability, and both MICS and DHS are increasingly conducting water quality testing (selected parameters). Of those households answering non-availability of water, unaffordability was cited as a reason in 0.1% of households (Georgia and Paraguay) and as high as 4.3% in Bangladesh, with an overall global average of 1.5%.

Water access to off-plot sources is identified by most surveys, but they vary whether the distance is expressed in metres (IES, Integrated Survey, LSMS, SEMS) or time per journey (CWIQ, DHS, MICS). The total access time per day is collected in some but not all Integrated Surveys and SEMS. The identity of the water hauler is collected routinely in MICS surveys, in earlier DHS surveys (but is no longer included) and sometimes in Integrated Surveys, Priority Surveys and SEMS.

The CWIQ survey only asks the time to water source and does not identify the water hauler. The respondent is asked why there is only "occasional or non-use" of services, and "too far" is one of the possible responses. The CWIQ also asks whether the respondent is satisfied with the service or not. Also, in relation to distance, the respondent is asked for the usual means of water collection (answer categories: on foot, mechanized vehicle, or non-mechanized vehicle).

Type of fuel used for cooking (and hence boiling water) is commonly included in DHS, MICS, LSMS and Censuses. The financial cost of fuel is collected by IES and some non-LSMS surveys. Time to collect fuel is commonly captured by IES (distance and place), non-LSMS surveys (distance and identity of collector), and priority surveys (distance and identity of collector) but not by CWIQ, DHS or MICS surveys.

Madagascar, November 11, 2018
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Time to access off-plot sanitation facilities (or place of defecation) is not captured by any national surveys. Some research studies have included a question on time to place of defecation for valuation of access time (Hutton et al 2014).

In terms of the denominator the WASH expenditure indicator, Table 6 provides a summary of results. Data on income are available from most types of survey, except DHS, MICS and most Censuses. However, the level of detail of questions varies significantly between IES, LSMS and SEMS – which provide the most detailed information – and CWIQ and priority surveys – which provide the least detailed information. The DHS, MICS and Censuses do ask questions on durable assets, thus enabling 'wealth' quintiles to be estimated. Some Censuses ask what types of benefits are claimed; however, this may be relevant only for countries where a benefits system is functioning. All surveys ask some questions about employment and work situation of household members, but there is significant variation in the level of detail collected by the different surveys.

Given that not all household surveys capture income reliably, a measure of total expenditure is sometimes a better measure of income than asking direct questions on income, as covered in Chapter 3. The most detailed and robust data on total expenditure are collected by IES, followed by LSMS. The level of detail for Integrated Surveys and SEMS varies between different types of survey. The CWIQ and priority surveys mainly collect major expenditure items; however, with questions on aggregate expenditures it is unlikely that the expenditure data do not fully capture all expenditures. The DHS, MICS and Censuses do not collect total expenditure data.

Table 6.
Data collected by surveys on household income and expenditure

SURVEY INSTRUMENT	EMPLOYMENT STATUS OF HOUSEHOLD MEMBERS	INCOME			TOTAL EXPENDITURE
		SALARY	NON-SALARY	OTHER PRODUCTION OR INCOME	
CWIQ	Yes	Yes, income stated under 12 main items, including salaries, gifts, sale of assets and remittances			By 10 main expenditure categories
DHS	Only women age 15-49 and men age 15-54 or -59	% cash income	% in-kind income	% other unpaid work	No
IES	Yes	Yes, detailed questions on all sources of income		Identifies food consumed that was freely received	Very detailed
Integrated Surveys	Yes	Yes, detailed questions on all sources of income			Yes, but level of detail varies between survey
LSMS	Yes	Yes	Yes		Yes, detailed
MICS	No (only child labour)	No	No	No	No
Census	Yes	Type of employment	Type of benefit claimed	No	No
Priority Surveys	Yes	Yes, major categories of income		No	Yes, major items only
SEMS	Yes	Yes, detailed questions on all sources of income		Identifies food consumed that was freely received	Yes, level of detail varies

In conclusion, the five main survey categories with expenditure data on selected WASH items are:

- **Income and Expenditure Survey (IES)**
- **Integrated Survey (non-LSMS)**
- **Living Standards Measurement Survey (LSMS)**
- **Priority Survey**
- **Socio-Economic Monitoring Survey (SEMS)**

These surveys allow WASH costs to be cross tabulated with service type and level, and from this the required costs of accessing the minimum or a given service level can be assessed. Their major weakness is that they have omitted some cost items, especially capital and maintenance costs; while other cost items might be included in broader expenditure categories such as hygiene products. Also, while there is one standard question on monthly water costs, and sometimes monthly wastewater costs, the inclusion of additional questions (and the nature of those questions) varies from country to country, and from survey to survey.

Representation, disaggregation and quality. These surveys are nationally representative and are most commonly implemented by the national statistics agency. Hence there is a high degree of credibility in the information that is collected, despite being incomplete on some WASH expenditure items.

The nine survey categories covered above are all nationally representative, and moreover data can be disaggregated and compared across a number of different population sub-groups – such as rural-urban, by ethnic group, by gender, by education level, by income level or income/wealth quintile, and by the first sub-national administrative level, among others. Data sets with these disaggregations will be very useful in comparing WASH expenditures among population groups that are more likely to face affordability constraints.

One aspect that needs to be further explored with survey and sampling experts is the degree of coverage, and breakdown possible, for populations living in specific low-income neighbourhoods, especially informal settlements and slums. Some governments may not allow surveys to be conducted in some types of housing that are not officially recognized. Furthermore, survey sampling methods usually do not allow data to be disaggregated for specific areas of a single city, for example.

Frequency and global coverage. When looking at expenditure surveys as a whole, they are conducted in countries at very different frequencies, varying from annual surveys (e.g. China), to frequent surveys (especially in E Europe and C Asia), to a survey every 5, 8 or even 10 years.[22] European Union countries implement Household Budget Surveys frequently: according to Eurostat, roughly two-thirds of countries of the European Union conduct annual Household Budget Surveys, while the remaining one-third conduct less frequent Household Budget Surveys[23,24]. Currently data are collected for all EU Member States as well as for Croatia, the Former Yugoslav of Republic of Macedonia, Turkey, Norway and Switzerland.

Some countries have implemented only one such expenditure survey, which does not allow conclusions about their frequency or about when the next one might be implemented. Annex D gives an indicative list of income and expenditure surveys conducted since 2014, with over 60 countries identified from internet sources. Given the frequency in many countries of at least 5 years between one expenditure survey and the next, it makes regular and up-to-date monitoring of WASH affordability very difficult, if it were to rely on these data sets alone. Indeed, data sets need to be as up to date as possible when informing a national policy response

[22] http://catalog.ihsn.org/index.php/catalog

[23] http://epp.eurostat.ec.europa.eu/portal/page/portal/household_budget_surveys/introduction

[24] Water supply, refuse collection and sewerage costs are covered in the standard forms HE04.4.

to unaffordable WASH services, due to the rapidly changing economic conditions of many low- and middle-income countries (e.g. water prices, general inflation, household incomes, economic growth, etc).

Access to data. There is considerable variability in the access to data sets, as countries have different policies. Some international agencies have special access to these data sets, and for the purposes of global monitoring of WASH affordability it is plausible to obtain many of these data sets directly from such agencies without going to each and every country to obtain permission. Second, although many questions are similar, they are not identical across all countries, hence each data set needs to be extracted manually and tabulated separately in a common analysis file (see Annex C). The World Bank has a project that harmonizes data set to enable comparison across countries. However, this data set is unlikely to be used for WASH affordability monitoring, because it omits some of the key additional questions on WASH expenditure that would contribute significantly to a WASH affordability analysis.

National monitoring. Given the periodic but infrequent nature of nationally representative surveys that provide the required data on WASH expenditure in low- and middle-income countries, most countries will not be able to conduct regular assessments of WASH affordability. Each country would need to wait until the latest expenditure survey data are made available to then update the WASH affordability analysis.

Global monitoring. In terms of global coverage, almost all countries are covered by at least one survey in the past five years asking detailed questions on income and expenditure, and also including some elements of WASH expenditure. However, because of the infrequent implementation of such surveys, a regular global monitoring report (e.g. every 2 years) would not provide up-to-date information for many countries on WASH affordability.

Potential future data sources. The future frequency of these surveys is presently unknown, but some close variant on business-as-usual would be expected. The survey questions do change over time, and hence opportunities will arise to add or change WASH questions related to coverage and expenditure to enable better assessments of WASH affordability. However, realism is needed in what changes can be made and how fast. Recommendations are made in section 6.1.2.

Myanmar, May 16, 2019
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4.2 Non-nationally representative surveys and studies

This second category is less likely to be an appropriate source of data for global monitoring than the first category covered in the previous section, but such surveys and studies can add significantly to national monitoring of affordability. For one, they involve methods and data sets that explore affordability from different angles, thus potentially providing a more complete picture. Also, they can be more focused on vulnerable populations, i.e. those who merit more attention in relation to the affordability of WASH services.

Localized WASH surveys and studies are commonly implemented by development partners and less often by local governments. For many implementing agencies, 'before and after' surveys are often a pre-condition of receiving funds in order to show how a population has been impacted by a programme. Some are used for design purposes prior to intervention, while others are mid-line during an intervention period or end-line at the end or some months following the intervention period.

There are some examples of surveys that have included WASH expenditure or other economic variables, and while they are insufficient for global monitoring at the present moment, they do indicate some potential for future monitoring of WASH affordability. The following five categories of economic analysis have been conducted widely, collected by several different survey types as described below:

1. Cost assessment
2. Benefit assessment
3. Cost-benefit analysis (which combines 1 and 2)
4. Willingness to pay assessment
5. Market assessment

The first type of survey is a **tailored survey** to collect data on economic variables. One example of this was a multi-country study conducted by the World Bank's Water and Sanitation Program (WSP) under the Economics of Sanitation Initiative (ESI). This initiative implemented a customised economic survey across thousands of households in six Southeast Asian countries between 2008 and 2010 (World Bank, 2015; Hutton et al 2014) for the purposes of a cost-benefit study. UNICEF implemented a similar survey in India in 2017 to assess the costs and impacts of Swachh Bharat Mission (UNICEF, 2019). These economic surveys included detailed questions on costs and benefits, including time use for sanitation. Results were also presented by wealth quintile. A new consortium called Uptime has collected expenditure data on four countries (Burkina, CAR, Kenya and Uganda) indicating rural people are willing to pay for a guaranteed maintenance service (McNicholl et al 2019).

A second type of tailored survey for assessing WASH practices and costs is the **water diary method** (Hoque and Hope, 2018, 2019). In this survey, households are asked to record each day their sources of water, volumes of water, water uses, and what they paid for them, as well as other variables. This method responds to the weaknesses of other types of household survey, such as those types of household survey covered in the previous section which provide 'snapshots' of WASH behaviours and expenditures at a particular time point and suffer from recall bias. Hence, the water diary method better captures the temporal variations such as seasonality in supply and coping responses. Water diaries suffer their own challenges, such as diarist fatigue, which may lead to short-cuts in recording information and eventually drop-out, as described in Hoque and Hope (2018).

A third type of study using survey methodology is a **willingness to pay** (WTP) study. These studies can be conducted by a range of sector stakeholders, mainly with the aim of determining a price for WASH services to ensure financial viability of the service. For a market provider with no access to subsidies, it might mean identifying whether a product or service can be introduced at a price that enables their business to operate. For an NGO or government provider, it might mean identifying whether services at a given price point are affordable and will be demanded by sufficient households to make the service worthwhile. In this latter case, subsidies may be used to support parts of the market to achieve both scale and equity. Indeed, within public-private partnerships, market players can be incentivised to provide services to populations where they are not fully financially viable. Hence, willingness to pay studies have played a vital role for many WASH sector stakeholders in determining their pricing strategy.

Currently there are no routine sources for obtaining willingness to pay data. A systematic review of WTP studies for water in 2012 found a large number of studies but when sorting for quality, found only 5 experimental studies that met the inclusion criteria (Null et al 2012). Some years later, Van Houtven et al (2018) conducted a meta-analysis and found 60 WTP studies on water which could be used for their analysis. However, overall, WTP studies are conducted spontaneously according to the needs of research or implementing organisations acting in isolation, and hence countries cannot rely on them being available for WASH affordability assessments.

A fourth type of study is an assessment of **WASH costs and financing using research methods.** The IRC's WASHCost project was one such study which conducted detailed research in selected communities to understand the full range of costs and financing sources to meet the communities' WASH needs. Similarly, the ESI study mentioned above collected field data on costs for sanitation and hygiene infrastructure. Also, the World Bank's Country Status Overview (in Africa) or Service Delivery Assessment (in Asia) estimated national cost benchmarks for WASH services for estimating the cost of meeting national targets.

A fifth type of study is a **financial analysis at the service provider level,** covering either a single provider or conducting a comparative analysis across service providers. An example of the latter s the World Bank's IBNET which collects data on utility prices and costs, and if utilities consistently report their data, it enables a time series analysis. A Safe Water Network (SWN) study also looked at price and demand changes over time for a small number of rural water service providers in Ghana, thus enabling conclusions about determinants of household demand.[25]

A sixth type of study is a **market assessment.** These can be aggregated at different levels, from a single seller to a national market; hence they can be nationally representative if data collected at the right scale. Some market data are collected routinely both by major suppliers on their own products and by market research agencies who may have major suppliers as clients. Government agencies, either directly or indirectly via a regulator, may also collect data on markets that touch on public policy such as toilet supplies, hygiene products, water treatment chemicals or fecal sludge management.

These six different types of survey or study can be very informative on the full range of WASH expenditures, household WASH behaviours and service or product markets in specific locations, and they can provide a snapshot in the countries where they are conducted. However, these types of survey are the exception rather than the norm and they tend to be conducted infrequently. They have generally been set up to answer immediate time-bound questions rather than providing routine data over time. Data sets are typically owned by the financing and/or implementing partner, and may not be made publicly available. Results are typically published in a report (grey literature) and sometimes in a peer-reviewed journal. Companies who conduct market assessments generally do not make their results publicly available. Therefore, these types of survey or study cannot be relied upon for global monitoring. On the other hand, given their in-depth and unique nature, they can provide a useful snapshot of affordability in some locations, which might or might not be representative of the country at large.

[25] 'Price change and station performance in Ghana.' Safe Water Network. 2017.

4.3 Administrative data and policy surveys

The third category of data source is information that is routinely collected by utilities, other service providers, regulators and local authorities. These data are likely to provide information on some key variables related to affordability such as service access (of customers), service compliance (of providers), prices of goods and services, and expenditures. These data sources include provider databases, policy surveys, and expenditure tracking.

Provider databases are available either through regulatory agencies or self-reporting such as national, regional or global industry associations. Regulatory data has a high likelihood of being accurate, and is likely to improve over time, assuming the regulator has both the resources and the authority (e.g. to impose punitive measures). Self-reported data to industry associations is less likely to be accurate because it is not a regulatory exercise and there is limited validation of submissions. The commitment of service providers to submit regular, quality data to industry associations will vary over time. Presently, the only initiative that provides some potential for global monitoring of affordability is the IBNET, managed by the World Bank. In the benchmarking initiative, IBNET encourages submission of a wide range of key performance indicators on water and wastewater. These include tariffs, average prices, average costs, and monthly cost of a given quantity of water for a single household (lifeline amount of $6m^3$). The reporting utilities are mainly from urban areas. The benchmarking database hit a peak in 2015 when 2,510 utilities covering 630 million people were reporting, although in more recent years there has been a sharp reduction in utilities reporting to the benchmarking database.[26] The tariff database, on the other hand, claims 2,567 utilities are reporting from 211 countries and territories. The database contains tariff structure and rates. These data could be combined with assumptions on consumption rates per household as well as average or poverty incomes per locality to calculate an affordability indicator similar to indicator 2.1, or indicator 2.4 if annualised capital costs are included in the tariff.

Information on other types of tariff, such as tariffs paid to informal WASH service providers or investments made by households in their own installations (such as latrines) are not monitored by any regulators or industry associations. Some studies have sought to estimate the value of these flows, but only at single points in time. Available evidence shows that these flows are likely to be substantial, particularly for sanitation (Tremolet et al 2010). Indeed, Danert and Hutton (2020) argue that the "3T" financing sources (taxes, tariffs and transfers) should be supplemented with HI (as household self-investment), which is commonly omitted from financing tracking initiatives and financial assessments.

Policy surveys provide information about the different measures to make WASH services more affordable to users. The main global sector resource providing such information is UN-Water's biannual Global Level Analysis and Assessment of Sanitation and Drinking-Water (GLAAS). This topic was already discussed in section 3.2.5. The survey consists of a questionnaire to Ministries and global sector donors every 2 years. In the latest 2018/19 round, the GLAAS survey covered 106 countries and 23 donors. For countries, the survey covered legal, regulatory, policy, programming, participation, monitoring and financing aspects. The following are the main relevant questions, though many other questions that explore the WASH sectors performance on efficiency, equity, collaboration and sustainability, which will all directly or indirectly affect WASH services, WASH prices and WASH affordability:

[26] https://database.ib-net.org/DefaultNew.aspx accessed on 5th June 2020.

1. Legal: Does the constitution or other legislation recognize water and sanitation as human rights?
2. Regulatory: To what extent do regulations, standards and regulatory instruments exist for drinking-water and wastewater?
3. Policy: Are policy and planning development processes effective?
4. Policy: What is the national coverage target in each sub-sector?
5. Policy: Is there an affordability target for drinking-water (rural, urban)?
6. Programming: To what extent are there measures to extend services to vulnerable populations in national policies and plans? (9 categories given in form)
7. Participation: Are there clearly defined procedures in laws or policies for participation by service users (e.g. households) and communities and what is the level of participation?
8. Monitoring: Are there clearly defined performance indicators used for equitable coverage?
9. Monitoring: What is the progress towards affordability target for drinking-water (rural, urban)?
10. Monitoring: Is progress in extending and sustaining service provision specifically to the following populations tracked and reported? (9 categories given in form)
11. Financing: If a sector / sub-sector plan exists, has the plan been supported with adequate financing to implement the plan? Are there sufficient human resources to implement the plan?
12. Financing: Are operations and basic maintenance (O&M) covered by tariffs or household contributions?
13. Financing: Are there specific measures in the financing plan to target resources to reduce inequities in access and levels of service and are they being applied for vulnerable groups? (9 categories given in form)
14. Financing: Are there financial schemes to make access to WASH more affordable for vulnerable groups?
15. Financing: Is affordability of WASH services defined in policies or plans (e.g. no more than 2% of median household income)?
16. Financing: Please provide examples of affordability schemes in use and the scope of coverage, including how specific groups are targeted for these schemes.
17. Financing: Going forward, do you estimate that financing from all sources allocated to water/sanitation/hygiene is sufficient to reach national targets?

Affordability and other analyses can usefully draw on GLAAS monitoring data. For example, GLAAS data were used in a recent analysis in Bangladesh which explained how the country had met the national MDG target through household investments in unregulated shallow tubewells (Fisher et al 2020).

Expenditure tracking shows the public funds and ODA allocated to and spent on water and sanitation, and sometimes includes investments made by service providers and contribution of water users. The data for these surveys are typically extracted from administrative systems. Public expenditure reviews (PERs) are an instrument promulgated by the World Bank and used extensively in different sectors of the economy. PERs are a snapshot in time that typically cover the previous 2-3 years. PERs specific to water and sanitation have been conducted in many countries as one-off exercises. Between 2003 and 2009, the World Bank funded 40 PERs in which the water sector featured. A review by van Ginneken et al (2011) covers 15 PERs in water and sanitation for sub-Saharan Africa. PERs present data on where public funding is spent, but they do not indicate accurately which households benefit from subsidies nor the expenditures they make on WASH services.

Since 2012, the UN-Water TrackFin initiative has been implemented by WHO[27] in more than 10 countries, focusing on the WASH sector. The methodology is based on the National Health Accounts and is implemented using a detailed software and data collection instruments. In some countries, household surveys are conducted to capture user contributions. WHO encourages responsible ministries to set up TrackFin units and provide capacity building in order to enable sustained and regular assessments, rather than one-off exercises. Similarly to the PER instrument, TrackFin does not identify which households benefit from subsidies; however, because it can compare public and private spending, it does estimate the proportion of the WASH sector that is subsidized by public spending.

[27] https://www.who.int/water_sanitation_health/monitoring/investments/trackfin/en/

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05 Comparative performance of approaches

Before making recommendations for monitoring of WASH affordability in Chapter 6, this chapters makes a summary assessment of the different approaches to measuring and monitoring affordability against selected criteria to conclude how they perform relative to each other.

5.1 Criteria for assessment

The Expert Group agreed that the indicators and measures for assessing affordability would be assessed against the following criteria:

1. Validity: the degree to which the definition of an indicator has encompassed the three dimensions of affordability, which are (a) the price or cost of WASH services at the household level; (b) the spending power of the household; and (c) the price or cost households incur in meeting other essential needs

- Do proposed indicators or methodologies capture our definitions of affordability, either individually or in combination?
- How can the indicator or generated data be interpreted? Are there benchmarks or thresholds that need to be considered as part of the indicator's design, in order to enable interpretation?

2. Accuracy: the degree to which the data used capture the definition intended.

- What elements of cost are captured or omitted?
- What is the expected quality of data? (e.g. question formulation, procedures for enumerator)
- Is there methodological agreement on additional data analyses or estimations that are conducted? (e.g. unit cost estimation, valuation of saved time)

3. Relevance and uptake: whether an indicator or methodology makes sense or is it acceptable to the stakeholders who are going to use it.

- Can the indicator be explained and understood easily by non-specialists?
- Does the indicator fit with common experience?
- Does the indicator fit with the agendas of key decision makers inside and outside the WASH sector?

4. Feasibility: the ease of estimating an indicator and applying a methodology, including required disaggregation.

- What is the coverage of data at the national level?
- What is the coverage of data at the global level?
- What data are available for sub-national disaggregation or population stratification?
- What further data collection is required to fill data gaps?
- What is the cost of extracting, compiling and analysing data for national or global uses?

These criteria are assessed qualitatively below for each indicator and methodology.

5.2 Expenditure threshold approach

Table 7 summarises the performance of the expenditure threshold approach against the four criteria and sub-questions.

While the threshold approach provides a crude assessment of expenditure relative to income, the utility of this approach for informing policy and programming has been questioned.

One major critique argues that focusing on current expenditure ignores the fact that many or most households do not have the national WASH standard – thus requiring a refocus of the affordability analysis on the costs that need to be paid to achieve that national standard. Hence, WASH expenditure tabulations need to be made by service level. A separate analysis can be made showing required costs to meet the national WASH standard for those currently below the minimum standard.

A second major critique highlights the fact that data on current expenditures are incomplete as many cost categories are omitted from the household questionnaire used in income and expenditure surveys. For some households, especially those not connected to a reliable piped water and wastewater service, this means that the majority of WASH costs might be omitted when answering the WASH expenditure questions found in IES questionnaires. These missing costs could be potentially filled by using standards e.g. for system maintenance at household level, or soap purchases.

Lebanon, 2020
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Table 7.
Performance of the expenditure threshold approach against criteria

CRITERIA AND SUB-CRITERIA	PERFORMANCE
1. Validity	
Dimensions covered	Covers (a) expenditure and (b) spending power of the household
Interpretation	Ratio of WASH expenditure to total expenditure gives a snapshot of different relative costs that different household categories face. A threshold for what is 'unaffordable' is helpful to policy makers to decide which households to support. However, there is currently no agreed threshold value across international agencies or countries; and interpretation is affected by the data issues covered below.
2. Accuracy	
Data completeness	Only partial WASH costs included in common IES 'Monthly expenditure' variable – it therefore ignores some recurrent cost categories and typically omits capital expenditures. Missing costs can be estimated to fill gaps. Time costs can be added onto financial costs in numerator, but not all country surveys have access time for water and none have access time for sanitation.
Data quality	Monthly expenditure more likely to be accurate if household faces regular costs, such as a weekly or monthly bill. Total expenditure is preferred over total income for denominator of the indicator, due to greater inaccuracies in income data.
Methodological agreement	Value of time spent for WASH does not have consensus, and in the literature there have been various sources of value for time: GDP per capita, average wage and minimum wage. Depending on the opportunity cost of time of the household member (e.g. whether it is a child of school age, a productive or non-productive adult, or whether the member is earning an income), anywhere between 15% and 100% of these wage values has been used.
3. Relevance and uptake	
Ease of explaining indicator	WASH expenditure as a percentage of total expenditure is easy to communicate, and already widely used. As no consensus currently exists on how to capture access time values – whether as a separate cost of integrated into financial costs – thus raising questions about how to communicate these costs.
Fit with experience	Many utilities, national decision makers and global agencies already use the expenditure ratio, and thresholds vary between 2% and 6%, while some include only water charges and others include wastewater.
Fit with decision-making	If consensus is reached on which threshold to use nationally or globally, and monthly costs are well captured, then an expenditure ratio approach gives clear guidance for determining an affordability policy and for targeting subsidies to households whose expenditure is likely to exceed the threshold
4. Feasibility	
Data for national monitoring	Income and expenditure surveys are conducted every 3-5 years for most LMICs. WASH expenditure data typically cover partial costs. Utility data sets could be used to reflect those populations, including cost per household for minimum water and wastewater levels, as practiced by IBNET. For 'Required' costs to meet minimum service level, no regularly updated data sets or benchmarks exist in most countries.
Data for global monitoring	At any timepoint, IES data for some countries will be up to date while others will be >3 years old, hence not reflecting current context. IES in some countries include questions on a broader WASH expenditure, which allows additional costs to be included. For 'Required' costs to meet minimum service level, the latest global data set is World Bank's 2016 publication estimating SDG WASH costs (targets 6.1 and 6.2), which needs updating.
Sub-national disaggregation	Most IES allow rural/urban and expenditure decile breakdowns. Other household categorisations are possible (e.g. female head, household size).
Potential to fill data gaps	Standard or benchmark costs can be used to turn partial into full costs. IES unlikely to be conducted more frequently. More detailed cost surveys could be implemented through local initiatives. A future global cost benchmark initiative could fill standardized unit costs for different service levels across a large number of countries.
Cost of extraction/analysis	With an established protocol (see Annex C), extraction and analysis can be conducted in a standard way for global monitoring; more in-depth country reports can be developed with other local studies on WASH expenditure.

Third, the ratio expenditure approach does not take into account other spending commitments a household faces on essential services, which will vary by context and by household. This highlights the need to take a multi-service perspective when measuring affordability, thus requiring that WASH expenditure is not considered in isolation. Other sectors have defined their own frameworks on assessing affordability, such as nutrition (adequate nutritional intake and the food poverty line) and health (what is termed 'catastrophic' health spending which propels a vulnerable household into poverty). A single benchmark ratio defined at the global level might not be desirable, as existing subsidies provided for WASH and non-WASH services differ between countries, as well as within countries.

Fourth, when time costs are added into the numerator of the expenditure ratio, it can significantly increase the ratio, as shown in the case studies (see Annex B). The ratio is increase most of all for those households with the least financial costs, as they are more likely to be accessing free or low-cost service or have no service at all. Hence, including access time costs will need international consensus around the valuation methodology to be more widely applicable.

Fifth, the ratio expenditure approach ignores the financial and economic benefits that flow from higher WASH service levels. There are reports that the 'poor' are willing to pay for 24/7 services as it transforms their lives and provides the time and improved health necessary for children to go to school, and for families to improve their economic situations. Hence households might see the high cost of water as having a high return, which means they are willing to pay the higher cost. Also, improved piped supply might lead to lower expenditure on vendor-supplied water, leading to net cost savings – hence the higher service level could leads to lower costs for poor households.

Sixth, the threshold approach also ignores other aspects of affordability such as whether existing financing from non-household sources is sustainable. For example, can the public sector continue to subsidise services at the same levels, and if not, these O&M costs, and eventually infrastructure replacement costs, might eventually be passed to the household.

5.3 Revealed preferences

Table 8 summarises the performance of the revealed preferences approach against the four criteria and sub-questions. Under some circumstances, revealed preferences can expose affordability issued faced by households, especially when high prices or price increase over time leads to household demand falling below the minimum standard. Both static and dynamic data analyses can enable useful interpretations on affordability. For water, quantity versus price changes can be recorded over time for individual households (if their consumption is metered). Alternatively, absolute water demand levels can be compared across households in different income deciles to assess the extent to which poorer households have suppressed demand. For sanitation, preferences can be revealed through market behaviour of households in one-off purchase decisions of toilets, periodic decisions on pit emptying, or demand for toilet cleaning products or soap.

However, the reasons explaining individual household choices can be hard to assess at the aggregate level, as there are many drivers of household spending decisions. These decisions are made based on an implicit hierarchy of needs and preferences which vary from one household to the next, thus making it hard to conclude whether WASH is truly affordable or unaffordable for a particular household or category of household. Where demand is particularly low for a WASH service, real-life experiments can be conducted to observe whether price reductions lead to significant increases in demand. The results would, however, need to be interpreted taking into account the many factors explaining consumption choices. Also, a distinction needs to be made between short-term changes and long-term equilibrium. For example, consumers might be attracted to purchase a lower cost product to test it out, but after their first experience, they may not demand the product in the longer-term.

Table 8.
Performance of the revealed preference approach against criteria

CRITERIA AND SUB-CRITERIA	PERFORMANCE
1. Validity	
Dimensions covered	Potentially covers (a) expenditure, (b) spending power and (c) other needs of the household
Interpretation	Potentially powerful way of identifying affordability issues for water, when price levels (and price rises) explain water consumption below the minimum service level. No thresholds are needed, but instead determination of relationship between price and demand - and having the data to identify whether rising prices reduce demand for specific population groups. Price changes might have dynamic effects, such as higher prices leading to a decision to fix a leaking pipe, for example. Also, demand may be inelastic because of essential nature of water and lack of other water sources – hence a poor household may have no other choice. For sanitation and hygiene, current demand for products and services would need to be interpreted through willingness and ability to pay.
2. Accuracy	
Data completeness	Assessment focuses on the relationship between price of and demand for a specific good. The relationship needs to be statistically determined, where possible, hence requiring adequate study design and sample size. If it can be assumed that no other variables change during the observation period, a demand/price comparison is sufficient to identify potential affordability issues for WASH.
Data quality	Quality varies by survey methodology applied or data collection method.
3. Relevance and uptake	
Ease of explaining indicator	A statement such as "The increase in water price led to x% of households consuming water below minimum threshold" can be understood, but beyond such a result, most data sets and findings will be more complicated to explain.
Fit with experience	The market for goods, and the relationship between price and demand, is generally well understood.
Fit with decision-making	When demand is weak for a service, the role of prices can be evaluated and recommendations made for price adjustments. However, adjusting prices for a specific segment of the population is challenging to achieve and may have unwanted side-effects.
4. Feasibility	
Data for national monitoring	Absolute levels of demand can be compared with prices in different jurisdictions, collected from utilities or from market data. Demand can be cross tabulated by household characteristic, depending on the data collected by the utility and what other data sets can be overlaid on utility data. Time-series comparisons are less common to assess how demand changes when prices are adjusted – though some opportunities exist to conduct case studies.
Data for global monitoring	No international data sets are available that assess prices with respect to demand, except IBNET benchmarking and tariff data. However, time-series comparisons may be unreliable due to changes in other conditions.
Sub-national stratification	Data obtained from utilities has limited, if any, socio-economic data on households, unless it is overlaid from other municipal data sets. The one exception is when a household has applied for or received a customer assistance program
Potential to fill data gaps	More case studies could be collected from utilities that have changed their prices and enable assessment of the impact on average demand.
Cost of extraction/analysis	Extraction of data sets from IBNET is simple and low cost. Further data collection would require a more significant effort.

5.4 Stated preferences

Table 9 summarises the performance of the stated preferences approach against the four criteria and sub-questions.

There are both strengths and weaknesses of stated preference measures. The stated preference approach potentially covers all three dimensions of affordability – as household opinions expressed in interviews will take into account WASH prices, their income level and other needs. The main advantage of the contingent valuation approach to measuring willingness to pay (WTP) is that it considers household priorities and eventual choices based on their own situation (constraints, opportunities and preferences). For example, it might happen that a household is willing to pay well above a defined affordability 'threshold' because of the social and economic benefits they recognize as resulting from using a better WASH service. Also, the stated preference methodology allows demand for a service to be voiced in cases where households are currently excluded, for example due to non-tenure of land or lack of legal status, where unserviced households might show a high willingness to pay for a service that is provided to other households nearby.

On the other hand, the contingent valuation methodology suffers various problems. Results of studies that have been used for policy making or price-setting have sometimes been shown to be inaccurate or incorrect after more data have been collected on actual market behaviour. Weaknesses can be addressed through implementing larger samples, using better formulated questions and more tailored analyses for the results to be valid.

Direct household responses to questions on WASH affordability have some similarities to the contingent valuation methodology, in that it relies on household subjective assessments. However, it is a simpler, more direct way to assess whether there are affordability constraints. If households are not accessing a WASH service, they can be given a range of reasons why not, among them "we cannot afford to pay for it" or "we do not want to pay for it". Given the limited experience with questions that directly ask households about WASH affordability, it is difficult to conclude how valid they might be. In designing such questions, it would be important to have a broader set of questions which help explain their answers to the questions probing on affordability, such as their perceptions of a desirable service level, their history of WASH services or their perceptions of what the government should do for them. In some countries, citizen committees act on behalf of the regulator to provide potential solutions to citizen complaints. Such platforms could be used to explore these issues.

Table 9.
Performance of the stated preference approach against criteria

CRITERIA AND SUB-CRITERIA	PERFORMANCE
1. Validity	
Dimensions covered	Potentially covers (a) expenditure, (b) spending power and (c) other needs of the household
Interpretation	The answers to consumer surveys give direct indication of whether a WASH service is economically accessible or not, either by comparing willingness to pay with price levels, or through a direct response from households that prices are unaffordable. This approach is a departure from an objective measure of affordability, and results can be quite different from those given by a normative approach (such as an expenditure ratio threshold). Given the inter-household variability, agreeing a single price that benefits the most households is difficult. However, the answers given by respondents can include additional relevant considerations, such as what economic or financial savings may result from WASH.
2. Accuracy	
Data completeness	As questions request the respondent to take into account all relevant costs and their current income levels, it is assumed that the full set of costs and issues are taken into consideration.
Data quality	Critics of stated preference approaches argue that respondents can give answers that do not reflect their actual situation or preferences: (1) expectation that they can gain from the answers they give, for example, that the eventual prices of service might be lower of they indicate low willingness to pay; (2) interviewer bias, by the way questions are framed; and (3) protest answers, either zero or very high, because the respondent wants to spoil the research or not have their answers counted. Hence attention is needed on questionnaire design and interviewer training.
3. Relevance and uptake	
Ease of explaining indicator	Willingness to pay is well understood. However, explaining the difference between objective and subjective measures of affordability can be complicated, and might confuse decision makers.
Fit with experience	Decision makers can relate to the concept of willingness to pay and individual preferences in their own lives.
Fit with decision-making	Given the subjectivity of the approach it might not be correct to determine policy based on a sample of divergent opinions and only subjective responses.
4. Feasibility	
Data for national monitoring	Currently very few data sources provide these data, except for some academic studies in the literature and exercises conducted by water providers. On the latter, data sets are rarely publicly available.
Data for global monitoring	Based on few available national sources, it is not possible to use these indicators for global monitoring.
Sub-national stratification	Existing studies typically collect household characteristics for stratification.
Potential to fill data gaps	It is not worthwhile to implement new surveys for this methodology alone, but questions could be added to existing surveys to gain potentially useful additional information.
Cost of extraction/analysis	It is costly to implement new research with household survey components and large sample sizes (to be nationally representative). However, there is a low marginal cost of adding questions to existing surveys, although additional training may be required for the enumerators.

5.5 Poverty status

Table 10 summarises the performance of the poverty status approach against the four criteria and sub-questions.

The use of poverty lines to define population groups that are least likely to afford WASH is potentially a very neat and simple approach. If a household is poor, they are likely to be the most deserving of assistance to help them achieve or sustain a minimal level of WASH service. The advantage of the poverty line is that it considers other essential needs, and therefore might be seen as most within the spirit of the human rights to safe drinking water and sanitation. However, the weaknesses of how poor households are identified might lead to a mis-categorization of households as poor that are non-poor, or of non-poor households that are poor (see Chapter 3.2.4). One problem of defining households by their poverty status is that poverty lines are typically set at national level and are thus a blunt instrument for deciding if a specific household in a specific neighbourhood can or should pay the full price of a WASH service that meets the national minimum standard.

Furthermore, the response to unaffordable WASH prices should be coordinated with the multi-sectoral response to addressing poverty. It is also unclear how households would be dealt with that are 'near poor' or at risk of being poor from shocks. Indeed, making such households pay for costlier WASH services might itself put them into poverty.

Table 10.
Performance of the poverty status approach against criteria

CRITERIA AND SUB-CRITERIA	PERFORMANCE
1. Validity	
Dimensions covered	Potentially covers (a) expenditure, (b) spending power and (c) other needs of the household
Interpretation	Rather than invent new thresholds, an approach that incorporates poverty status can use existing poverty thresholds, such as those defined as 'poor' and 'extremely poor'. Whether additional subsidies should be targeted to the poor depends on what social protection measures have already been implemented. As poor households are more likely to have a WASH service level below the minimum standard, targeted subsidies to poor households to afford movements up the WASH ladder makes good policy sense.
2. Accuracy	
Data completeness	Poverty assessments can be conducted using IES, hence enabling cross-tabulations with levels of WASH expenditure.
Data quality	The methods for poverty assessment are long-established and have been improved over time. However, the measure can be blunt in some circumstances, depending on how the poverty definition deals with savings, wealth or capital tied up in livestock or land.
3. Relevance and uptake	
Ease of explaining indicator	Using poor versus non-poor in relation to WASH expansion should make sense to decision makers, as it is an established approach.
Fit with experience	Identifying the poor as deserving of further social protection measures fits closely with experience.
Fit with decision-making	It is easy to channel further subsidies based on poverty status as an established mechanism exists in most countries.
4. Feasibility	
Data for national monitoring	Poverty data are widely available and used.
Data for global monitoring	Poverty data are widely available and used.
Sub-national stratification	Survey sources enable multiple types of stratification.
Potential to fill data gaps	No or few data gaps to fill.
Cost of extraction/analysis	Minimal cost as data can be easily cross tabulated using existing surveys.

5.6 Enabling environment responses to affordability

Table 11 summarises the performance of the enabling environment indicators against the four criteria and sub-questions. Given these indicators cover different aspects of the response to the affordability issue, the performance against criteria will vary from one indicator to the next. Overall, these indicators are predictive of whether services are likely to be affordable based legal on frameworks, policies, programming approaches, market attributes, monitoring, financing mechanisms and flows, rates of water disconnection, and bill collection rates. However, these indicators say little about the prices paid and their actual affordability. For this reason, they will not themselves be sufficient, but rather they will provide important additional data for a fuller interpretation of other affordability indicators. They will also help guide the appropriate responses based on what is already being done to improve affordability.

The picture of WASH affordability is therefore not complete without inclusion of indicators of what measures are being taken – or could be taken – to make WASH more affordable. Indeed, some of these indicators will help explain the contents of the numerator or the denominator, which are affected by different forms of subsidy and household income supplementation, respectively. Therefore, there will be an interplay between the enabling environment indicators and the expenditure-based affordability indicators. For example, poor households might find a basic WASH service affordable exactly because there is a policy that ensures WASH subsidies are received by poor households.

Given the large number of indicators, it is necessary to place them together and view them from different angles to enable a correct and overall interpretation. Brief assessments were conducted in the country case studies, synthesised in Annex B and available as separate country reports. There is therefore no prior experience of a comprehensive analysis of these indicators, hence a more in-depth approach needs to be developed and further case studies documented.

In addition to household affordability, policy analyses cannot ignore that WASH costs have to be paid from one of the 3 Ts (tariffs, transfers, taxes). Hence, an exploration is needed of how to link household affordability with broader issues of societal affordability, taking into account the full production costs and sustainability considerations (i.e. where water pricing takes into account long-term water availability).

Table 11.
Performance of the enabling environment indicators against criteria

CRITERIA AND SUB-CRITERIA	PERFORMANCE
1. Validity	
Dimensions covered	Includes indicators which are predictive of the extent to which poor and vulnerable households are given specific consideration in paying the price of WASH services, hence implicitly covering dimensions (a) WASH expenditure and (b) spending power. No WASH sector instruments currently include questions on other needs of the household, though this could be gathered from other sources.
Thresholds required	Most enabling environment indicators have yes/no responses. Few indicators are expressed as a percentage value.
2. Accuracy	
Data completeness	In the GLAAS survey, some countries omit to fill in some questions if they cannot easily answer them.
Data quality	The GLAAS survey is typically filled through a sector consultation and is checked for consistency by the GLAAS team.
3. Relevance and uptake	
Ease of explaining indicator	Overall, the enabling environment indicators are simple to explain, even though no single indicator will indicate affordability or not.
Fit with experience	Overall, the enabling environment indicators typically fit with experience.
Fit with decision-making	Overall, the enabling environment indicators are designed to be relevant for decision makers, with a clear pathway to making WASH services more affordable.
4. Feasibility	
Data for national monitoring	In the most recent round, GLAAS was completed by 115 countries and territories (mainly low- and middle-income countries).
Data for global monitoring	GLAAS is completed by a sufficient number of countries for global monitoring.
Sub-national stratification	Current data sets are national, with disaggregation by sub-sector. Specific questions focus on how different population groups are dealt with, which enables some stratification.
Potential to fill data gaps	Future GLAAS surveys can be adjusted to include additional affordability indicators, e.g. disconnection rates, market attributes for poor people such as competitiveness and access, and availability of affordable loans
Cost of extraction/analysis	Global data sets are available for all countries in a single file and hence cross-country summaries are easily tabulated. Building narratives based on the data requires more resources to analyse the data for single countries and triangulate with results of other affordability assessments. As GLAAS surveys have evolved and changed over time, analysis of time-series would require more resources to complete.

06 Conclusions and recommendations

This synthesis report has shown the many opportunities as well as constraints to measuring and monitoring the affordability of water, sanitation and hygiene. Given the current data sets, it will be challenging to monitor affordability at the global level in any broad sense, using the identified approaches and methodologies. That said, there are several avenues to pursue in analysing existing data sets which can uncover issues of (un)affordability in a significant number of countries globally, both high income and low- and middle-income countries. The six country case studies, summarised in Annex B, indicate some of the affordability issues that can be identified with current evidence. If similar studies were conducted in a sufficient number of countries from different world regions, then a global picture would emerge. As with all endeavours, the funding available for affordability monitoring will determine the scope and precision of the findings. This chapter provides both overall conclusions and recommendations for monitoring of affordability at global and at national levels.

6.1 Global level monitoring

6.1.1 Conclusions

Several alternative angles have been explored in this report for understanding whether households are able to afford WASH – though most of these examine relative affordability (on a sliding scale) as opposed to absolute affordability (affordable versus not affordable). The latter can only be determined using the expenditure threshold approach when affordability thresholds are introduced, which until now have been arbitrary values between around 3% and 6% of household income. Alternatively, application of the poverty line can identify households likely to find higher levels of WASH services unaffordable; and also subjective assessments of affordability can be made when households are asked directly whether they can afford WASH services or not.

Returning to the three dimensions of affordability introduced in section 2.2, the first two are the most critical to capture:

1. What people are either (a) currently paying, or (b) would pay for (at least) the minimum service level.

2. How this compares to either (a) their total income or expenditure, or (b) their disposable income.

Data on these variables are available from nationally representative income and expenditure surveys which are conducted every 3 to 5 years in a significant number of countries globally, although cost data rarely cover all components of WASH covered in Chapter 3.2.1 (see Table 2 and Figure 2).

Cost data are also available from the World Bank's IBNET utility database, which gives a snapshot of utility performance indicators and tariffs in selected countries and jurisdictions whose utilities (or regulators) have submitted data. However, the benchmarking and tariff databases are currently far from complete for global monitoring purposes, and they cover mainly urban areas.

The third dimension of affordability – what households have to pay for other essential services – is important to understand what resources households have remaining for WASH expenditure. In a multi-country assessment of affordability, it would be difficult to use a single threshold value to accurately assess affordability in a range of different contexts, given the differences in other essential services provided or supported by welfare states.

As proposed in Chapter 3.2.1, it might be possible to account for this third dimension in the disposable income calculation, by subtracting benchmark values for other essential costs such as food, housing, education and medical costs. However, any estimates of these costs would need to be aligned with affordability initiatives from those sectors, giving a cost estimation for an

essential basket of goods. Given the considerable inter-household variability in household composition (total members, their age and their health status), as well as property ownership, it becomes a very complicated exercise. Hence, for now, it is easier to make an affordability judgement based on total expenditure as the denominator.

6.1.2 Recommendations

Recommendation 1. Strengthen data sets and data analyses of income and expenditure surveys

1.

Existing income and expenditure surveys that are nationally representative provide the richest and most expansive data sets available on WASH as well as total expenditures. Cost estimates can also be made for meeting service gaps and bringing all households to (at least) a minimum WASH service level defined either by national standards or the SDG targets 6.1 and 6.2 indicators. In the future, these data sets can be supplemented by (a) more questions in national income and expenditure surveys to enable better capture of a wider range of WASH expenditures; and (b) tailored WASH expenditure surveys conducted in localities where WASH services are likely to be challenging for populations to afford.

2.

Using nationally representative income and expenditure surveys, the monthly/annual costs of water and wastewater services should be extracted and tabulated:

a. By rural-urban area,

b. By decile and other socio-economic markers, and

c. By service level (piped, non-piped basic, below basic, no service; and degree of seasonality in service).

Sudan, February 16, 2014
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While imperfect, these surveys are the most available ones and can therefore be used as a foundation for WASH cost data which can be built on. Data gaps to fill include: the costs of non-piped services that might vary from month to month; other costs such as hygiene and sanitation services which are usually omitted from these surveys; and the value of access time for both water and sanitation. Questions might cover water access and water prices in different seasons (e.g. wet and dry season), where there is seasonal variation (as is already done for water source in some DHS and MICS surveys). Given that not all surveys are publicly available, any global monitoring effort would need to obtain permission from all countries for the use of their data sets.

3.

Additional tabulations should be made incorporating imputed costs of access time. Distance or time to water source is captured in some income and expenditure surveys. In the absence of these data, average access distance or time data can be extracted from DHS or MICS surveys and combined with income and expenditure surveys based on the water source. Sanitation access time can be added to the time cost calculations, if data exist for a country or else data can be extrapolated from other countries. Transparency is needed on assumptions made (e.g. number of journeys per day) and time valuation, and sensitivity analysis should be used. Number of hours spent by households collecting water can be compared with total household time budget, thus avoiding the pitfalls of valuing time in monetary units.

4.

To know what each country needs to plan in order to meet national WASH targets, the required unit costs of WASH services should be estimated for different service levels, covering basic, piped, and safely managed services (see Recommendation 2 below). When based on real data, the context should be described to assess whether it has country-wide relevance and whether it is a sustainable and climate-resilient service. For example, if the current tariff does not reflect the full water production cost or wastewater treatment cost, upward adjustments are needed. Efforts should be made to estimate national averages; if there is significant sub-national variation, high and low values can be used to show the potential range in the costs of WASH services to households. As this analysis involves combining different data sources, it is possible to estimate both capital and O&M costs. Separate analysis can be conducted on the affordability of upfront capital costs, given these are commonly the costs which are least affordable to poor households. Also, if a country plans to use public funds to pay a share of the capital or operational costs, the service costs can be adjusted downwards to reflect what households themselves are likely to pay.

5.

To estimate the WASH expenditure ratios, the WASH expenditures extracted from IES should be compared with the total income or expenditure of households. For households that need to increase their service level to meet the minimum service, the costs of achieving it should also be added, as demonstrated in Annex B.

Uganda, October 23, 2019
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6.

To strengthen WASH expenditure data in the future, a first task will be to develop a list of expanded WASH expenditure questions for future household surveys. Given the space limitation in national household surveys, it will be necessary to prioritise and shortlist the expenditure items that capture the main costs items in a majority of settings. In particular, it will be important to capture the WASH costs of non-utility service providers and household self-investment, as argued by Danert and Hutton (2020). This means capturing lumpy expenditures over 12 months prior to the survey (which is often the maximum recall time in an expenditure survey), taking into account that prices, quantities and sources might vary over a single year period. In addition, capital items need to be better captured in terms of their value, their expected duration and how often they are renovated or replaced. When reviewing the core and expanded questions to measure WASH affordability, there is an opportunity to better capture water needs and expenditures for non-domestic uses, given their importance in the economy of households, especially in rural areas. Published studies on the costs of coping with WASH expenditure (e.g. Gurung et al 2017; Cook et al 2016) can be used to further explore different aspects of WASH affordability.

Recommendation 2. Build and strengthen global databases of WASH tariffs and costs

7.

Aside from income and expenditure surveys to collect cost data, there already exists a range of data sources on the costs of providing WASH services. These include the World Bank's IBNET global utility data base with data on performance and tariffs, academic papers, data sets and reports from development agencies and academic institutions, and engineering departments of relevant ministries in countries. However, these studies and data sets are found in many different places and there is no platform consolidating them. Also, studies and data sets reference different service levels or are provided in different units of measurement (e.g. cost per infrastructure, cost per household, cost per capita). Furthermore, cost data quickly become outdated given the high rates of inflation and technology change in many countries. It is therefore recommended to create a common database which collects and compiles cost data from all these sources in a standard format, which can be used to assess the cost and affordability of service expansion and improvement in many countries simultaneously.

8.

From the IBNET global utility data base, it is recommended to extract and tabulate selected performance indicators. These can be averaged across all participating utilities for each country for data submitted in the previous 3 years. Variables of particular interest are (a) cost per cubic metre of water and wastewater, (b) cost per month per household for a lifeline amount of water (6 m^3), and (c) monthly cost as percentage of median wage. It is also interesting to assess the financial viability of a utility, such as a comparison of average costs with average revenues. However, the number of utilities submitting data to the IBNET benchmarking platform is currently in decline, and many utilities who submit data do not submit for every year. The gap is even greater for utilities in low-income countries. IBNET therefore does not – at present – provide a reliable option for global monitoring of affordability. Case studies can be made for selected utilities that have submitted their data, as illustrative of the prices faced by their customers. Hence, any future affordability initiative might promote the submission of complete data regularly to the IBNET platform, as it provides a standard and credible platform for monitoring prices and affordability in a large number of utilities simultaneously. The data submitted can also be used by national governments, local governments and regulators alike.

Recommendation 3. Strengthen the use of the UN-Water GLAAS survey to collect and analyse policy indicators relevant for affordability assessment

9.

The GLAAS survey has considerable value as a tool for global monitoring on the status of the enabling environment across more than 100 countries. Many of the indicators collected by the survey are of relevance to affordability, and when triangulated with WASH expenditure data it is possible to develop a fuller understanding of whether policy responses are improving affordability and/or which new policy measures might improve future affordability.

10.

Some indicators collected by GLAAS have direct relevance, such as the setting of an affordability target for drinking-water, or whether affordability schemes exist for vulnerable groups. Others have indirect relevance, such as the availability of public funds and the degree to which the sector finances are likely to meet the national coverage targets.

11.

Further assessment will be possible on how indicators perform in terms of validity and country response rate, in order to make recommendations for improved indicators in future cycles of the GLAAS survey. The reporting of some indicators needs to be improved, such as whether the affordability of WASH services has been defined in policies or plans (e.g. no more than 2% of median household income), or whether progress towards affordability target for drinking-water is monitored. In addition, deeper insights are needed into how national policies are implemented at sub-national level, as it will vary at different administrative levels and by different service providers. Additional questions could be added to the GLAAS survey on water disconnection rates, market attributes for poor people such as competitiveness and access, and availability of affordable loans.

Recommendation 4. Reach a broad consensus on the setting of a threshold or range for an affordable WASH service, preferably with reference to broader poverty assessments and affordability of other essential goods and services

12.

Given different international agencies, governments and utilities are using different thresholds, it is important to try and reach a consensus on how to set and use affordability thresholds in the future. First, it is recommended to review the issues and determinants of an affordability threshold while enabling national and local authorities to adapt the thresholds to their context. International agencies might use affordability 'bands' rather than point estimates. Different thresholds should be explored for water alone, water and sanitation together, and WASH as a whole.

13.

A threshold value that only considers the costs of WASH services risks leading to overly simplistic proposals which might be poorly applied in country settings – for example, concluding that WASH services are affordable when they are not. It will be necessary to engage in the discusion a range of players from other sectors or fields who have different perspectives and interests.

14.

It is therefore recommended to constitute a cross-sectoral panel to discuss the threshold value and find consensus on questions such as whether affordability thresholds should be used in different sectors, and how to interpret the expenditure data and affordability indicators. It may indeed not be desirable to set a single global affordability threshold, given the contextual factors and variability in cost components captured by different data sets.

Guinea-Bissau, January 16, 2020
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6.2 National (and sub-national) level monitoring

6.2.1 Conclusions

The six national studies conducted and summarized in Annex B have demonstrated what standard analyses might be possible for a larger number of countries. These analyses can be extended by drawing on additional studies and data sets to enable a better interpretation of the findings. Indeed, one of the main purposes of the global analyses is to highlight potential affordability issues that need further analyses to explore and propose solutions. A country-level assessment of affordability has the flexibility to draw on a variety of available data sets and partner experiences. It can also collect other relevant data from service providers or populations through additional surveys. The presentation of findings to sector partners and experts can lead to a rich discussion on the validity of the results and the missing pieces, and to inform the policy and programmatic responses. Any such deeper or enhanced assessment of affordability can, in turn, be used to inform the global assessment.

6.2.2 Recommendations

At national and sub-national level, considerably more options are available for assessing affordability, and for combining such analyses with well formulated responses where lack of affordability is identified.

Recommendation 5. Conduct more in-depth country case studies to explore how WASH affordability can be better understood using available data sets, contributing to the implementation of enhanced national policies

15.

The 6 country case studies in Annex B and their individual reports can be used to further the policy dialogue in these and other countries, leading to better understanding of affordability issues among government stakeholders and in-country partners. Further quantitative and qualitative analyses can be conducted where data permit, and different surveys may be triangulated (e.g. IES, DHS, MICS) and gaps filled. More fine-tuned local interpretations are possible, based on locally defined poverty lines, location-specific average incomes and existing levels of subsidy. This requires a mapping of these variables on the expenditure data and other data tabulation provided by the various affordability analyses. This level of analysis could be called a country assessment type 1.

16.

Other case studies can be sought based on the availability of sub-national or small area data sets that have significant potential to make conclusions about WASH affordability. This may include slum or district surveys conducted by government or partners, or expenditure data from specific utilities or groups of utilities (e.g. as available from IBNET). For example, initial case studies on WASH affordability for utilities that have submitted data to IBNET could generate interest among stakeholders and become the foundation for broader analyses encompassing more utilities. This level of analysis could be called a country assessment type 2.

17.

When there is local interest in exploring WASH affordability further, additional surveys may be implemented that contain a fuller set of questions that cover a broader range of affordability dimensions or indicators. It is important to define a minimum and extended set of questions to capture WASH costs more fully and other essential needs and their costs, and (socio-economic) disaggregations, which allow more precise conclusions. This might include implementing a cost benchmark initiative at sub-national level, to account for within-country variations in both capital and O&M costs

18.

The lessons learned can be fed back into the global dialogue on WASH affordability and lead to fine-tuned recommendations for global monitoring.

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Annex A: Affordability definitions for different basic needs

Adequate housing

"Personal or household financial costs associated with housing should be at such a level that the attainment and satisfaction of other basic needs are not threatened or compromised. Steps should be taken by States parties to ensure that the percentage of housing-related costs is, in general, commensurate with income levels. States parties should establish housing subsidies for those unable to obtain affordable housing, as well as forms and levels of housing finance which adequately reflect housing needs. In accordance with the principle of affordability, tenants should be protected by appropriate means against unreasonable rent levels or rent increases. In societies where natural materials constitute the chief sources of building materials for housing, steps should be taken by States parties to ensure the availability of such materials."

Adequate food

"Economic accessibility means that food must be affordable. Individuals should be able to afford food for an adequate diet without compromising on any other basic needs, such as school fees, medicines or rent. For example, the affordability of food can be guaranteed by ensuring that the minimum wage or social security benefit is sufficient to meet the cost of nutritious food and other basic needs." (Human Rights Council Resolution 7/14. The right to food)

Highest attainable standard of health

"Economic accessibility (affordability): health facilities, goods and services must be affordable for all. Payment for health-care services, as well as services related to the underlying determinants of health, has to be based on the principle of equity, ensuring that these services, whether privately or publicly provided, are affordable for all, including socially disadvantaged groups. Equity demands that poorer households should not be disproportionately burdened with health expenses as compared to richer households."

Water

"Economic accessibility: Water, and water facilities and services, must be affordable for all. The direct and indirect costs and charges associated with securing water must be affordable, and must not compromise or threaten the realization of other Covenant rights."

"To ensure that water is affordable, States Parties must adopt the necessary measures that may include, inter alia: (a) use of a range of appropriate low-cost techniques and technologies; (b) appropriate pricing policies such as free or low-cost water; and (c) income supplements. Any payment for water services has to be based on the principle of equity, ensuring that these services, whether privately or publicly provided, are affordable for all, including socially 276 disadvantaged groups. Equity demands that poorer households should not be disproportionately burdened with water expenses as compared to richer households."

Mali, 2020
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Annex B: Findings from six country case studies

B1. WASH coverage and expenditures

B1.1 Introduction

This Annex presents a comprehensive assessment of an exhaustive list of affordability indicators, to better understand how each performs and what is their potential for national and global monitoring of WASH affordability. In order to assess our affordability indicators, we have applied them to six different countries, including Ghana, Mexico, Uganda, Pakistan, Cambodia and Zambia.

B1.2 Data availability

Basic information on WASH access levels at the national level and relevant stratifications, such as residency in rural or urban areas, are needed in order to assess quality of access and equity. While not essential in every case for estimating affordability indicators, these datasets are valuable for setting the context and interpreting the findings of any exercise which includes the estimation of an affordability indicator. In addition, estimating affordability indicators based on the ratio of WASH expenditure over some measure of household spending power requires WASH expenditure data, and overall household expenditure data. The most common sources of these data come from national survey exercises that include WASH expenditure data, WASH access data as well as total household expenditure estimates. Therefore, we will explore access levels, equity of access, and the availability of expenditure data (for WASH access as well as total expenditures) in all six countries included in this report. This exercise will also outline the availability of data in each of these categories, and some brief recommendations on future data collection efforts.

All data for access, equity and expenditures are from publicly available, household surveys, conducted at the national level, using a representative sample. These datasets are the Cambodia Socio-Economic Survey 2015 (CSES); Pakistan's Household Integrated Economic Survey / a Household Integrated Income and Consumption Survey 2015-16 (HIES/HIICS); Zambia's Living Conditions Monitoring Survey 2015 (LCMS); the Uganda National Panel Survey 2015/2016 (UNPS); Mexico's 'National Survey of Income and Expenses of Homes' 2016 (ENIGH); and Ghana's Living Standards Survey 6 – 2014 (GLSS6). All these surveys collected data on household access to water and sanitation but did not collect data on access to handwashing facilities. In addition, these datasets collected data on total household expenditures and any on-going expenditures for water, including monthly bills, maintenance expenses or consumables purchased. Although information on savings and debt was not collected (and therefore household income was not estimated), they all had the data necessary for creating deciles of total household expenditure, as well as categorizations of either 'rural' or 'urban' for all households, which were used to explore equity in the context of affordability.

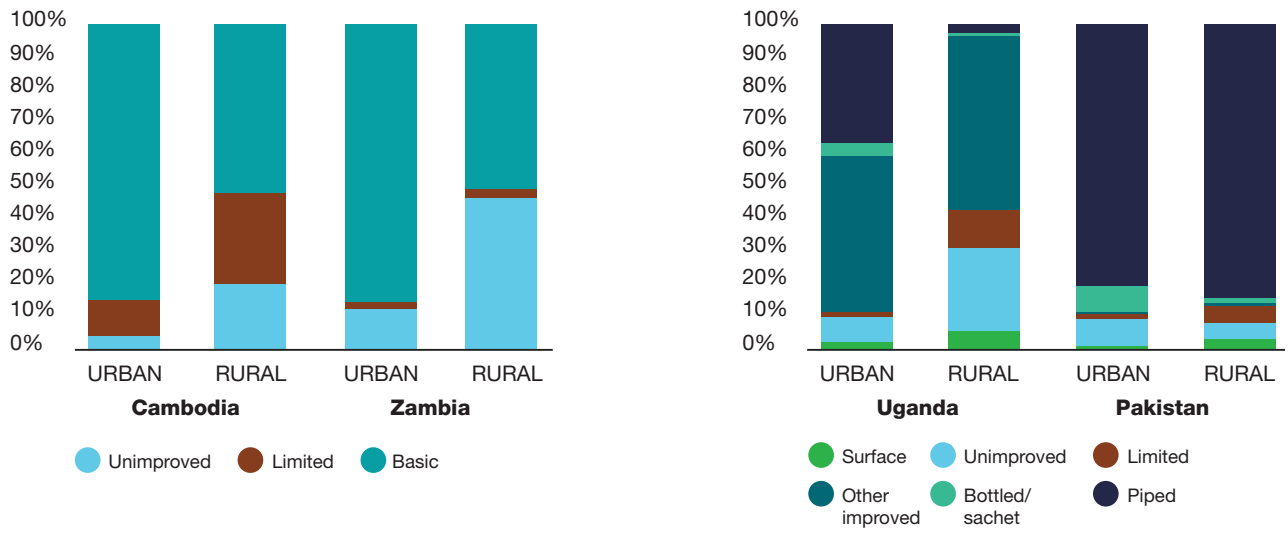
Cambodia, Uganda, Ghana and Pakistan collected estimates on time expenditure for water collection, but in different ways. Zambia collected distance between the house and the primary water source, but in order to use this in some of our indicators we would need the average walking speed, which was not available for Zambia. In the Uganda survey, total time for water collection over a 7-day period per household member was asked. Mexico collected information on the time spent collecting either water or firewood: since this data cannot be segregated by activity, it too is not useful for our purposes. As an example, we calculated the monetary value of time expenditures associated with collecting water for Ghana only; this allowed us to add time costs to monetary costs, as required for indicators 2.2, 2.5, 3.2 and 3.5.

B1.3 Water access

We chose four different stratifications for this report, in order to include equity as a core dimension along which affordability is tracked and understood. These stratifications included (i) the rural-urban divide; (ii) deciles of total household expenditure (a proxy for household income levels); (iii) the types of WASH access and (iv) the levels of WASH access (as per JMP ladder). These stratifications were used individually and in combination. Universal availability was an important criterion for selection of these stratifications; other stratifications that are more relevant within certain countries might be useful in other contexts.

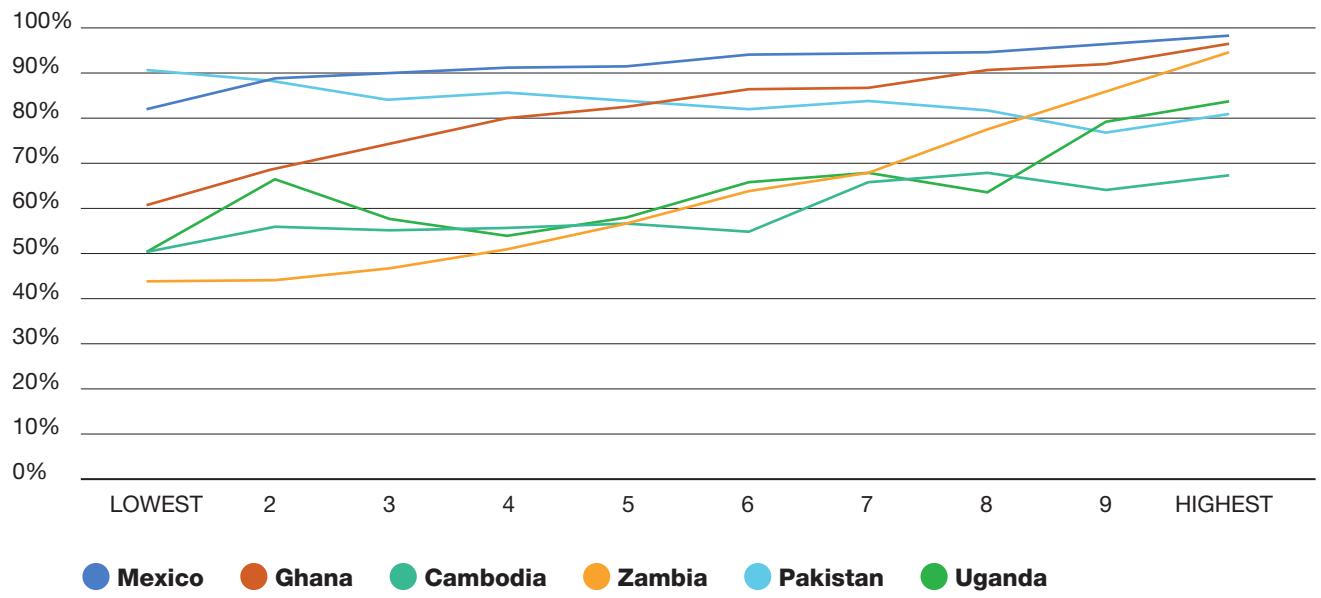
Figure B1 shows how households get their drinking water in urban and rural areas for Cambodia, Zambia, Uganda and Pakistan. Access in Cambodia and Zambia are shown across the levels included in the JMP ladder of water access; this was the most simple characterization of access that we used. Access in Uganda and Pakistan was further broken-down; unimproved was disaggregated into surface water and other unimproved, while basic access was broken down into bottle/sachet, piped and other improved. Both sets of categorizations for access are useful for setting the national context, and also showing inequities in access, without requiring income proxies.

Figure B1.
Coverage of water services in rural and urban areas of Cambodia, Zambia, Uganda and Pakistan



In Figure B2, basic water access levels for each decile of total household expenditure shows the relationship between spending power and access in Mexico, Cambodia, Zambia, Pakistan, Uganda and Ghana. As can be seen, the inequities increase with lower per capita GDP for Mexico, Zambia and Ghana, as would be expected, while the correlation is much less strong in Cambodia. Whether inequities in access are expressed by strata of spending power or across the rural-urban divide, understanding affordability requires first understanding access levels and inequities in access.

Figure B2.
Coverage of Basic WASH services in Ghana, Cambodia, Zambia, Pakistan, Uganda and Mexico.



Cambodia

In Cambodia there is a wide gap in access between urban and rural areas. In 2015, the gap between rural and urban coverage for basic water access was 32%, and for basic sanitation it was 40%. Limited water sources were used by 11% of households in urban areas, and by 28% of households in rural areas; high proportions relative to other countries. Shared sanitation facilities were far less common; only 3% in urban areas and 5% in rural areas (see Figure B1). Access to WASH was mediated by household income levels (as proxied by total household expenditure), but the effect was much more pronounced for sanitation than for water. The difference in coverage to basic water access between the lowest and the highest deciles of total expenditure was 16% (see Figure B2); but the difference in coverage to basic sanitation access between the lowest and highest deciles of total expenditure was 44%.

Ghana

In 2013, coverage of basic water access was 84% on average across all of Ghana. Coverage of basic water was 96% in urban areas, but it was 28% lower in rural areas. Safely managed water supply was available in less than 10% of rural households in 2015, compared to 44% in urban areas. Nationally, basic sanitation coverage was very low, at 14%, with not much difference in urban and rural areas, which were 16% and

11%, respectively. Water access was clearly moderated by income levels, as only 60% of households in the lowest decile of total expenditure had basic water access, while the same level of access was enjoyed by 94% of households in the highest decile. Sanitation access was also moderated by income, but it was relatively across all households: in the lowest decile, only 9% had access to basic sanitation, while in the highest decile this was raised to only 24% of households.

Mexico

In 2016, coverage of basic water was 92% on average across all of Mexico. Basic water access was 97% in the highest decile of total expenditure; although still relatively high by global standards, this coverage was 15% lower in the lowest decile (see Figure B2). This shows that further work is needed, but that basic services are accessible for a large majority of households, in all wealth categories. Some tabulations could not be made for Mexico because there was no binary rural/urban location identifier for each household; and also the time expenditure data available included both water collection and firewood collection, and not water collection specifically.

Pakistan

In 2015/2016, coverage of basic water was very similar in rural and urban areas; 86% in the former and 89% in the latter. Basic sanitation access was much lower though; only 64% nationally. Likewise, roughly 90% of the country spent 15 minutes or less collecting their water, each trip. The average time spent per day accessing water from different sources varied considerably; surface water and other unimproved sources had a larger time expenditure than piped sources or other types of basic access. Surprisingly, richer households, on average, spent more time waiting and collecting their water than did poorer households; 20% of the households from the richest decile of total expenditure spent more than 15 minutes waiting and collecting their water, while the same was true for only 6% of the households in the poorest decile.

Uganda

In 2015/2016, coverage of basic water was 31% lower in rural than in urban areas while for basic sanitation the national coverage was very low at 19%. A small number of urban dwellers (1%) were spending more than 30 minutes fetching water from an improved source, but this proportion grows to 12% in rural areas. The average time spent per day accessing water from different sources did not vary considerably. While time expenditures for piped water or bottled/sachet water were negligible, the average time expenditure for other sources did not vary much. These other improved sources, and unimproved sources, required around 15 minutes total time collection per day in urban areas and nearly double that in rural areas, on average.

Zambia

In 2015, coverage of basic water was 23% lower in rural than in urban areas (see Figure 1). For households in rural areas using a piped water source the average distance was 2.4 kilometers; this was substantially more than the distance to other sources. The average distance traveled accessing water varied considerably between different sources in rural areas. The distance traveled in urban areas, for all types of sources was much less than the distances in rural areas. For basic sanitation the coverage in rural areas was very low at 11%, although most households in rural areas had at least limited access. There is a strong correlation between income (as proxied here by total household expenditure) and access (see Figure B2), for both water and sanitation. For the lowest decile of total expenditure, only 45% have access to basic water sources, and only 5% have access to basic sanitation, whereas for the highest decile these figures are 86% and 82% respectively.

B1.4 Linkages between reliability, resilience and affordability,

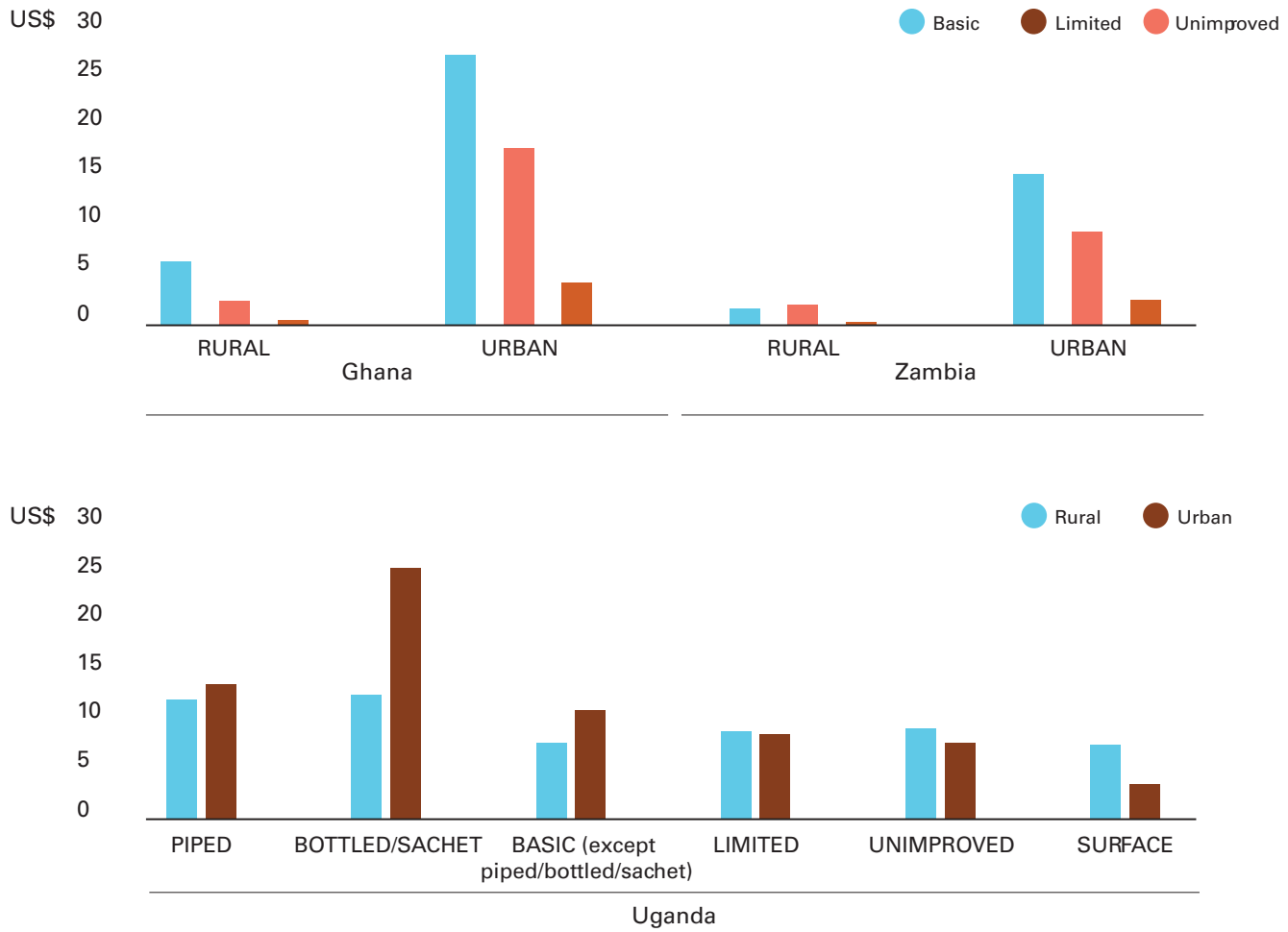
Affordability is an important first step towards breaking down the determinants of access. Reliability and resilience are also important factors determining WASH access over time. Here we use reliability to mean consistency of supplies hour to hour, day to day and week to week. Reliability might shift seasonally but it is a baseline level of likelihood that water will be there when needed. Resilience is the ability to maintain the current reliability after a major shock; for example, an earthquake, a climate incident, a broken pump or an economic recession. Just like the minimum acceptable access level must be defined in any affordability indicator in order to ensure that such indicators do not encourage a back-sliding in access, the same danger exists for maintaining the resilience and reliability of access as well.

For example, if the water utility operator in Accra reduces volumetric tariffs for piped water access, this will increase affordability and might also increase access. If the tariffs were reduced through subsidy, then this tariff reduction will not contribute to any change in reliability or resilience. But if the loss in revenues lead directly to insufficient funds for operations or maintenance, then this could lead to decreased reliability and resilience. In this scenario, an increase in affordability will have been due to a decrease in reliability and resilience, perhaps an undesirable outcome. At the same time, resilience might decrease over time, simply due to the changing climate; in order to maintain resilient supplies, in the face of climate change, more investments will be needed in many countries around the world. Where these investments are passed on to households in the form of increased prices and tariffs, affordability will decrease. Thus, affordability is not just linked to access type and quality, but also linked to reliability and resilience, and could be impacted by climate shifts. Unpacking these relationships is an important part of designing and assessing affordability indicators.

B1.5 Household monetary expenditures on WASH

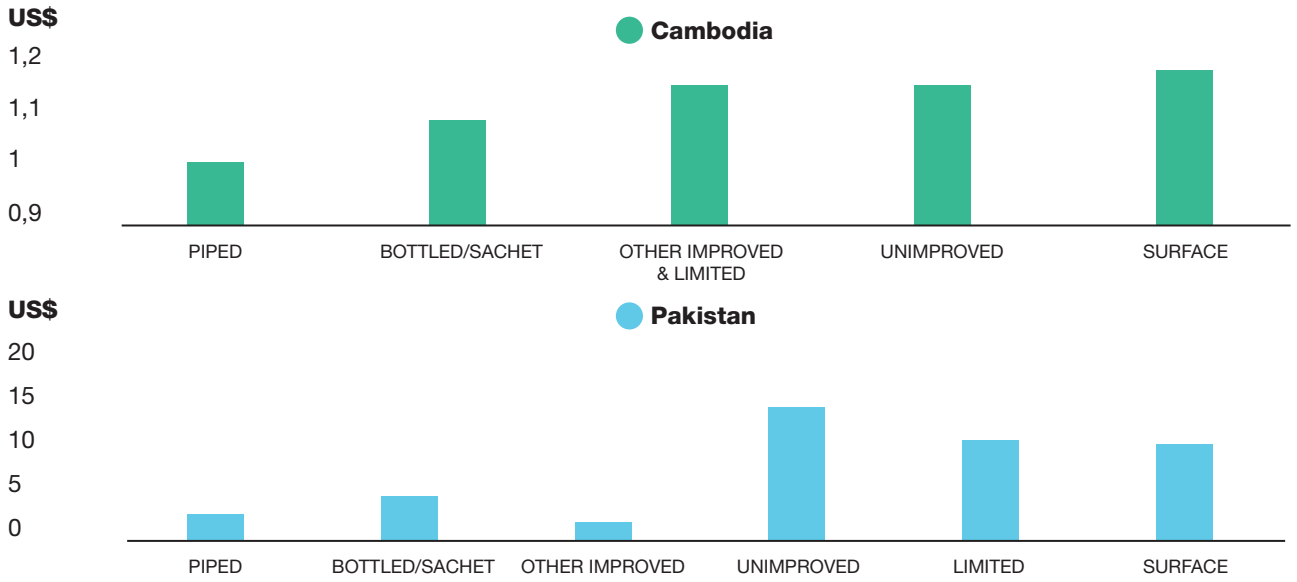
When water sources are categorized by level of service, there are clear differences in household cost between sources achieving a basic level of service versus limited or unimproved service (Figure B3). In Ghana, a basic service costs approximately US$ 23 (GHS 110) per person per year, while a limited service is about one third the cost. Limited access points might cost less either due to changes in quantity or quality; the mix of sources included in 'limited access' might be less expensive access types, such as public wells; but it might also indicate that households with more limited access are more likely to share their access points with multiple households, might also be collecting a lesser quantity of water. Most likely, it is a combination of both factors that leads to lower average costs. Rural households in Uganda, Zambia and Ghana spent less than urban households, for all levels of water access (see Figure B3). But in Cambodia, urban households spend less, on average, than rural households, for all levels of access.

Figure B3.
Annual per capita expenditures on WASH O&M, in rural and urban areas of Ghana, Zambia and Uganda (converted to 2019 USD)



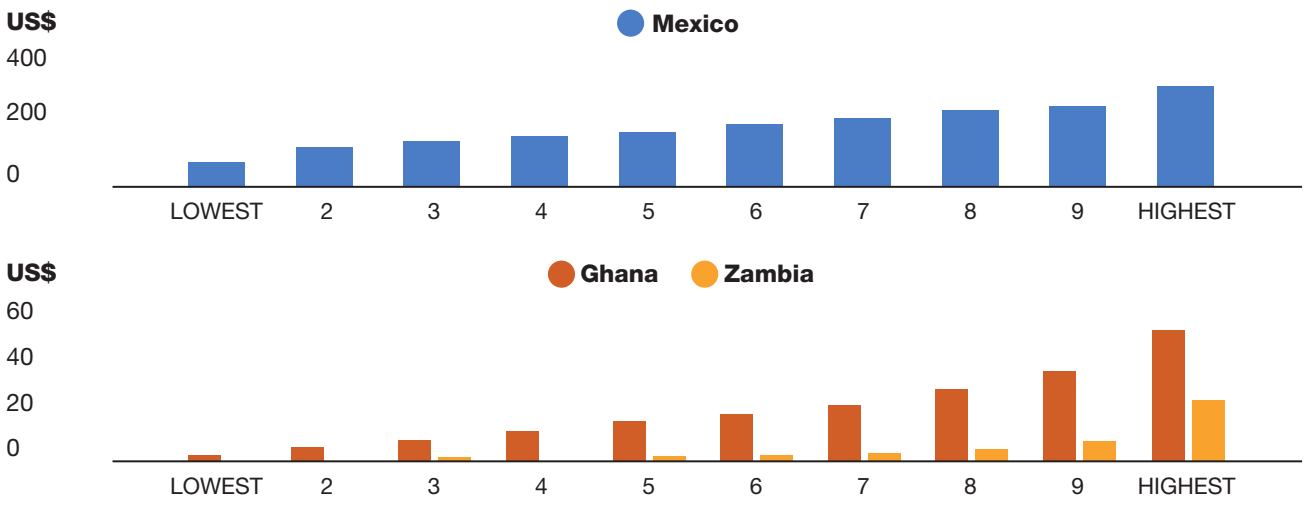
We calculated the average per capita expenditure on WASH for each of the six countries included in this study. We found a wide range of expenditures, from US$0.55 to US$185. Ugandans spent, on average, USH 29,180 (US$7.88) per capita per year for WASH O&M to pay for the WASH expenses captured in the UNPS. Zambians spent, on average, ZMW 7.9 (US$0.55) per capita per year to pay for all WASH expenses captured in the LCMS. In Ghana, households spend an average of US$ 30 (140 GHS) per capita per year on WASH services, with the majority accounted for by water supply. In Ghana, the richest households spend US$ 65 (GHS 307) per capita per year on WASH which is over 10 times as much as the poorest two deciles. In Pakistan, not only is the average annual expenditure for piped water less that spent for unimproved sources, improved sources were roughly one third the annual expenditures for unimproved sources. Expenditures in rural and urban areas of Pakistan were not significantly different. Mexicans spent, on average, MXN 3504 (US$185.04) per capita per year for water expenses, as captured in the ENIGH.

Figure B4.
Annual per capita expenditure on water access in Cambodia and Pakistan.



The difference between countries was much larger than the difference between water access types. This supports our hypothesis that looking at expenditures alone, without accounting for spending power, is an inferior measure of affordability. While absolute values changed from country to country, the pattern of expenditures across different types of access remained largely consistent, and in line with expectations: improved sources cost more. The one exception to this was Cambodia, which had roughly the same levels of expenditures across all types of water access (see Figure B4). The pattern of partial expenditures for O&M across deciles of total expenditure, was the same across all countries: higher spending power was correlated with higher expenditures on WASH, as was expected. The absolute amounts, converted to US dollars, varied greatly (see Figure B5). This was likely, in part, due to our use of exchange rates rather than estimates of purchasing power parity (PPP), although had we used PPP rates, this would not have completely offset the differences between countries.

Figure B5.
Annual per capita expenditure on WASH access across deciles of total expenditure in Mexico, Ghana and Zambia.



B1.6 Household time expenditures on water collection

As mentioned above, there is a relationship between income level (as proxied by deciles of total household expenditure) and levels of WASH access (see Figure B2). Likewise, there is a relationship between WASH expenditures and level of WASH access (see Figures B3 and B4) and between WASH expenditures and income level (see Figure B5). Several factors contribute to these relationships: for one, poorer households may access similar levels of water access to richer households, but purchase lower water quantities. Likewise, lower income households, looking to limit their expenditures on WASH, might opt for lower access levels, that cost less but also have lower water quality, lower reliability, or lower resilience, as compared to higher income households. Along these lines, poorer households may opt for similar levels of access, or lower levels of access, which cost less but require a higher time expenditure, either because they are shared with other households (and require waiting) or they are located at a distance from the households (and require travel). There is an opportunity cost for time expenditure. We therefore looked at distance (for Zambia) and time expenditure (for Uganda, Pakistan and Ghana) per trip while collecting water. Lastly, we have estimated the annual time expenditure for collecting water in Ghana by incorporating data on the frequency of collection at the household level. This allowed us to then monetize the total annual time expenditure, by multiplying this amount by the Ghanaian minimum wage.

In urban areas of Zambia, piped water and bottled water took less time to collect than other types of improved water access; likewise other types of unimproved access took less time to collect as compared to surface water. In rural areas of Zambia, higher time expenditure is correlated with use of improved sources: the higher the service level (improved instead of unimproved source), the more time it takes to collect water. In the case of rural Zambia, there seems to be a willingness to spend time in order to access higher quality water sources (see Figure B6). Whereas in Uganda, the time expenditure on improved appears to be similar to unimproved water sources (Figure B7).) Aside from these case studies, Nauges and Whittington (2009) review the literature on how households choose among water sources. Most studies support the idea that households are willing to walk and to pay more for higher quality sources.

Figure B6.
Distance to primary water source in Zambia, in urban and rural areas.

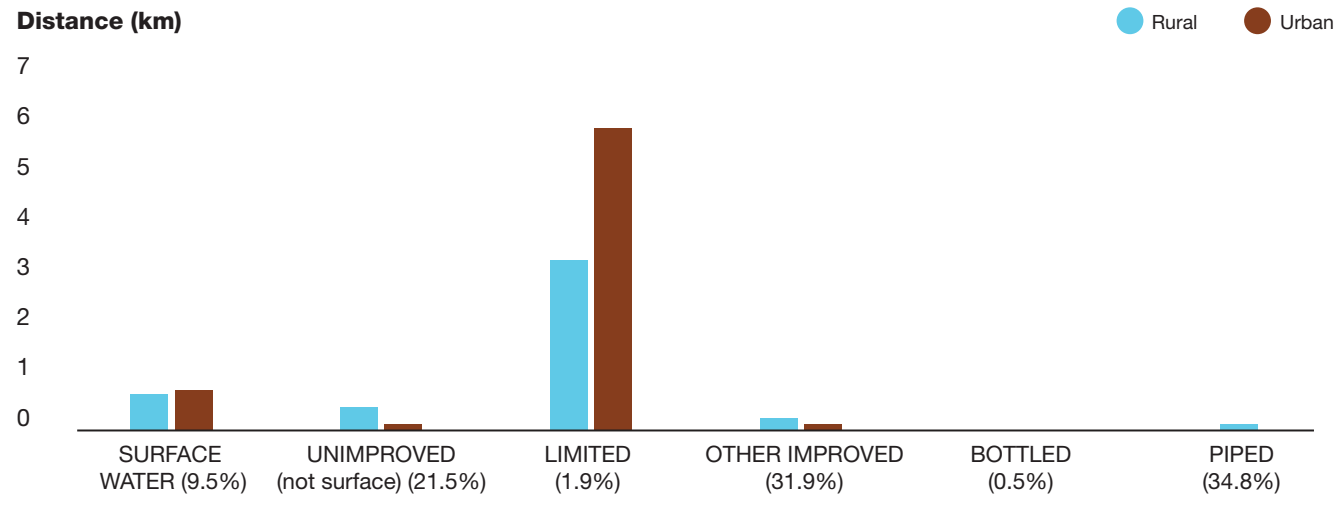
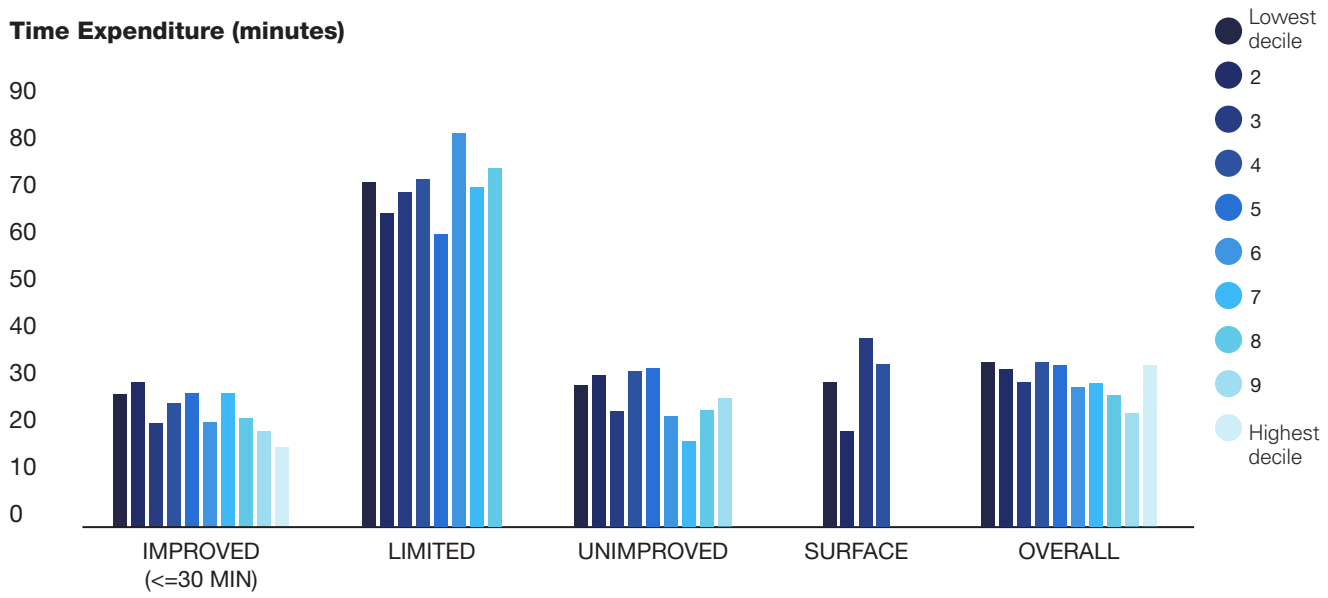


Figure B7.
Daily time expenditure for water collection in Uganda, across deciles of total household expenditure.



We broke down time expenditures across deciles of total expenditure overall, as well as across both deciles of total expenditures and water access levels (see Figure B7)[27]. Looking at Uganda overall, there is a correlation between income levels and time expenditure; there was a general trend that higher total household expenditures had lower time expenditures in general, with the exception of the highest decile. This trend did not hold up for unimproved sources when the data was subset by access type; for unimproved sources, while there was a difference in average time expenditure across access types, there was not a correlation between time expenditure and deciles of total household expenditures for data subset by access type. This implies that, to a certain extent, income level determines the type of access, and the type of access is a determinant of time expenditure (see Figure B7).

Time per trip data in Pakistan was collected as a categorical variable. We have retained this format and calculated the prevalence of each of these categories across water access types and deciles of total household expenditure (see Figure B8). Improved water access has a lower time expenditure than unimproved sources; within improved sources, bottled water took the most time, while surface water took more time than other unimproved sources. Unexpectedly, higher average time expenditures were found in higher income households (see Figure B8). Both of these patterns were markedly different than the patterns observed in Zambia.

[27] Only categories with >10 households (N>10) were included

Figure B8.
Time spent per trip while fetching water, across major water service levels, and household residency, in Pakistan. The proportion of the total population availing of each type of water access is included in the parentheses with the column label.

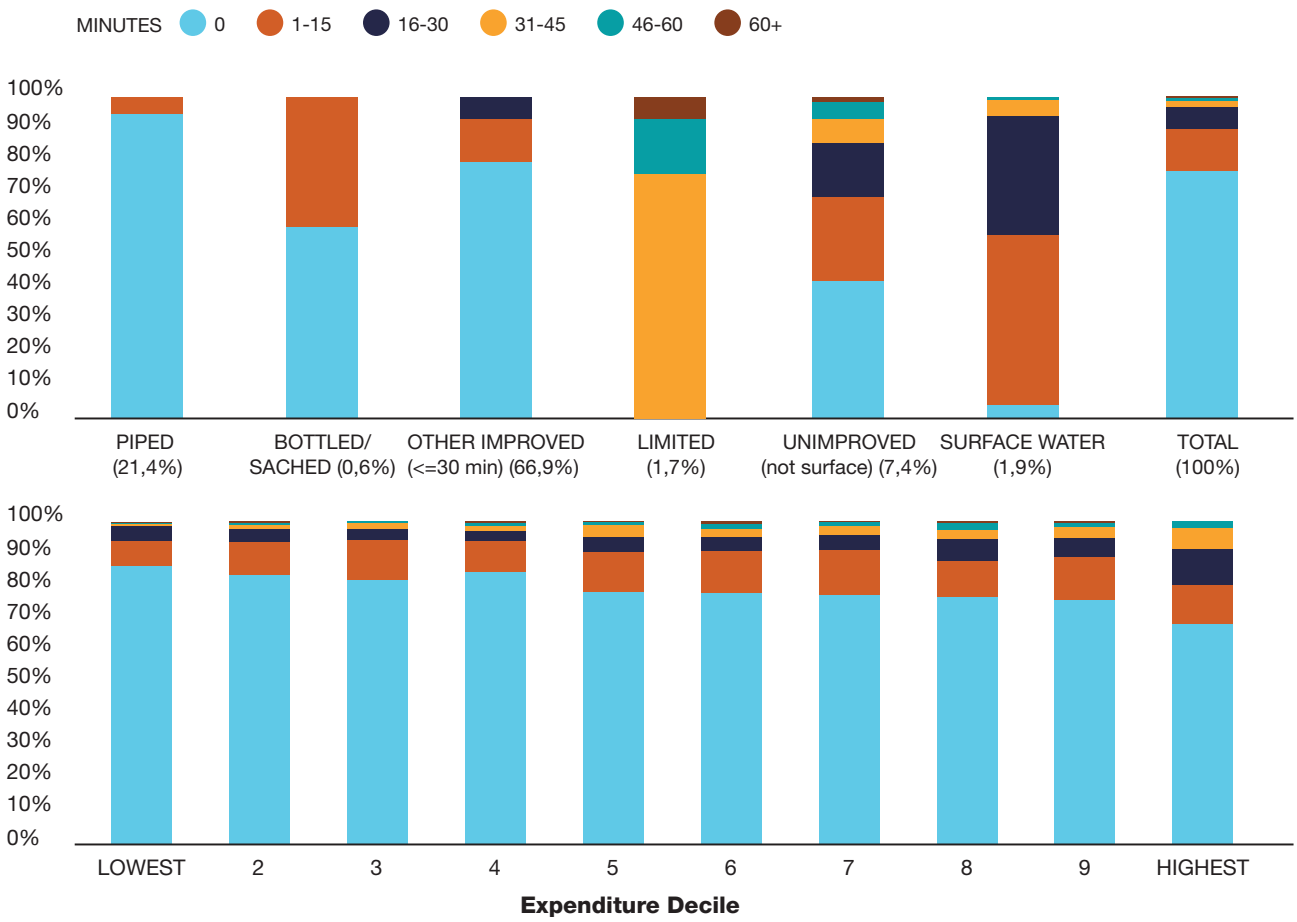


Figure B9 shows the average time spent per trip accessing water from different sources in Ghana. The longest daily collection times are from flowing surface water sources such as rivers or streams (average 80 minutes per day), followed by stagnant surface water sources and unprotected springs (average 50 minutes per day). Most other community water sources require at least 20 minutes, while piped water off the premises and rainwater on premises require a little over 10 minutes (see Figure B9). Interestingly, whether urban households spent more time or rural households spent more time varied between different sources, unlike in Zambia. Figure B10 presents the same data broken down across income quintiles; as can be seen, time expenditure for water collection depends almost entirely on water access type, and not income, the same result as was observed in Uganda. This indicates that improved sources are preferred, and people are expressing that fact with their feet; it also indicates that the level of access is an important part of determining time expenditure, and therefore also impacts affordability through time costs as well as monetary costs. Decreasing the time needed to collect water from improved water sources has the potential to free up a significant amount of labour, which could then be used for other productive pursuits. Likewise, to the extent that time costs have an opportunity cost, making improved sources more accessible will make them more affordable.

Figure B9.
Time expenditure per trip for water collection in Ghana, across different types of water access, in all areas, as well as rural and urban areas.

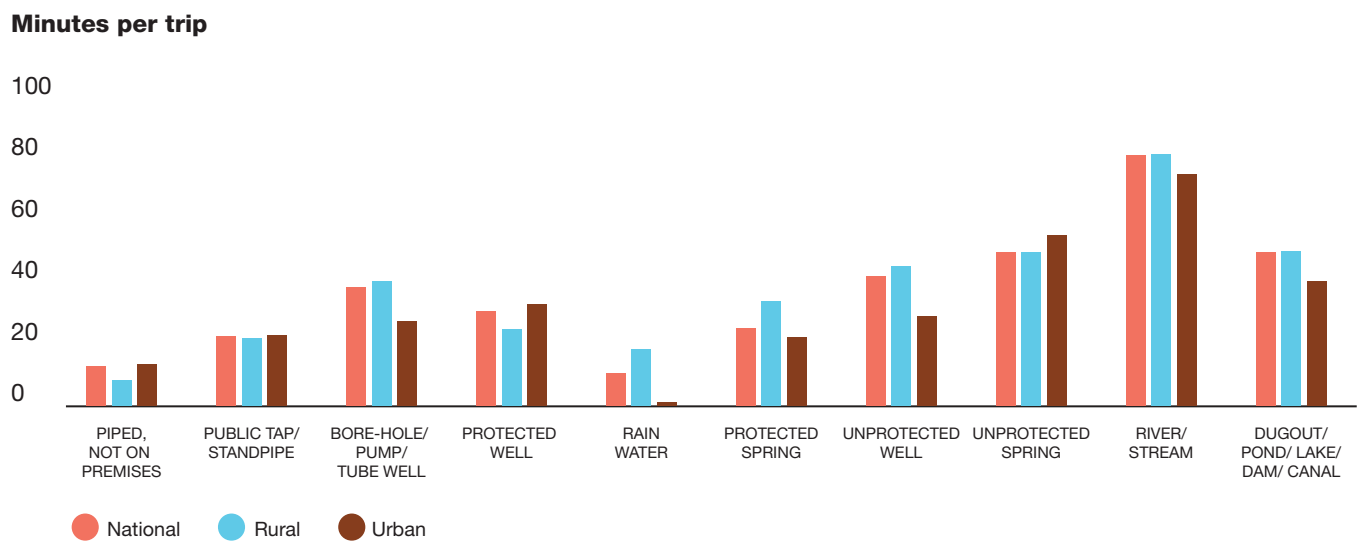
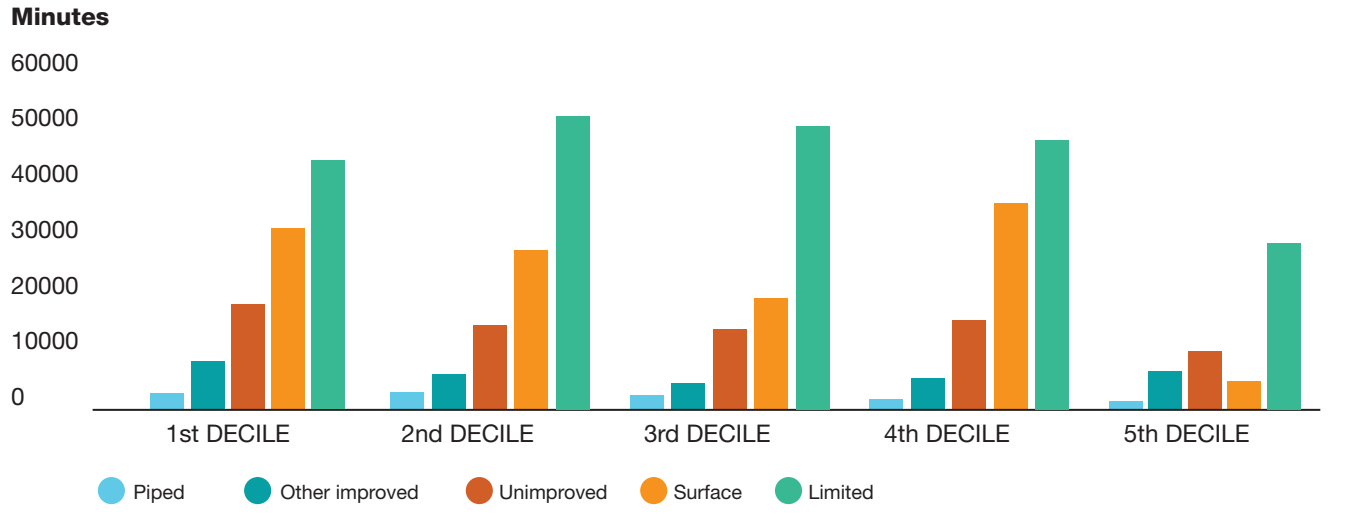


Figure B10.
Average annual time expenditure for water collection per household in Ghana, across different types of water access, and across quintiles of total household expenditure.



In Figure B10, we estimated the average time spent collecting water per year, valued at the Ghanaian minimum wage rate, and converted to US$ in Figure B11. Figure B12 shows the ratio of reported monetary expenditure over the value of the reported time expenditure when using minimum wage as the value of time. Using these time valuations, only piped water has an average monetary expenditure significantly above the value of time expenditure.

Time expenditure is clearly a significant cost, and the trade-off between time expenditure and monetary expenditure does seem to shift based on the type of water access. Therefore, any affordability indicator which does not incorporate time expenditures, at least in the case of Ghana, would be missing a significant dimension of access cost. The importance of time costs will be picked up in the affordability indicators covered in the next section, below.

Figure B11.
Monetized time expenditure for water collection in Ghana, across different types of water access, in all areas, as well as rural and urban areas.

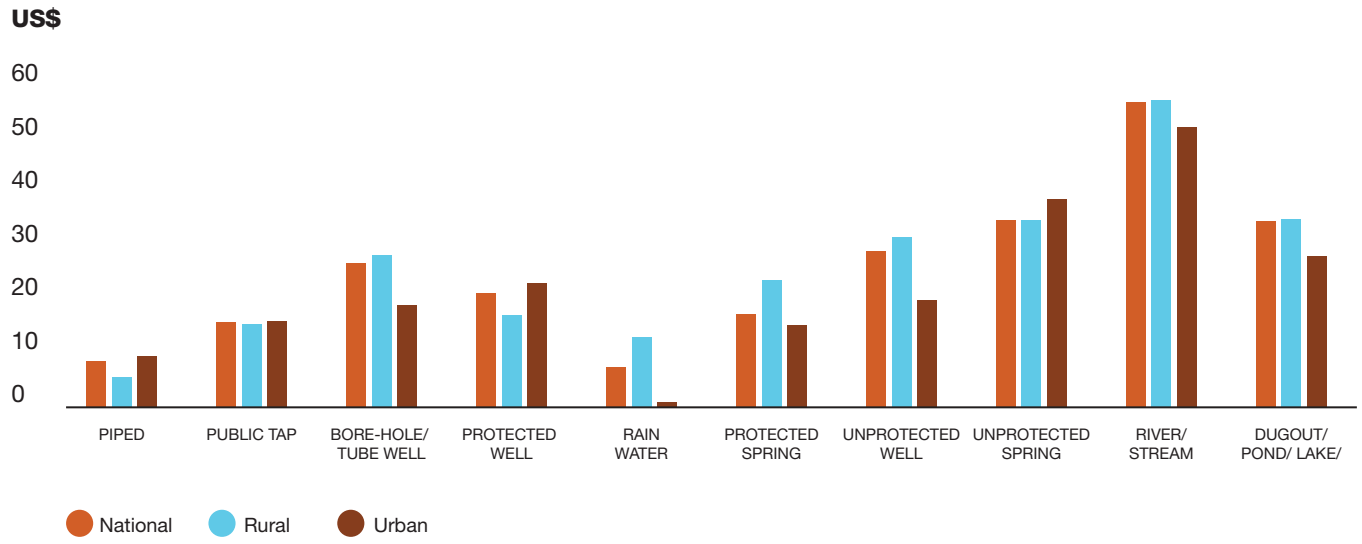
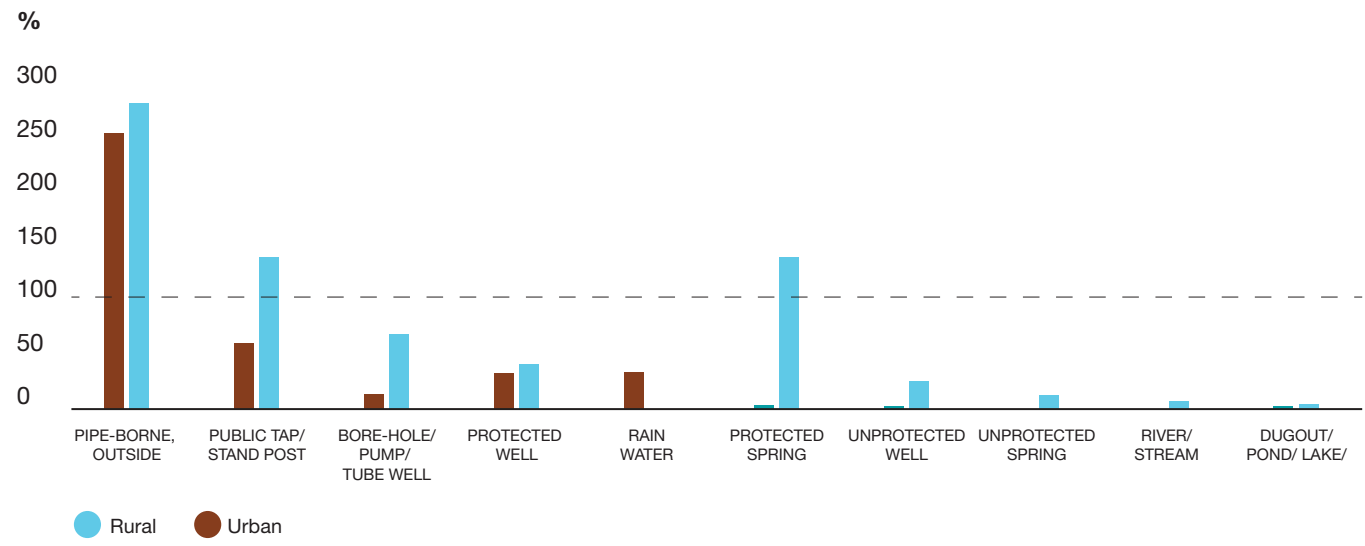


Figure B12.
Ratio of average annual monetary expenditures to average annual value of time to fetch water from different water sources in Ghana (100% indicates the two values are equal; over 100% means monetary expenditure is higher than the value of the time expenditure).



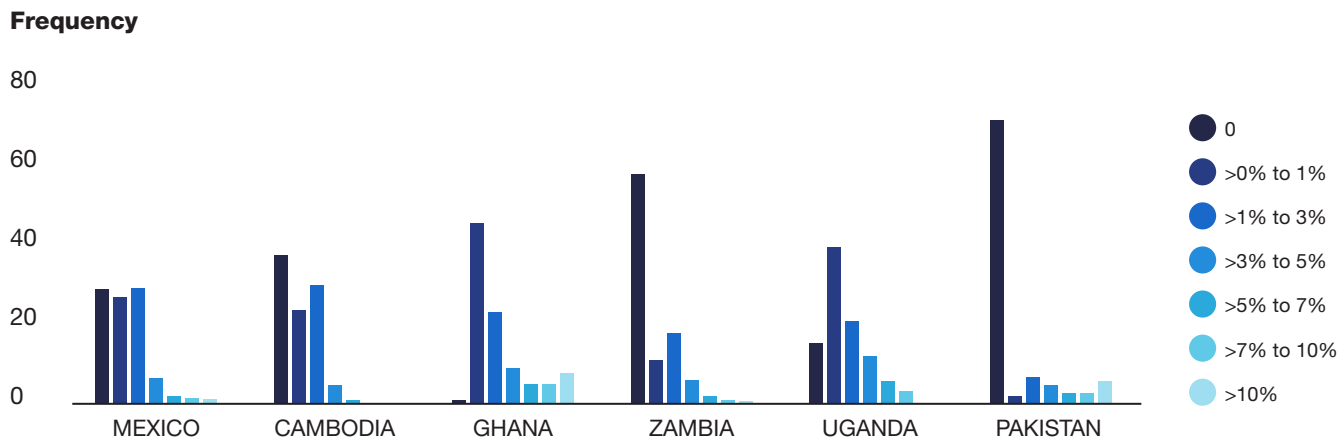
B2. WASH expenditure as a proportion of total expenditure

Different indicator options are outlined in section 3.2.1. Due to availability of data, selected options were tested

B2.1 Partial WASH operational expenditure as a proportion of total expenditure

Estimating affordability by calculating Indicator 2.1C is useful for instances when affordability targets might be set to a specific level of spending, for instance 5% of household expenditures. Indicator 2.1C is shown in Figure B13 for the entire population of Mexico, Cambodia, Ghana, Zambia, Uganda and Pakistan. There is a large range in the percentage of households which reported paying no money for O&M WASH expenses: 72% in Pakistan, 59% in Zambia to 30% in Mexico. The proportion of households that pay less than 1% of total expenditures was 16% in Uganda and 48% in Ghana and higher than that in all other countries. Only 2% of households in Cambodia paid more than 5% of their total expenditures on WASH O&M; this goes up to 5% of households in Mexico and Zambia, 12% in Pakistan, 19% in Ghana and 22% in Uganda (see Figure B13). Ugandan households spent, on average 2.4% of total household expenditures on WASH O&M; in Zambia this was 2.1%; in Ghana 3.0%; in Pakistan 4.1%; and in Mexico 1.5%. In Ghana the average was 1.7% for rural areas and 5.5% for urban areas.

Figure B13.
Distribution of partial WASH expenditure share as percent of total expenditure across major cut-offs, for Mexico, Cambodia, Ghana, Zambia, Uganda and Pakistan (Indicator 2.1C)



In the case of Uganda, urban households seem to pay more on average, for improved sources, than did rural households, and less than rural households for unimproved sources (see Figure B3). Incorporating spending power, through the ratio proposed in Indicator 2.1C, resulted in an entirely different pattern. Estimating Indicator 2.1C across water access types, in rural and urban households in Uganda, we see that urban households pay slightly higher proportions of their income for limited access and bottle or sachet water (see Figure B15). In Figure B14 we see that Indicator 2.1C was higher in urban areas than in rural areas for both Ghana and Cambodia. We can also see a general tread of lower affordability (higher rates for Indicator 2.1C) in higher levels of access; the one exception to this was basic access in rural Cambodia (see Figure B15).

Figure B14.
Partial WASH expenditure as a share of total household expenditure in rural and urban areas across different types of water access in Uganda (Indicator 2.1C)

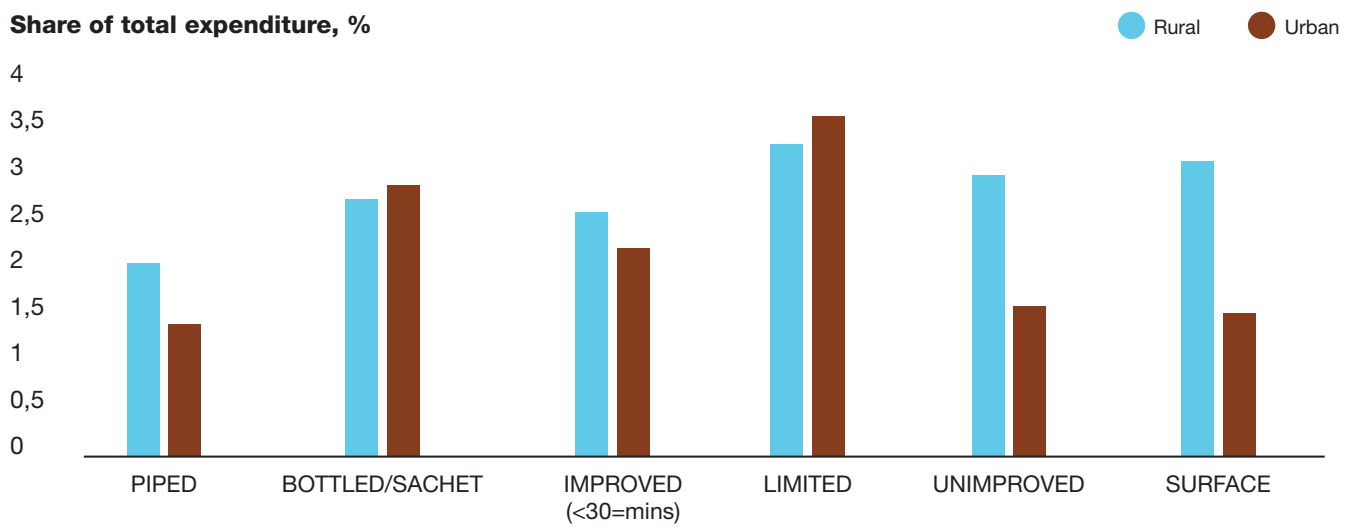


Figure B15.
Partial WASH expenditure as a share of total household expenditure in rural and urban areas across different types of water access in Ghana and Cambodia (Indicator 2.1C)

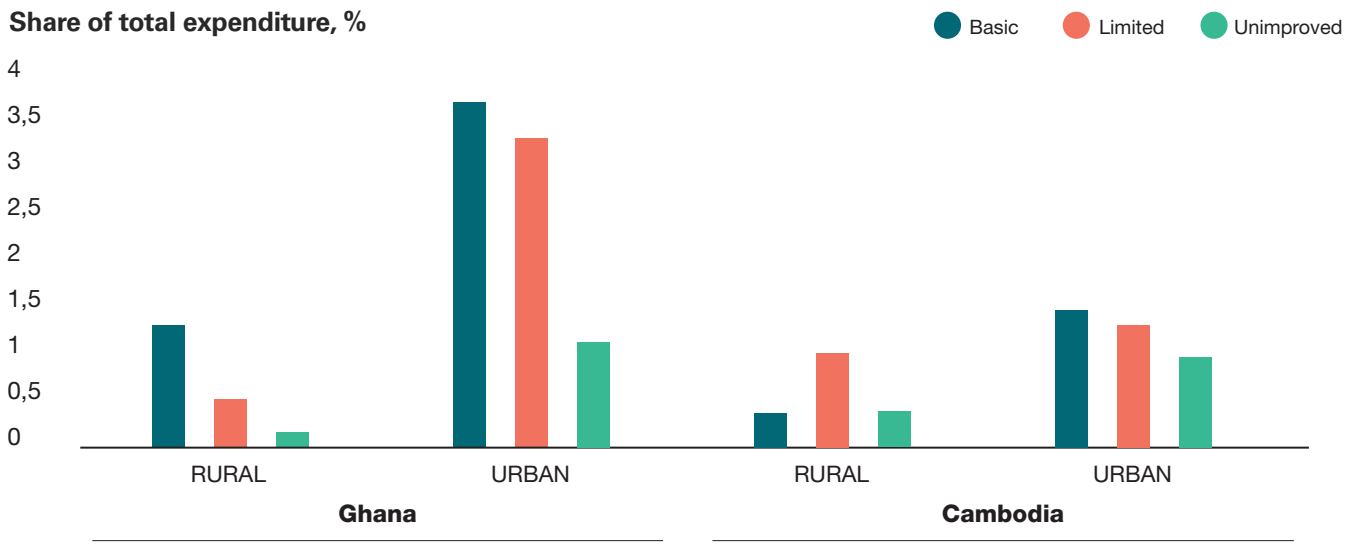
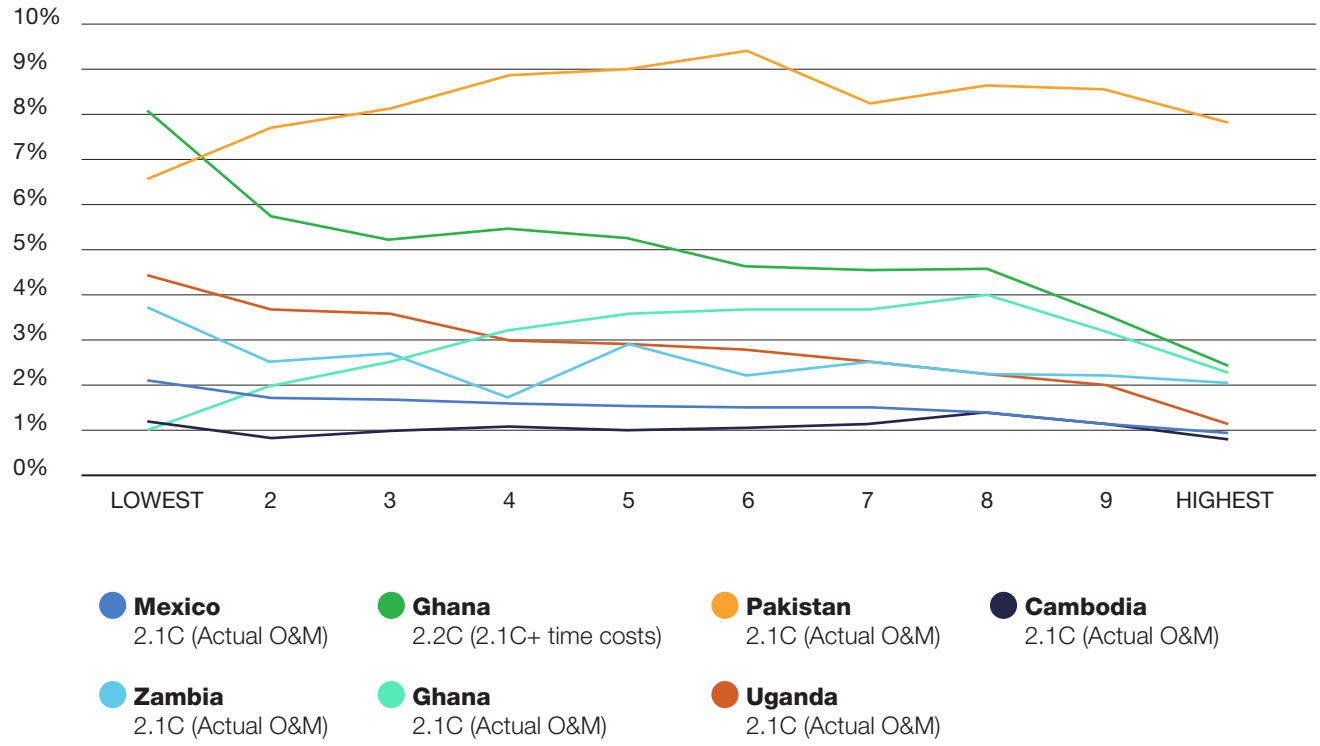


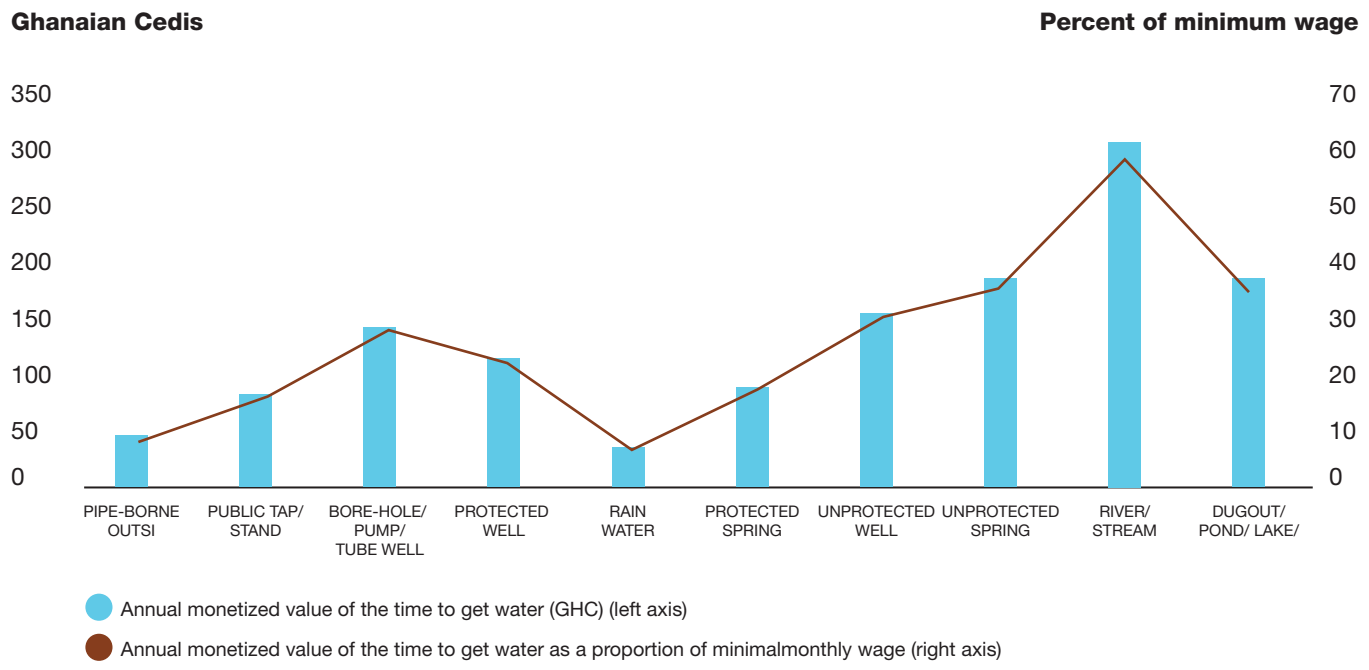
Figure B16 shows Indicator 2.1C, across deciles of total household expenditure for all six countries – including all households. In addition, we have calculated Indicator 2.2C for Ghana, using household level data on water collection trips per day and a time valuation equal to the daily minimum wage in Ghana. Mexico, Zambia and Uganda appear to have a trend: higher income households seem to spend a lower percentage of expenditures on WASH. In Cambodia, Ghana and Pakistan, the proportion of total expenditures did not seem to be correlated with income levels. A different pattern emerged for Ghana for Indicator 2.2C: including time expenditures resulted in a clear correlation between income level and affordability (see Figure B16).

Figure B16.
Comparison of actual O&M costs for Mexico, Cambodia, Ghana, Zambia, Uganda and Pakistan (Indicator 2.1C) and actual O&M + time expenditure for Ghana (Indicator 2.2C), across deciles of total expenditure



As mentioned in the previous chapter, including time expenditures in the numerator, without including a time budget for hours available for housework in the denominator, may lead to inaccurate affordability estimates. In general, this will inflate indicator estimates, but it will likely bias this inflation towards lower income households, since they generally have higher time budgets for housework. Given that data is not available on time budgets, the decision to include time expenditures, and introduce any associated bias, has to be weighed against not including time expenditures at all, and whether indicators without time expenditures are sufficiently valid. This is a difficult decision; in the case of Ghana, including time expenditures changed the relationship between of affordability indicator estimates and income levels, but it did so in line with expected bias, making it impossible to disentangle the two with the available dataset. Having said that, Figures B9-B12 make show ample evidence that time costs are significant; in Figure B12 we see that they are possibly more significant than monetary costs. Simply not including them may lead to an invalid picture of affordability, depending on the context. Figure B17 shows the variation in access time costs between different water sources, both in Ghanaian Cedis and as a percent of the minimum wage rate. Across all water sources, the average time spent accessing water is 27% of the minimum wage. This percent value can theoretically be converted to number of days of work by multiplying the percent of minimum wage (27% average) by the number of working days per month. If the latter is 22 days per month, the time spent accessing water average 6 days per month.

Figure B17.
Annual monetized value of the time to fetch water, in GHC and as percent of minimum wage



B2.2 Required expenditure on WASH as a proportion of total household expenditure

Affordability indicators 2.1-2.5 incorporate data collected directly from households, which is a reasonably good method for gathering accurate data, despite some cost category omissions. Unfortunately, household costs sometimes refer to unimproved water sources and unimproved sanitation access. This makes sense because lower levels of access are often more affordable as well. Therefore, in order to design an affordability indicator that does not implicitly encourage lower levels of access, we adopted the JMP's definition of basic access, and sourced data on typical operational and capital costs to meet basic WASH service levels, for rural and urban areas. These cost estimates were validated by local experts. Costs are presented in Table B2 below. These estimates were used to calculate Indicators 3.1C, 3.2C, 3.3C, 3.4C and 3.5C.

These are rough approximations made at the national level, and do not incorporate the variation in cost that would naturally happen across the variety of local contexts which exist at the sub-national level. We acknowledge that some households will require higher (or lower) investment than others to reach water sources, or to build basic access to sanitation. Like with time costs, this presents another situation where an indicator might be more valid but less accurate; having one estimate for the most typical required costs does not have the same level of accuracy than reported actual costs, but it does ensure that affordability is not increased at the expense of basic access, an important component of indicator validity.

Table B2.
Unit costs per capita for O&M and capital costs (US$, 2018 prices)

COUNTRY	REQUIRED COSTS PER SERVICE LEVEL		ANNUAL PER CAPITA COSTS				LUMP SUM CAPITAL PER CAPITA	
			RURAL		URBAN		RURAL	URBAN
			O&M	CAPITAL	O&M	CAPITAL		
Pakistan	Water	Basic	1.2	3.8	2.6	8.4	1724.1	1051.8
		Safely managed	12.4	21.6	16.5	19.2	1235.8	1017.0
	Sanitation	Basic	7.6	7.1	6.4	5.0	313.3	327.6
		Safely managed	10.0	9.8	9.8	7.8	828.3	615.2
	Hygiene	Basic	1.9	0.3	1.9	1.5	10.0	25.5
Uganda	Water	Basic	1.0	10.4	8.0	6.3	91.7	100.1
		Safely managed	-	-	-	-	-	-
	Sanitation	Basic	0.9	36.4	14.6	40.8	245.4	291.6
		Safely managed	0.9	36.4	34.4	40.8	245.4	291.6
	Hygiene	Basic	0.5	2.1	0.5	4.2	0.3	7.7
Mexico	Water	Basic	2.2	5.8	7.4	26.1	826.1	1865.4
		Safely managed	3.8	4.0	22.2	4.0	125.0	125.0
	Sanitation	Basic	16.2	48.3	55.3	31.9	1155.6	1420.4
		Safely managed	6.0	29.3	15.2	29.7	1350.0	1370.3
	Hygiene	Basic	7.0	0.8	3.8	5.2	20.0	40.0
Cambodia	Water	Basic	1.2	3.0	0.9	3.1	228.3	678.4
		Safely managed	7.4	4.9	9.8	16.2	177.8	660.0
	Sanitation	Basic	3.7	3.6	5.9	4.3	100.9	251.7
		Safely managed	4.3	5.8	19.5	16.1	256.9	958.5
	Hygiene	Basic	0.7	0.1	0.7	0.3	1.4	1.9
Zambia	Water	Basic	0.7	2.6	0.7	2.7	23.6	22.1
		Safely managed	51.1	40.3	57.5	58.6	501.9	730.1
	Sanitation	Basic	3.9	12.1	16.8	26.2	140.8	326.9
		Safely managed	7.9	6.6	26.9	7.9	82.6	97.9
	Hygiene	Basic	3.0	0.5	3.3	0.3	3.7	4.2
Ghana	Water	Basic	1.0	1.6	107.1	3.5	19.2	60.0
		Safely managed	-	-	-	-	-	-
	Sanitation	Basic	0.5	11.3	4.3	16.5	87.5	205.9
		Safely managed	-	-	-	-	-	-
	Hygiene	Basic	5.0	0.5	5.2	1.9	0.5	14.7

Source:
estimates from Hutton and Varughese (2016), adjusted and validated by selected in-country stakeholders

Indicator 2.1C does not take into account the quality of access. Therefore, setting affordability targets using Indicator 2.1C alone carries the risk of encouraging lower (and cheaper) access types, and thereby creating a trade-off between affordability and other policy goals such as safety (through better water quality), accessibility (with lower time requirements), reliability or resilience. One way to balance this trade-off is to compare Indicator 2.1C with 3.1C: for households that have a higher score for the former, as compared to the latter, we may assume that basic access is likely to have been achieved. This also indicates that any household which reports zero partial WASH expenditures (0% for Indicator 2.1C) is at risk of accessing less than basic access. While such a result needs further validation, this simple comparison is nonetheless a potential first step towards assessing affordability while protecting competing policy goals. Figure B18 provides a comparison of the distribution of Indicator 2.1 and 3.1 across Mexico, Cambodia, Ghana, Zambia, Uganda and Pakistan. We can see clearly that basic access is completely unaffordable for the vast majority of households in Zambia and Pakistan, while there are significant minorities that can afford basic access in Cambodia and Uganda and a majority that can afford it in Mexico. While this comparison was done looking at the distribution of results for Indicators 2.1 and 3.1, it can also be performed at the individual household level as well.

Figure B18.
Distribution of partial WASH expenditure share, and required WASH expenditure share on O&M for basic WASH service across major cut-offs, for Mexico, Cambodia, Zambia, Uganda and Pakistan (Indicator 2.1C and 3.1C)

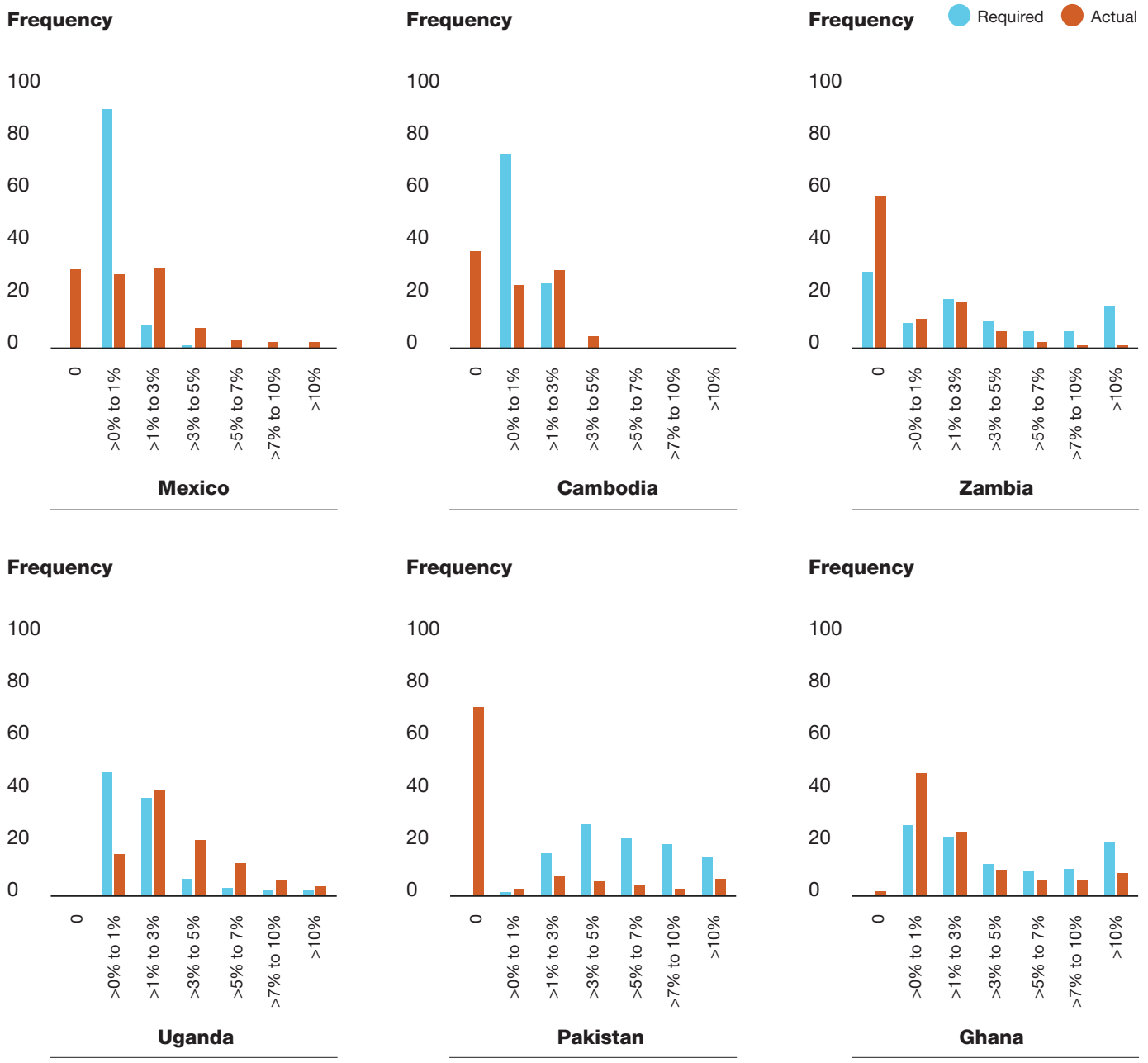
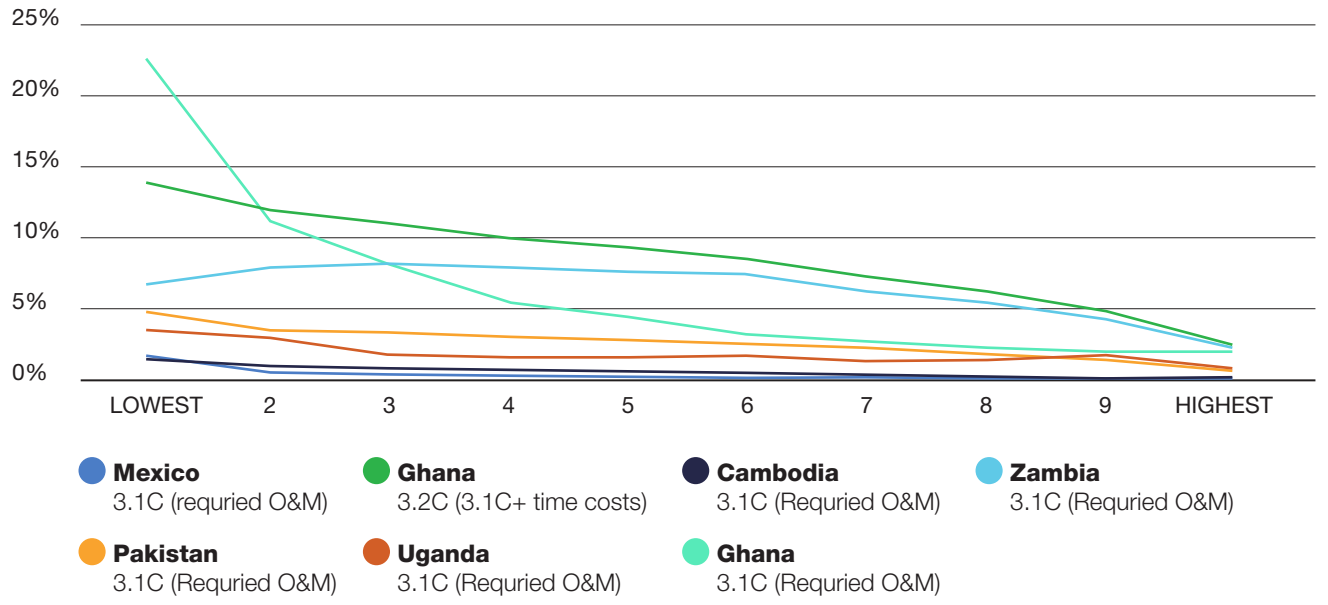


Figure B19 shows the results of Indicator 3.1C for Mexico, Cambodia, Ghana, Zambia, Uganda and Pakistan. Looking at our estimates for Indicator 3.1C, a more pronounced relationship between household income levels and affordability emerged, as compared to Indicator 2.1C. In addition, the protocol for calculating 3.1C accounts for the trade-off between quality of access and affordability. We have further calculated Indicator 3.2C for Ghana (see Figure B19), showing that when both time and required expenditures are taken into account, there emerged a clear and pronounced negative relationship between income level and affordability.

Figure B19.
Comparison of required O&M costs for Mexico, Cambodia, Ghana, Zambia, Uganda and Pakistan (Indicator 3.1C) and required O&M + time expenditure for Ghana (Indicator 3.2C), across deciles of total expenditure



For Indicators 3.1C and 3.2C, while they do incorporate time expenditures, and also incorporate policy goals regarding the quality of access, they do not include capital costs. Capital costs are particularly tricky, since they were not included in the national datasets of household-level information. Therefore, it was not possible to calculate Indicators 2.3C, 2.4C or 2.5C. But we were able to make single estimates at the national level for both O&M and capital expenses, using interviews with in-country experts and secondary data sources. It should be reiterated at this point that we used these single, national estimates to replace the O&M cost data at the household level, for only those households that reported having less than basic access when calculating Indicators 3.1C and 3.2C. Therefore, those indicators retained some national sample data in the numerator of the WASH expenditure to spending power ratio. This was not the case for Indicators 3.3C, 3.4C and 3.5C; in these indicators the capital contribution amount was the same for all households. This is clearly not meant to represent reality, but to give a rough approximate estimation of the affordability of *basic access*, as opposed to the affordability of *current access*.

Figure B20 shows the results of Indicator 3.4C for Mexico, Cambodia, Ghana, Zambia, Uganda and Pakistan (Zambia and Uganda are shown separately to allow for the use of an appropriate scale). Incorporating capital expenditures using an annualized amortization formula (as described in the previous section) resulted in a similar pattern as was observed for Indicator 3.1C, for Mexico, Cambodia, Zambia, Uganda and Zambia, although at a sometimes significantly higher level for all income levels. The difference between Indicator 3.1C and Indicator 3.4C was sometimes a factor of 1.8-3.2 time larger for the lowest decile, and between 0.25 and 1.25 for the highest decile in Mexico, Cambodia and Pakistan. Similarly, there was an increase by a factor of 11.7 and 117 in the lowest decile and 3.7 and 8.6 in the highest decile for Uganda and Zambia respectively. But the negative, linear relationship between income level and affordability was retained in all five countries, as might be expected. Ghana, on the other hand, did not have a linear relationship between income levels and affordability indicator 3.1C; but with Indicator 3.4C, a more clearly linear relationship between income levels and affordability emerged (see Figure B20).

Figure B20.
Comparison of annualized total required O&M costs for Mexico, Cambodia, Ghana, Uganda, Zambia and Pakistan (Indicator 3.4C), across deciles of total expenditure

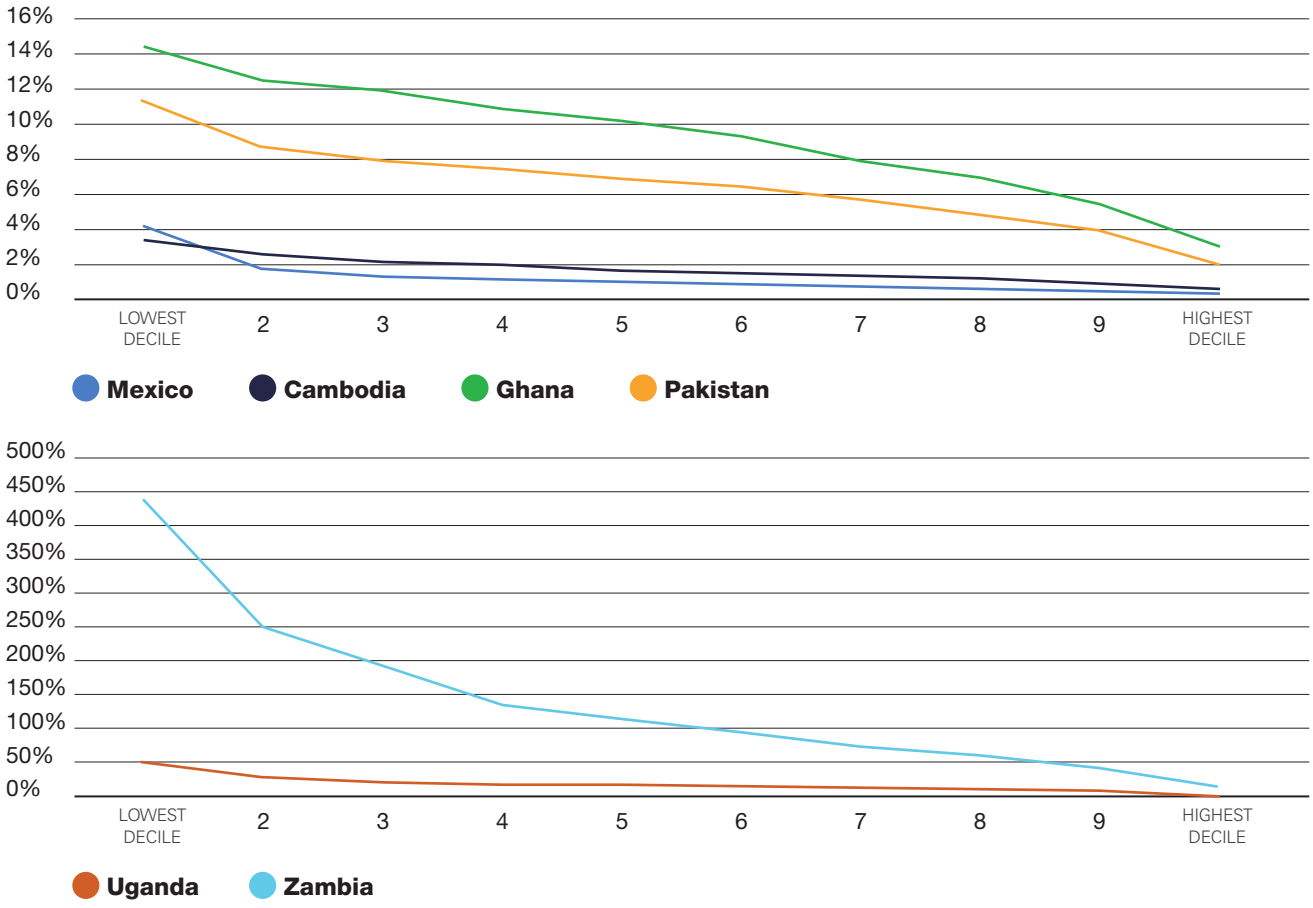


Figure B21.
Comparison of WASH costs as percent of total expenditure under different indicators in Ghana, across deciles of total household expenditure

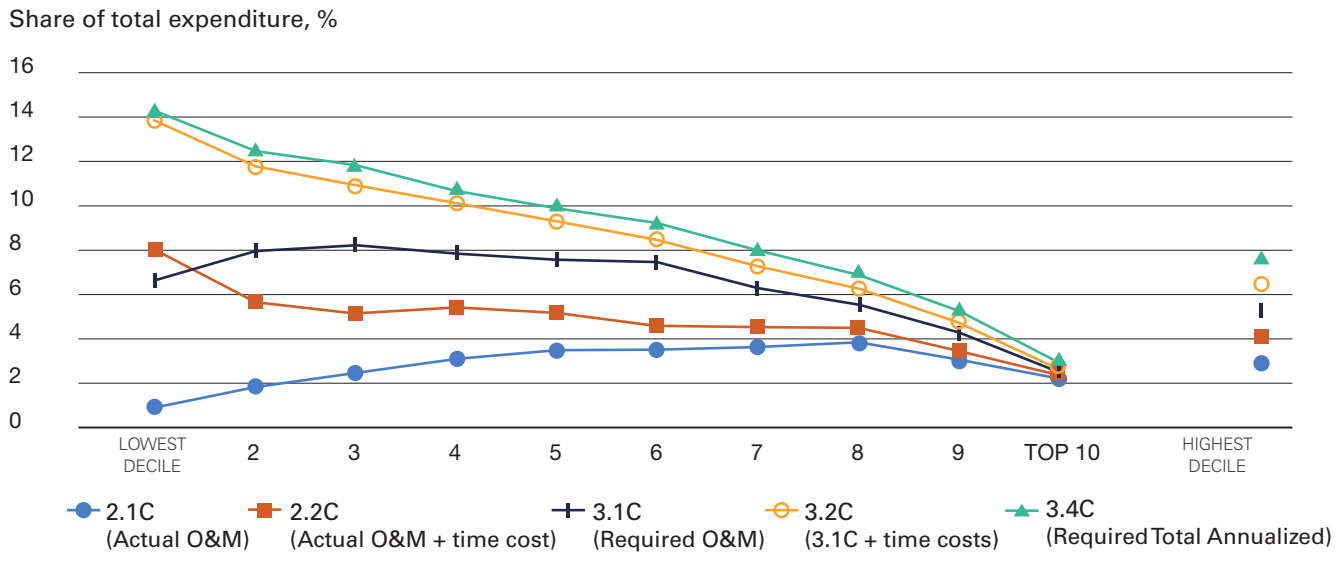
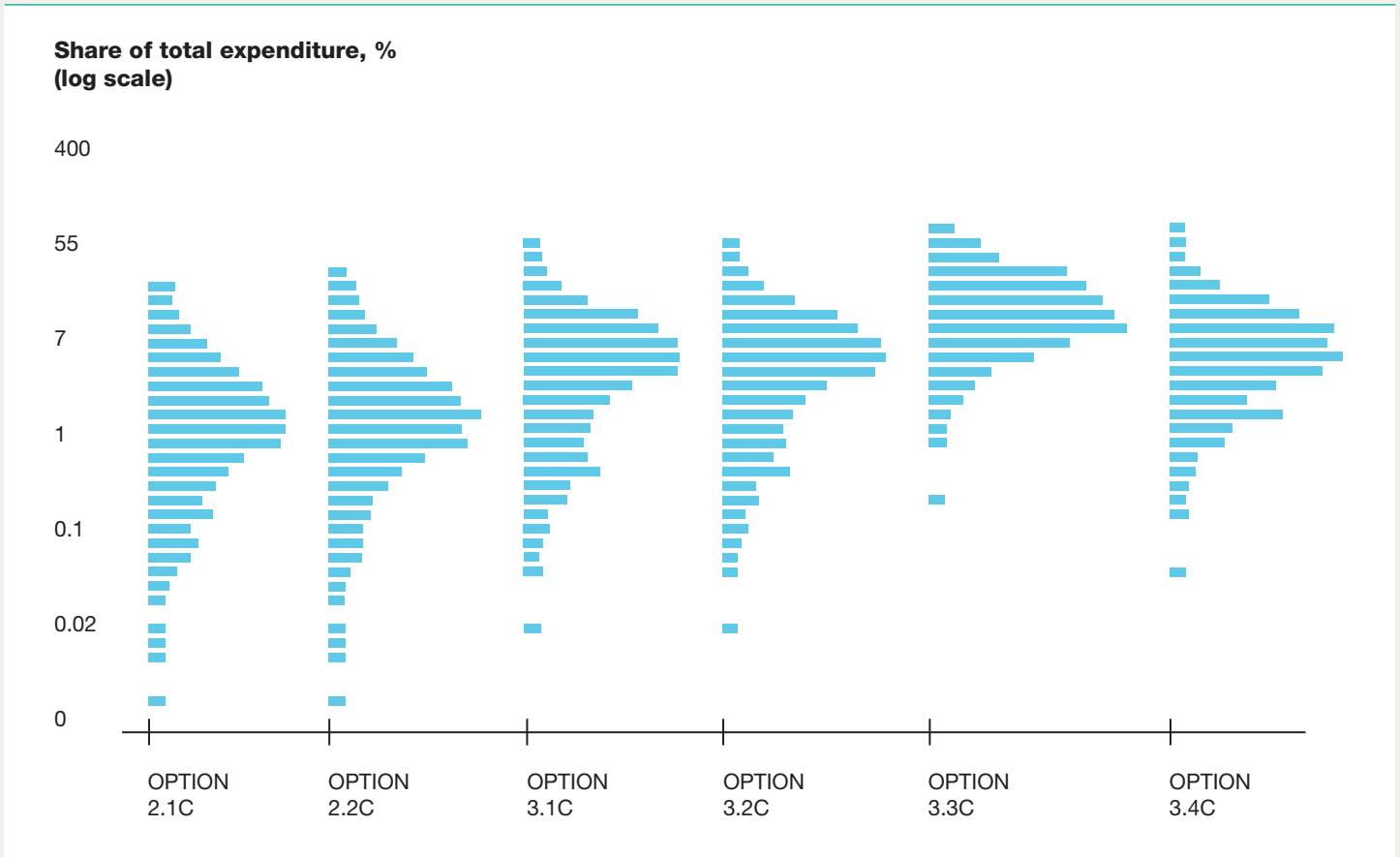


Figure B21 shows a summary of different indicators by income decile and overall, for Ghana. The indicator using only actual partial costs for O&M (2.1) shows little variation across total expenditure deciles, indicating lower WASH costs for poorer households. This is likely because poorer households have lower levels of WASH access; comparing indicator 2.1 with other indicators that incorporate either time costs or access level show this to be the case. The real costs of accessing WASH services, which include time costs, vastly exceed the current partial actual financial costs paid by households, with greater impact the lower the household income. When time costs are taken into account (Indicator 2.2C), poorer households end up spending a higher proportion of their income on WASH access. This contains the important assumption that the valued time costs (at minimum wage rate) are considered the same as cash spending. Although some households may not have a choice, these results indicate that many households choose WASH access options that have lower monetary costs but higher time costs. For example, even if a household has a closer water source that costs money, they may choose to use their spare time to collect water from a more distant source instead of spending cash on the more convenient water service. Figure B22 shows the same indicators as in Figure B21, but includes the distributions of households over the range, in logarithmic values. We see a log-normal distribution, which is what we might expect from a representative sample.

Figure B22.
Distribution of households with basic WASH service level in Ghana, across the spectrum of WASH costs in relation to total expenditure, by indicator, log values



For all the indicators estimated in this chapter, a few additional caveats must be kept in mind. First, not all data are recent: the Ghana data was collected in 2012, which means that it may already be obsolete. And none of the datasets were less than four years old. Higher frequencies of data collection will help make affordability indicators more relevant to policy-makers, although that is true for all policy-relevant data collection efforts. Likewise, the data presented here has been standardized to a certain extent, using definitions of access adopted from the JMP's water and sanitation access ladders, for example. It is likely that there is some variation on the ground in how different types of WASH access are defined; this may have contributed to any differences between countries, but it can also be present within intra-country analyses as well, to the extent that definitions have not been harmonized at a national level. Lastly, while we have presented a comprehensive assessment at the national level, mostly focused on water, a more focused analysis may be desired, looking at affordability at the level of a single urban conglomeration, or looking more at sanitation, for example. In sub-national analyses, and in an analysis of sanitation costs, we suspect, there may emerge more instances were lower levels of access cost more than higher levels of access: such cases would indicate a need for a re-assessment of current subsidy distribution, and any associated policies.

B2.3 Recommendations for future analyses and data collection efforts

Current datasets from Ghana have allowed us to calculate Indicators 2.1C, 2.2C and 3.1C-3.5C. Data for Cambodia, Uganda and Pakistan also had data on time expenditures associated with water collection, but in contrast to Ghana, they did not have data on the number of trips per day made to collect water. Adding a question to future data collection efforts regarding the number of trips per day would increase the accuracy of time expenditure estimates and allow the estimation of Indicators 2.2C and 3.2C. Zambia currently collects data on distance; converting this question to a time expenditure instead would likely accomplish similar policy goals regarding access, and also allow time expenditure estimation. For similar reasons, we would recommend that Mexico separates data on time spent on firewood collection and water collection. In addition, in order to estimate Indicators 2.3C-2.5C, adding data collection on capital expenditure would allow more accurate affordability assessments regarding the full range of WASH cost categories. A list of data needed for the estimation of Indicators 2.1C-2.5C and 3.1C-3.5C is presented in Table B3, along with an accounting of which ones are present in the data sets used in this report.

In this report we used four sets of categories through which we analyzed Indicators 2.1C-2.5C and 3.1C-3.5C: these were residence in rural or urban areas, deciles of total household expenditure, types of access or levels of access. The first two categories allowed us to explore affordability through the lens of equity; the second two categories allowed us to explore potential trade-offs between quality of access (in terms of access and water quality/safety) and affordability. Additional data have the potential to allow the interrogation of the trade-offs between affordability and reliability, resilience or intra-household equity. We recommend that such analyses be explored in the future, and if possible, some of the questions listed in Table B4, or other similar types of information, be integrated into future data collection efforts.

As mentioned earlier, ratios of expenditures over a measure of spending power is only one category, out of four categories identified, of affordability indicators. Other types of data are necessary in order to explore the other categories. For example, a static assessment of demand, one of the affordability indicators in the category of revealed demand, requires data on the sufficiency of water quantity (see Table 5). In addition, comprehensive poverty assessments, the fourth category of affordability require the kinds of data listed in Table B5, such as poor/non-poor status, or regular payments of water charges.

Table B3:
Data available (Y) or not available (N) from country surveys to estimate indicators 2.1C-2.5C/3.1C-3.5C and to provide population disaggregation

TYPES OF TOILETS	GHANA	UGANDA	CAMBODIA	MEXICO	PAKISTAN	ZAMBIA
Water partial O&M expenditure	Y	Y	Y	Y	Y	Y
Sanitation partial O&M expenditure	Y	N	Y	N	N	Y/N
Hygiene partial O&M expenditure	Y	N	N	N	N	N
Water capital expenditure	N	N	N	N	N	N
Sanitation capital expenditure	N	N	N	N	N	N
Hygiene capital expenditure	N	N	N	N	N	N
Total household expenditure	Y	Y	Y	Y	Y	Y
Rural/urban status	Y	Y	Y	Y	Y	Y
Water access level	Y	Y	Y	Y	Y	Y
Sanitation access level	Y	Y	Y	Y	Y	Y
Hygiene access level	Y	Y	Y	Y	Y	N
Time spent to wait for & collect water	Y	Y	Y	N	Y	<Distance>
Number of trips per day to collect water	Y	N	N	N	N	N
Time spent per day/month on urination, defecation & menstruation	N	N	N	N	N	N
Household time budgets for housework & leisure	N	N	N	N	N	N

Table B4:
Additional categories that can be applied to Indicators 2.1C-2.5C and 3.1C-3.5C, and whether included in survey (Y) or not (N)

	GHANA	UGANDA	CAMBODIA	MEXICO	PAKISTAN	ZAMBIA
Intra-Household Inequality						
Gender and age group of water collectors	Y	Y	Y	N	N	N
Reliability and Resilience of Access						
Last time the water facility broke down, how long did it take to have it fixed and working again?	Y	N	N	N	N	N
When was the last time the water facility broke down?	Y	N	N	N	N	N
Frequency of deliveries/availability	Y	N	N	Y	Y	N
How has the availability of safe water for household consumption changed in your community since 2008?	N	Y	N	N	N	N
Seasonal water access	N	N	Y	N	N	N
Seasonal time to collect water	N	N	Y	N	N	N

Table B5:
Additional data which would be useful for the calculation of other affordability indicators, and whether included in survey (Y) or not (N)

	GHANA	UGANDA	CAMBODIA	MEXICO	PAKISTAN	ZAMBIA
Static Assessment of Demand (Consumption Level)						
Deficiency of water quantity	Y	N	N	N	N	N
Comprehensive Poverty Assessments						
Regular payment of water charges	Y	N	N	N	N	N
Poor/non-poor status	Y	Y	Y	Y	Y	Y
Distribution of communities by major reason for incomplete toilet coverage (%)	N	Y	N	N	N	N
What are the main constraints that your household faces in accessing safe water sources?	N	Y	N	N	N	N

B3. Household behaviours, WASH prices, consumption and choice

B3.1 The advantages of demand assessment

One of the potentially most powerful indications of affordability is to assess the relationship between household demand, prices and price changes. As consumers, especially poorer ones, choose their consumption level of a good or product based on the price, price increases can lead households to cut back on their consumption of water. Arguably, the effect of a change in water price on demand is less than it would be for many less essential goods. In the context of encouraging more efficient use of scarce resources, or for the goal of conserving water in local ecosystems, this can be a good thing. But only up to a point: the price of water can also be considered a barrier to access for poorer households, for example. If high prices, or price rises, lead poorer households to refrain from demanding a sufficient quantity of water that is required to maintain health and livelihoods, it could be concluded that the minimum standard has become unaffordable to these households. Likewise, if it is higher prices which specifically cause households to choose riskier water sources, or sources with known water quality problems, then it can be said that water from the preferred source is unaffordable for those households.

The advantage of affordability indicators that take into account household demand, household perceptions, price elasticities, demand management policies or willingness to pay (WTP) studies, is that such an assessment potentially covers all three dimensions of affordability outlined in chapter 2. Household behaviour in relation to changes in the cost of WASH access is a response that integrates WASH prices, household income and the cost of other basic needs, through income, substitution and complement effects on demand. Hence, assessing household responses to WASH prices might be considered a more valid way of examining affordability indicators, as compared to the WASH expenditure indicators covered in Annex B2.

In the following sections we will cover methods that assess demand and preferences through either cross-sectional data sets or panel data. Cross-sectional data allows some assessment of affordability across households for a single point in time, a static assessment, or snapshot of household behavior. Panel data allows for the estimation of demand models, price elasticities or willingness to pay. Furthermore, demand models can use two broad categories of data: revealed preferences and stated preferences. In the next few sections we will first look at cross sectional analyses, and then move on to preference modeling.

B3.2 Static assessments - consumption level

One approach to measurement is to examine a one-point-in-time snapshot of a sample of households and assess their apparent choices in the face of different service options with different prices. It is the process of incorporating consumer choice that allows integration of all three dimensions of affordability. Yet, the word 'apparent' here indicates that we can surmise, but without triangulation with other data sources; we cannot say with any certainty. Therefore, these types of indicators might be considered more valid indicators, but with lower certainty.

Static assessments of consumption levels require information on the existing WASH service levels per household, and the opportunities available for accessing higher service levels. Broadly speaking, two questions in relation to affordability can be analysed:

1. To what extent are households consuming less than they should, or choosing to use WASH types that do not meet minimum service levels?

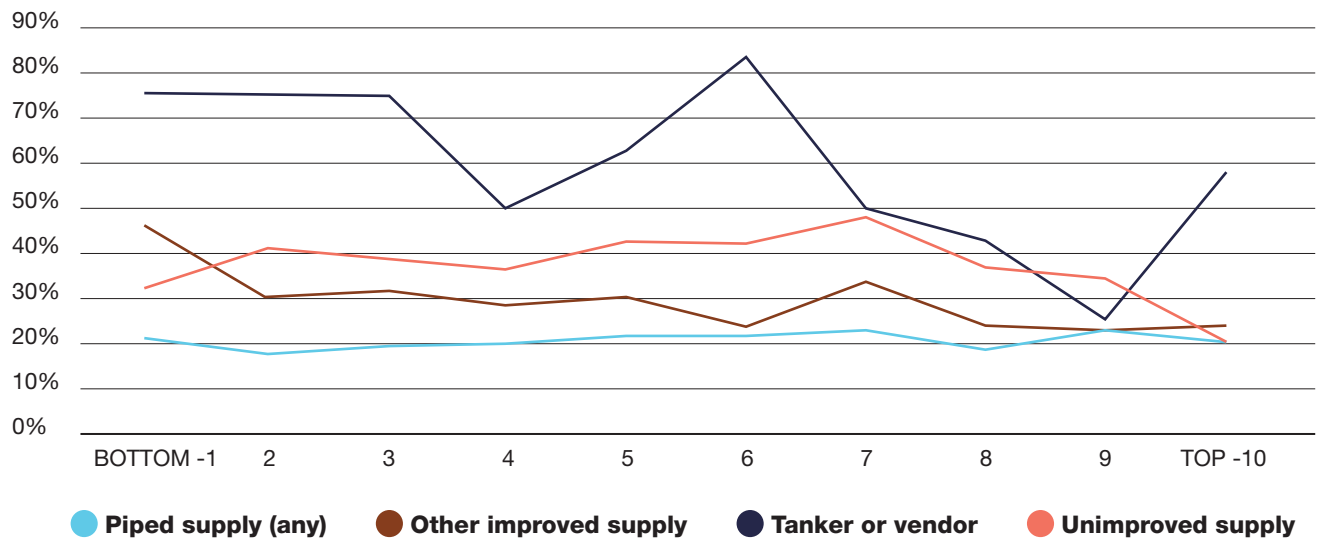
2. To what extent are prices likely responsible?

In terms of the first question, it is necessary to first define a minimum service level for WASH access, then examine those who do not have that minimum service level and try to understand why that is so, specifically looking at whether prices and costs are a significant barrier. Defining a minimum service level for WASH can include dimensions of water quality, safety, water quantity, reliability, cleanliness and convenience; it may also include some assessment of resilience and sustainability of access, and for sanitation it may also include aspects of dignity as well. For the purposes of this study, the WHO/UNICEF JMP's 'basic' service level is used due to it being relatively more feasible than other alternatives; data is widely available regarding coverage of basic access, allowing comparison across countries. The definition of basic access for both water and sanitation access types, is a rough proxy for safety, reliability and convenience. It does not explicitly include, however, water quantity, resilience or sustainability of access, nor measures of dignity.

When tabulating service coverage by income decile, there was a clear relationship between income level and basic water access in Mexico, Zambia and Ghana, and a less obvious relationship, if any at all, in Cambodia. There are many reasons why households might not have basic WASH access: socio-cultural reasons; a lack of norms regarding WASH access; lack of WASH programmes or government support; and a lack of affordable options. Challenges with regards to affordability might be due to household income constraints, the upfront infrastructure costs by themselves (refer to the lumpsum capital costs in Annex B2.2) or the on-going costs (such as the operations and maintenance costs or the monthly bill).

Although the definition of basic water access does not specify minimum quantities of water needed to maintain health, livelihoods and well-being, water quantity can still be used in conjunction with basic access categories to create an affordability indicator. If consumption levels are known, then an indicator can be built looking at the proportion of households using less than 70 litres per capita per day (the minimum standard quantity of water designated by the WHO) across access types and income deciles. Alternatively, deficiencies in quantity can be evaluated by the households themselves; Figure B23 shows how households in Ghana responded to a question on whether they experience regular deficiency of water quantity for different sources. Overall, the greatest deficiency is for water tanker or vendor-supplied water, followed by unimproved supply. However, the deficiency appears to be similar for the bottom 6 or 7 deciles, while the deficiency reduces for the higher income households, on average. This implies that piped supplies might be more affordable than the other water access types and tanker or vendor water unaffordable; it could also mean that there are other restrictions, such as infrequent or insufficient deliveries. As can be seen by this example, static assessments of affordability based on household behaviours can be useful for identifying the access types that are most or least affordable; it can also be used to assess whether this indicator varies for lower income households. But it does not allow for setting of maximum thresholds of affordability, as a percentage of income, for example.

Figure B23.
Deficiency of water quantity across different water supply categories, by income decile



Source:
GLSS6

B3.3 Static assessments – household preferences and perceptions

Like a static assessment of consumption, it is also possible to conduct a simple, static assessment of prices. But in this case, the only option is to ask households directly about their perceptions of WASH affordability. Such questions examine why households do not use minimum service levels (whether temporary or regularly), and whether a higher price is one factor that disincentivizes consumption. It can also be informative to directly ask households questions about affordability and enables exploration of why a household cannot afford a service. Asking households whether they feel the price they pay is affordable for them potentially covers all three dimensions of affordability – as household opinions expressed in interviews will take into account WASH prices, their income level and the costs of other essential needs. However, household responses are highly subjective, and bias can be introduced by the expectations and mood of the respondent, and the way questions are asked.

Of the six countries included in this report, only the Uganda data collected information on the constraints to access. For water access, households were asked, 'what are the main constraints that your household faces in accessing safe water sources?', with answer options including 'long distance', 'inadequate sources', 'high costs', 'insecurity', 'no problem' and 'other'. For the proportion of households that reported 'high costs' as the main reason, this may be a good indicator of affordability. Regarding sanitation access, community leaders were asked for the major reason for incomplete toilet coverage in their community: 24.5% stated 'low income' as the main reason, indicating a lack of affordability in those communities. Other major reasons included 'ignorance' (23.8%), 'negative attitude' (towards sanitation) (21.7%), 'poor soil type' (8.4%), 'no land' (5.2%) and 'poor landscape/ terrain'(4.1%). This does not mean that affordability was not a challenge in these other locations, just that it was not the most prominent challenge.

B3.4 Dynamic assessments – revealed preferences and willingness to pay estimation

Dynamic assessments use observations of how consumers react to price changes. This requires information before and after a price change, hence requiring time series data on the same households or service areas. Such observations can be used to estimate the price elasticity of demand (PED), a measure used by economists to show how consumers adjust their demand for a good or service when faced with price changes.[29] There are many instances in the research literature which use actual consumption data in a revealed preferences approach. Meta-analyses have compiled dozens of demand studies in industrialized countries that use actual consumption (billing) data, first by Dalhuisen et al (2003) and later by Sebri (2014).

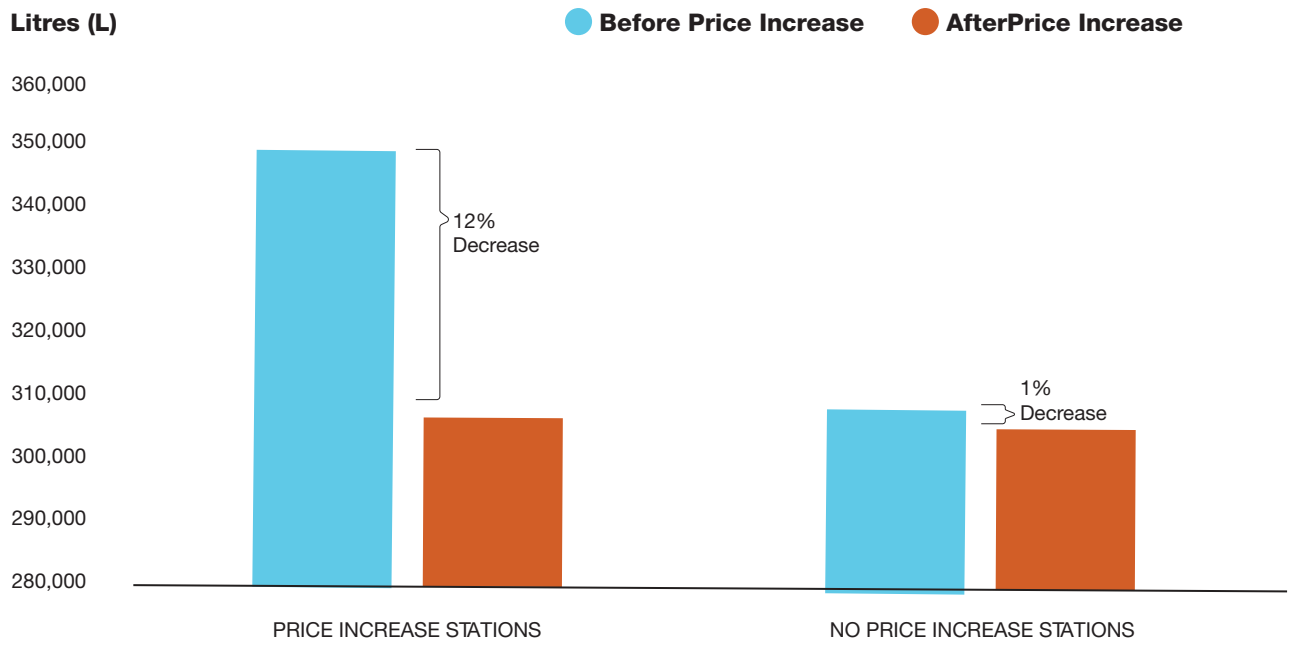
One illustrative analysis is conducted by the Safe Water Network (SWN), in Ghana. SWN analysed impacts of water price changes on connection rates and water consumption, with a view to increasing cost recovery rates to make water stations more financially viable (Worsham et al., 2018). The price increase applied in the SWN coverage areas depended on the technology. For example, a limited mechanization system, which accounted for 26 out of the 35 stations, increased prices from US$ 0.015 to US$ 0.026 per 20 litres. The study found that average monthly sales volumes decreased by 12% in the 15 months after the price increase, compared with the 15 months preceding the price increase (see Figure B24). The study reports that low socio-economic status (SES) households were most affected by the price increase, with an average decrease in sales of 26%. The average consumption of 53 litres per household per day before the price increase dropped to 45 litres after the increase. These prices compare with the current user cost of public utilities of US$ 0.0123 per 20 litres[30]; hence the revised SWN prices are higher, but arguably provide a better quality and continuity of service for rural dwellers.

[29] More precisely, the PED gives the percentage change in quantity demanded in response to a one percent change in price. PED refers to the change in demand resulting from changes in their own price (called 'own-price elasticity of demand'); there is also the cross-price elasticity of demand, which in the case of water is the elasticity of demand for a given water source with respect to the change in the price of water from another water source. It can be used to assess substitution between two water sources and the factors that explain it.

[30] Based on 2.98 GHS per cubic metre, converted to US$ at exchange rate of 4.7.

Figure Source:
Safe Water Network (2018)

Figure B24.
Average monthly volumes per water station, comparing those with and without price increase



In addition, 57% of low SES households reported decreased use, compared to 19% in high-SES households. At the 6 water stations without a price increase, average monthly sales decreased by 1%. However, within 10-15 months of the price increases, sales were back to the pre-price increase rates. This suggests households accommodate the price increase, either through income increases or cuts in other expenditures. Other factors such as rainfall and payment plans were not taken into account in the comparisons and might account for some of the changes over time. Also, water sold via household water connections was more resilient to price increase than onsite sales, due to the convenience and the higher proportion of high-SES households with household connections, who proved less sensitive to the price increase.

Revealed preference demand modeling is routinely used in the research literature, for policy analysis and in private enterprise. Projecting demand for a given price is a valuable tool for service providers and producers of consumer products. Using these techniques as an indicator of affordability requires the same steps as in static assessments: first define a minimum service level for WASH access; this might be an access type, a quantity of water, or both. Second, a minimum acceptable percentage of the population consuming at or below this minimum service level must be chosen. Third, the demand model is used to examine what percentage of households might consume below that minimum service level for each price level; affordable prices are those which project that the acceptable percentage of the population is consuming at or above the minimum acceptable consumption level.

B3.5 Dynamic assessments – stated preferences and willingness to pay estimation

Stated preference data are generally collected using one of two methods: contingent valuation (CV) or discrete choices (DC). With CV a hypothetical product or service is described, and then a series of gradually increasing prices are presented; the survey participant is requested to indicate the highest price they are willing to pay (WTP). With DC, two or more hypothetical products or services are presented, including the prices associated with each, and the survey participant is requested to indicate their preference. DC requires that the full set of options be included – for example, all the feasibly accessible water access types face by a given household. Although stated preference data is collected at one point in time, a simulated dynamism is created by designing a variation in the prices, service levels, attribute desirability, overall quality or quantity of the products and services presented across the options and between different survey participants. The goal is to estimate the average amount that participants are willing to pay for an introduction of, or improvement in, a given service or product. WTP surveys are typically conducted to project the potential consumer demand and are often used by service providers or producers of consumer goods in order to assess market potential and to set prices.

Unfortunately, the number of WTP studies using stated preferences are limited. We did a search using the name of each country, the phrase 'willingness to pay' and the word 'water', then repeated the searches again, but this time using the term 'sanitation'. We then filtered the search results for relevance by reading the abstracts of the papers that came up; we only included papers that focused on the WTP for different types

of access, not for household water treatment systems. This resulted in a list of 13 publications: one focuses on sanitation access, one includes both water and sanitation access and the remaining focus on water access (mostly piped water access).

Five of these papers are summarized here, one for each of the following countries: Pakistan, Ghana, Zambia, Mexico and Uganda. No WTP papers were found for Cambodia. The research articles that we found are not an exhaustive list, but they do present a representative summary of the types of stated preference, WTP information available in these five countries. In Zambia, Abramson et al. looked at WTP in a rural area using a discrete choice experiment. In addition, they included new concepts, along with WTP: willingness to borrow and willingness to work. These new concepts were added because local residents had a WTP far below the cost of various water access improvements – a clear indication that they are not affordable (Abramson et al., 2011). In Karachi, Pakistan, Asim and Lohano used the contingent valuation method to estimate WTP for improved piped water services. Their estimates of WTP for 'safe and regular' piped water services were far above the current average billed amounts, indicating that affordability criteria were met in the city, but at a trade-off with lowered service quality (Asim & Lohano, 2015). In Mexico City, Rodríguez-Tapia et al. looked at coping costs and compared them with WTP estimates using the contingent valuation method. They found a positive WTP for improved water quality in piped water services, which was a larger percentage of family income among poor households than among the rich (Rodríguez-Tapia et al., 2017)installation of filtration devices, and other means of water purification. The demand for better water quality was tested by estimating the household's willingness to pay (WTP. In the Accra-Tema region, Ghana, Kwabena et al. also used contingent valuation methods to estimate that households with private, shared or public piped water access were willing to pay up to 7 times their current expenditures, in order to get safe, piped drinking water delivered on premises. Only households that used trucked water had a WTP which was lower than their current expenditures, indicating that trucked water was not affordable, but piped water largely is (Twerefou et al., 2015). Like observations in Mexico City and Karachi, the affordability of piped water services in Accra-Tema was at the cost of lower quality services. In a rural village in Uganda, Wright et al. found that the WTP for access to a public tap was higher than the estimated cost of services for that tap, based on the costs incurred by two neighboring villages that had already installed a similar system (Wright et al., 2014).

In general, the established research on WTP for WASH has had very consistent limitations: it is always focused on one location (one city, or one village), it is almost exclusively focused on water access, and within that it is almost exclusively focused on piped water services. While WTP estimates for sanitation, or even hygiene for that matter, is a gap that could theoretically be filled through a focused effort, it is hard to see how broader comparisons, at a national or international scale might be made possible.

Currently there are no routine sources for obtaining data on stated household preferences and perceptions. Data on WTP is most commonly conducted by academic institutions, not governments. It is unclear if this was because governments did not find value in them, or if it was due to a lack of technical capacity. Looking into how WTP studies might be designed specifically with the goal of evaluating the impacts of policies or interventions on affordability, especially at larger spatial scales and over time, is worth further exploration and scrutiny. Ostensibly, this category of indicators has the potential to be the most accurate and valid, if logistical challenges could be overcome in its implementation.

Of the 20 MICS studies (introduced in section 3.2.2) with a question exploring the reason for non-availability of water sources, of those households stating unavailable water sources, in Ghana 2.1% replied it was unaffordable.

Stated preference data can also be combined with revealed preference data in some cases; this technique helps to minimize bias and maximize information about WTP for a variety of service levels and product attributes. Using stated preference models or combined stated and revealed preference models as indicators of affordability is done in exactly the same way that revealed preference models are used. First a minimum service level for WASH access is defined, along with a minimum acceptable percentage of the population consuming at or below this minimum service level. The stated preference demand model is then used to determine what prices meet or exceed these minimum thresholds, indicating that they are affordable.

B4. Comprehensive poverty assessments and implications for meeting other essential needs

B4.1 Indicator options and dimensions covered

An alternative to WASH-specific assessments covered above is a more general picture of the socio-economic situation of a household, and how WASH payments (or non-payments) interact with these. Hence the focus of these methodologies and indicators is on the second and third dimensions of affordability – the household spending power and the payments for other essential (non-WASH) products and services. Given that the latter depends on the prices and subsidy levels of public or welfare services, which might change from year to year, it is important to have indicators that integrate the larger picture, in a dynamic way.

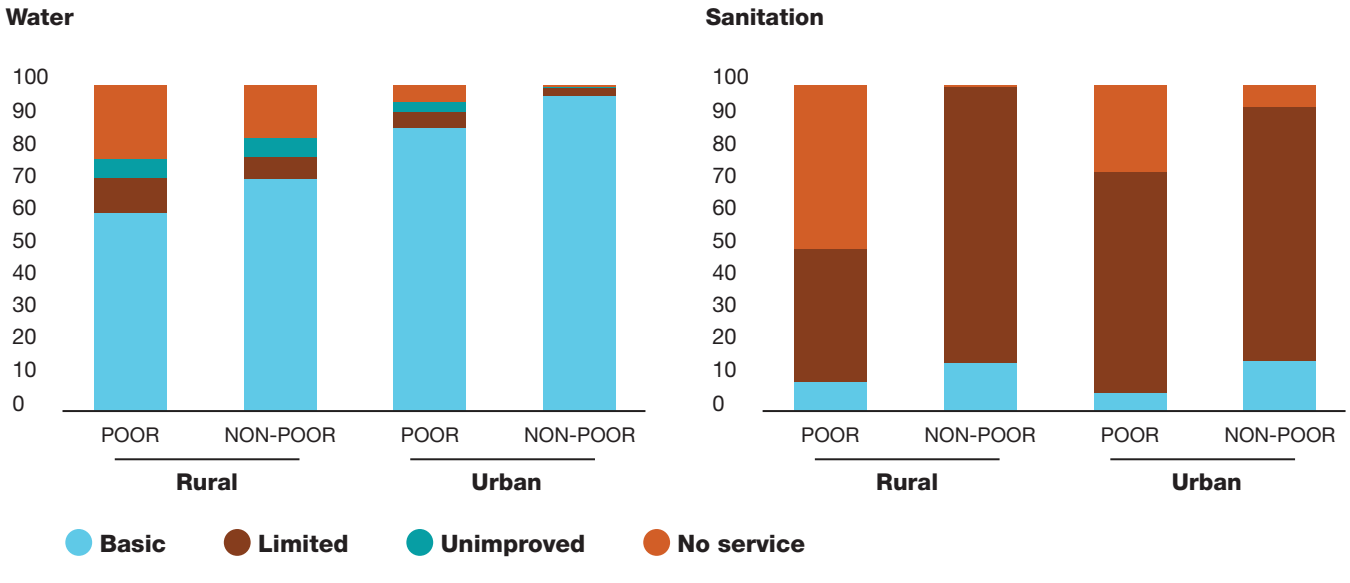
B4.2 WASH coverage for poor and extreme poor

One targeting mechanism for subsidies and subsidised services to make essential services more affordable is in relation to the poverty line. If a household is classified as being poor (using criteria that can be applied from national, sub-national or community levels) then it could be concluded that they should not pay the full costs of WASH services. Using the GLSS6, it was estimated that the poverty line (food and non-food) is at US$ 280 (GHS 1,314) per adult per year, while extreme poverty line (food only) is US$ 167 (GHS 792) per adult per year. Therefore, for the purposes of this current study the first of these rates was applied equally across rural and urban areas, and to all members in a household (not just adults), in order to identify which households are classified as poor.

Figure B25 shows the spread of households by the Ghana poverty line in 2013, according to their poverty status and their level of water and sanitation service. Poverty status is a predictor of basic water and sanitation coverage, but there are many poor households with a water service and many non-poor households without basic water service. In rural areas, 16.5% of non-poor use surface water sources compared with 22.4% of the poor. Hence targeting households by poverty status would leave some non-poor out, who might be near-poor and not able to afford shouldering the costs of water service themselves. Likewise, for sanitation, it is a similar picture when looking at a basic versus non-basic service. However, we can see that open defecation in rural areas is almost exclusively in poor households, indicating that the rural poor are prioritizing other essential needs over access to sanitation. Other measures of vulnerability such as female-headed households or high-risk communities can also be tabulated with available data, but are not included here. This type of analysis was restricted to Ghana for the purposes of this report.

Figure Source:
GLSS6a

Figure B25.
Households classified by poverty status and water (top figure) and sanitation (bottom figure) access, by rural and urban areas



B4.3 Comparison of WASH costs for poor and non-poor

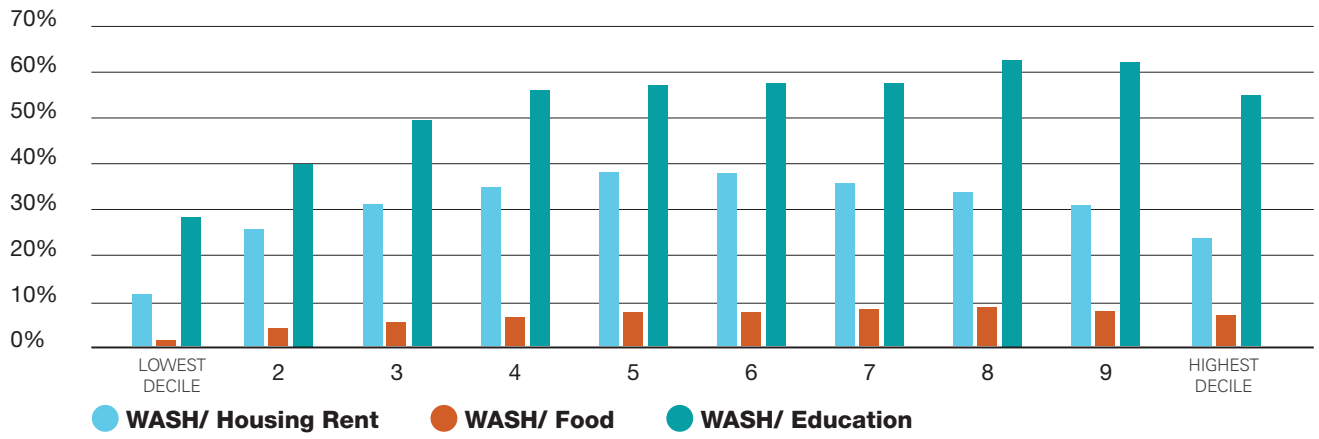
An alternative approach is a more detailed analysis of the WASH component of the poverty basket, by assessing what is the spending on WASH allowed for in the poverty line, termed PL_{WASH}. The implication is that any WASH costs paid by poor households above PL_{WASH} would not be affordable to the household, and therefore paying that cost would risk pushing them further below the poverty line. As essential needs, water, sanitation and hygiene would typically be included in the non-food component of the poverty line calculation. The World Bank, however, largely avoids identification of which non-food items are included in the poverty line, recognizing that there will be significantly different outcomes depending on what are considered essential needs (Ravallion et al., 2009; World Bank Institute, 2005). Instead, the World Bank uses the median expenditure on non-food items and takes a percentage of that to estimate the non-food component of the poverty line. Hence, the non-food items are not assessed individually, and this makes it impossible to know what proportion of it should be reserved for WASH expenditures. Similar limitations existed in the datasets used in this report.

B4.4 WASH spending leads to reduced consumption of other essential goods

An interpretation of affordability implied from statements made by the UN Special Rapporteur at the time of the HRTWS resolution in 2011 is that water spending should not impact on other essential needs: "Access to water and sanitation must not compromise the ability to pay for other essential needs guaranteed by human rights..."(Human Rights to Water and Sanitation - UN Special Rapporteur, 2011) Hence to assess such a requirement, a broader analysis of household spending and consumption is needed. However, it is difficult to assess what are the impacts of water spending given every context has its own price levels and options for substitution (e.g. alternative water sources). Moreover, needs and preferences for services will vary from household to household depending on socio-cultural, demographic and personal factors. This makes interpretation of what is determining the status quo very challenging. Two analyses are possible. One is to assess the relative spending on WASH versus non-WASH items, focusing on the essential items. The other is to expand the revealed preferences analysis which was discussed in section 2.2.4, to include other essential goods as well.

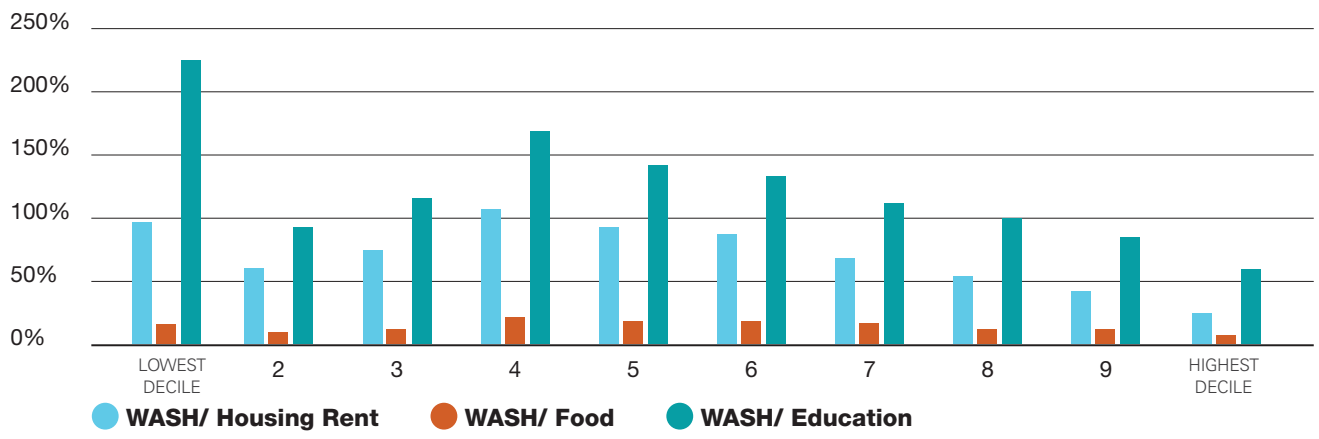
We have applied the first approach to the Ghana data. This is a snapshot of households at a single timepoint with a given set of prices and service offers. Figure B26 shows the actual WASH costs as a percent of other essential goods (food) and services (housing and education), and because all values are below 100%, it means that WASH expenditures are less than these 3 essential items. In particular, food expenditure is more important than WASH expenditure, especially for lower income households, but also housing and education are more important at lower income deciles. This is partly because many households, especially at lower income levels, have significantly lower WASH costs (due largely to the fact that they have an unimproved or limited service).

Figure B26.
Actual WASH expenditure as a proportion of other essential services, across income deciles



When the required WASH costs are used instead of actual costs, and zero subsidy assumed, the findings change significantly, as shown in Figure B27. The indicator includes capital costs, but excludes time costs. For the poorest income decile households WASH costs would be as high as housing costs and about twice the education costs. Therefore, it is doubtful that the poorest households could raise the income needed, or substitute other expenditures, to pay the additional costs of a basic WASH service (including both O&M and annualised capital costs).

Figure B27.
Required WASH expenditure (Indicator 3.4C) as a proportion of other essential services, across income deciles



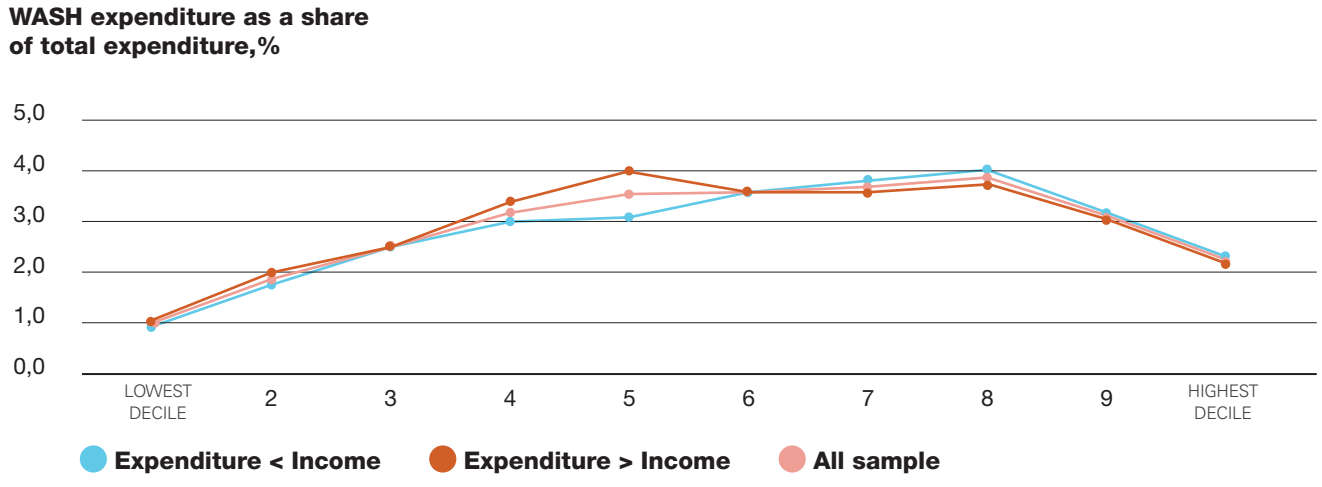
The second approach was not applied, due to a lack of data. This approach analyzes WASH costs in relation to other essential goods costs is to examine the household response to a change in prices. The analysis would go beyond that in section 2.2.4, as it includes the impact on demand for other services. For example, if water prices increase or a household decides to invest in a household water supply or a sanitation facility, what is the impact on other essential spending? Such an assessment needs observation of at least two points in time, both before and after the change. This would be available from tailored surveys such as the one of Safe Water Network (section 2.2.4), or panel data, where there has been changes in absolute or relative prices of water services. As far as we know, no such data sets or analyses are available for the countries included in this report at this time.

B4.5 Spending exceeds income, suggesting households are living beyond their means

A final approach attempts to identify whether a household is living beyond its means, and explores whether high WASH costs might account for that. From GLSS6, total household income (TI) can be compared with total household expenditure (TE), and their WASH spending share (Indicator 2.1C) tabulated for those with TE>TI versus those with TE<TI. Figure B28 shows that households in deciles 4 and 5 have higher WASH costs as percent of income for those households that appear to be operating at a deficit. From the data it is not possible to say whether the WASH costs are causing this apparent deficit.

However, the weakness of this analysis is a limited ability to identify excess spending from the income and expenditure survey data. For example, the GLSS6 data from Ghana, as with all income and expenditure surveys, does not closely relate income and expenditure given the difficulties in getting household respondents to accurately estimate their income and expenditure. Indeed, it is well known that estimates of annual income can be very inaccurate – due to multiple and variable sources of income, especially in rural settings where incomes are more seasonal. Also, households might not want to inform on the full extent of their income, fearing information will be used to levy additional taxes or charges.

Figure B28.
Actual WASH O&M cost as a percent of total expenditure in Ghana, comparing households with/without excess spending, by income decile



For future analyses, and with better data sets, a household could be identified as living beyond its means in other ways: (a) are they reducing their savings to afford their daily living or large capital items? (b) are they borrowing large amounts of money, and at a level which is unlikely to be repayable from future earnings? Once households are identified who fall into this 'financial stress' category, the spending on WASH can be examined as to whether it is high (e.g. above 5% of expenditure) or very high (e.g. above 10% of expenditure).

B5. Summary

In concluding, we seek to make some judgement drawing on General Comment 15: "…payment for water services has to be based on the principle of equity… Equity demands that **poorer households should not be disproportionately burdened** with water expenses" (ESCR-Net, 2003). Using Indicator 2.1C, it appears that poor households are not currently **disproportionately burdened** with water expenses. However, this is because water is sometimes hauled from a distant source with a low monetary cost and open defecation is commonly practiced, especially in rural areas. Thus, when including time costs, as was done here for Ghana, the costs increase significantly for lower income households. Also, when including other coping costs of poor WASH, such as drudgery and personal insecurity – especially for women and girls – or health costs of consuming contaminated water – the costs increase significantly for those with poor WASH, which are disproportionately poor people.

In terms of judging what is affordable versus what is not affordable, the findings from this study are very instructive. This study has found that any conclusion about affordability using an indicator that includes a threshold will be heavily influenced by the choice of threshold. The most valid indicator is one that includes the full costs for all households, while also maintaining a minimum service level. In the case of this analysis, the 'basic WASH' service level was chosen. We found indicators that protected a minimum standard to be a basic requirement and necessary for judging any indicator to be valid. Under this scenario (Indicators 3.1C, 3.2C and 3.4C), the costs to households, especially poor households, are significantly higher, as shown in Figure B20. Were basic WASH to be expanded to reach all Ghanaian households, for example, some of the subsidy mechanisms are likely to take effect, thus protecting the poor. However, the cost of this subsidy to the government and external partners needs to be assessed in order to understand its feasibility in the short-term.

At the same time, the cost and feasibility of undertaking detailed affordability assessments restricts the number of indicators that are possible, and it can also restrict the basic design options that are available. Within the subset of indicators that are feasible, we also found several instances where increased validity came at the cost of decreased accuracy. We cannot say which is better, as it is likely that will depend on the context in which an affordability indicator is used and the purpose for which it is applied. But we do find it important that an assessment is done when choosing which affordability indicator makes the most sense in a given context, and we argue that validity, feasibility and accuracy as we have defined them, are key criteria to be considered.

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Indonesia, November 13, 2018
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10 Annex C. Protocol for data extraction

C1. Introduction

This note presents a methodology of calculating WASH affordability indices using a household living standards survey (or LSMS). This kind of survey provides detailed information on incomes and incurred expenditures at household level. This note shows a step-by-step procedure for calculating WASH affordability indexes by using survey datasets. This document consists of four parts, namely selecting and recoding WASH variables, aggregating consumption expenditure by major categories, selecting key household characteristics variables, and calculating WASH affordability indices.

C2. Selecting and recoding WASH variables

1. Drinking water

A LSMS survey usually has two variables that provide information about a surveyed household's: (i) access to source of drinking water, and (ii) time spent to get the water from the source and return home. A combination of these variables forms a new variable for drinking water, based on the WHO/UNICEF Joint Monitoring Programme's (JMP) definitions under the SDG monitoring. The new data on drinking water shows different levels of service accessible to the population.

Table C1 shows composition of a ladder variable based on information on sources of drinking water and time to get water available from Ghana Living Standard Survey (GLSS 6).

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Table C1.
The ladder of service level of drinking water

SOURCE OF DRINKING WATER	TIME TO GET WATER <30 MINS	TIME TO GET WATER >= 30 MINS
Piped water into dwelling	Safely managed[1]	
Piped water to yard/plot	Safely managed[1]	Limited
Public tap or standpipe	At least basic	Limited
Tubewell or borehole	At least basic	Limited
Protected dug well	At least basic	Limited
Protected spring	At least basic	Limited
Bottled water	At least basic[2]	Limited
Rainwater refers	At least basic	Limited
Public tap or standpipe	At least basic	Limited
Tubewell or borehole	At least basic	Limited
Protected dug well	At least basic	Limited
Protected spring	At least basic	Limited
Unprotected spring	Unimproved	Unimproved
Unprotected dug well	Unimproved	Unimproved
Cart with small tank/drum	Unimproved	Unimproved
Tanker-truck	Unimproved	Unimproved
Surface water	Unimproved	Unimproved
Others	Unimproved	Unimproved

Notes:
[1] It is assumed to be safely managed but misses information on quality and continuity of service
[2] Classified as basic, on the condition that remaining domestic water needs are met from a basic water source

Source:
GLSS 6

If there is no record on the time to get water for any given household, it is assumed that this household spent less than 30 minutes to get water. This assumption might lead to overestimate of the service level for households that get water from springs and wells.

Sources of drinking water may vary from country to country, and the list of sources of water is not always standard between countries, although harmonization of categories has occurred under the influence of the JMP reports and the core WASH indicators issued by JMP and used by national statistical offices in designing the response options. While GLSS 6 shows more extensive list of sources of drinking water, some other datasets might provide shorter lists. For example, in Pakistan's HIES / HIICS 2015-16 dataset only 5 sources of water were listed, but they generally comply with Table 1.

2.Sanitation

When it comes to sanitation, LSMS usually has information on types of toilet used by households and whether this facility is shared with other households. Table C2 below shows a formation of different service levels (ladders) of sanitation based on WHO/ UNICEF JMP definitions.

Table C2.
A ladder of sanitation service level

TYPES OF TOILETS	NOT – SHARED	SHARED
W.C. – flush to septic tank or sewer	Safely managed[1]	Limited
KVIP	At least basic	Limited
Improved pit latrine	At least basic	Limited
Public toilet	-	Limited
Bucket/Pan	Unimproved	Unimproved
No facilities (bush/beach/field)	No service	-
Other/shared toilet facilities not meeting quality standards (e.g. no superstructure, open pit)	Unimproved	Unimproved

Table C2 shows that GLSS 6 provides 7 mutually exclusive type of toilets used in Ghana. There is no fully harmonized list of type of toilet across countries, although again, harmonization of categories has occurred under the influence of the JMP reports and the core WASH indicators issued by JMP and used by national statistical offices in designing the response options. Hence it is difficult, for example, to make correct judgements about whether a pit toilet meets the improved criterion or not.

According to JMP, improved sanitation facilities are "those designed to hygienically separate excreta from human contact, and include: flush/ pour flush to piped sewer system, septic tanks or pit latrines; ventilated improved pit latrines, composting toilets or pit latrines with slabs."[31] Therefore, some expert knowledge about technological aspects of different types of toilets in a different country is needed.

[1] This classification pre-supposes that human excreta is treated before safe disposal.

Figure Source:
GLSS 6

[31] https://washdata.org/monitoring/sanitation accessed 15 May 2020

C3. A variable on WASH expenditure

The LSMS usually provides information on a household's expenditure for water and wastewater / sewerage. This information may come in two ways. For example, in GLSS 6 expenditure for water supply and sewage removal can be found in *household expenditure section*. This section also requests information about a household's expenditure on major domestic equipment including water pumps and water cans. The same information, albeit more detailed, can be found in the *housing section*, which provides data not only about types of sources of drinking water or sanitation facility, it also sheds light on the quantity of water used, the value of the bill for water, and the actual household's payment for supplied water. Although the *Household expenditure section* contains data in a harmonized monetary unit per specified time period, data in *housing section* provides raw data with different units of measure. Therefore, it is always smart to utilize all information that exists in different parts of the survey datasets. The *Housing section* should be a starting point, whichever survey instrument is used for WASH analysis (e.g. LSMS, IES, etc).

Table C3 shows different units of measure for volume and time period used in *Housing section* of GLSS 6. According to this survey, there are 4 different measures of volume and 7 different measures of period of time.

Table C3.
Conversion to common units of measurement

WATER VOLUME		
Litre	Litre	1
Gallon	Litre	3.8
Bucket[1]	Litre	18-20
BILL FREQUENCY		
Daily	Monthly	0.03
Weekly	Monthly	0.23
Monthly	Monthly	1
Quarterly	Monthly	3
Half yearly	Monthly	6
Yearly	Monthly	12

[1] http://www.conversion-website.com/volume/bucket-to-liter.html

The GLSS 6 is unusual in that it provides very detailed information on WASH, while this is not always the case with other LSMS surveys. For example, the GLSS 6 reported data on quantity of water used, while none of the other five countries analysed had such information.

Also, surveys vary in how many units of measurement they use. For example, in the Pakistan HIES / HIICS 2015-16 survey, units of measurement for time and monetary values were already unified to one common denominator. Most surveys have a standard and unified approach when it comes to reporting periodic expenditure or WASH.

When it comes to WASH expenditure variable, it consists of several elements that can be found in each dataset. First, the questionnaire of the datasets has to be thoroughly investigated. For example, in GLSS 6 there are questions directly asking about households' expenditure for water (supplied) and toilet (used). This data is accompanied with a unit of time. Additionally, household were asked about their expenses for soap and other goods for hygienic purposes. Some households are pumping water to get drinking water in developing countries. In such cases, household expenditure on pumping equipment (amortization or maintenance) has to be taken into account as well. Electricity used for pumping water (if not hand-pumping) is impossible to impute unless there is a specific information on the use of energy for household appliances and lighting.

It is very important to take into account a variable on time to get water. This variable is presented in most LSMSs. Converting the time used to get water into corresponding monetary value is an imputation task. For example, in the analysis of GLSS 6, a minimum wage in Ghana in 2013 was used as a factor by which a variable of time (to get water) was multiplied to arrive at the monetary value. This approach might be disputable from an economic point of view because a minimum wage represents a labour market clearance rate, while the time spent for carrying water for a household use is not considered as market activity.

Nevertheless, this simple approach sheds a light on the burden that a household bears if one takes into account the opportunity cost of time.

Not all survey datasets provide all information about WASH. In particular households' expenditure for toilet use was not available for Pakistan, Uganda, Mexico and Zambia datasets. In Cambodia's dataset, there were only information about amount of money a (members of) household spent for accessing public toilets. Also, a variable on time to get water could be missing in some surveys; for example, the Uganda dataset did not have this variable.

As indicated above, useful data on WASH can be found in different parts of the surveys. It is important to separate these variables, recode them accordingly and label in a meaningful way. When working with datasets, similar information can be found in different parts of the survey, but it may need to be adjusted to the common metric for the analysis.

WASH expenditure variables can be expressed in two ways depending on the inclusion of imputed value of the time to collect water. In a formal way, this can be expressed in the following way:

EXPwash = EXPw +EXPt/s +EXPh.p (1), where

EXPwash
HOUSEHOLD EXPENDITURE FOR WASH PER MONTH

EXPw
HOUSEHOLD EXPENDITURE FOR WATER SUPPLIED PER MONTH

EXPt/s
HOUSEHOLD EXPENDITURE FOR TOILET USE AND SEWERAGE PER MONTH

EXP h.p
HOUSEHOLD EXPENDITURE FOR HYGIENIC PRODUCTS PER MONTH

In the datasets, calculation of total WASH expenditures using this formula requires adjustment. Data on expenditures across each WASH component may not be balanced. Data on expenditure for water is usually full and complete for each household record, but data on expenditures for sanitation facilities (toilet use and sewerage) might not be reported by some households. In some LSMS this issue is more acute than others. There are three main alternatives for dealing with missing values in this case.

1. All missing values were replaced by 0 (zero).
2. All missing values are ignored; hence average values do not include these households in the denominator.
3. All missing values are replaced by what sanitation and/or sewerage are expected to cost for each household (based on their sanitation option).

Our analysis adopts solution 1. There were two main reasons for this decision. The most important reason is that it is likely the household could not express a cost for sanitation and sewerage O&M because there were none, or they were minimal. Or, some costs, such as toilet cleaning materials or labour, are included under other expenditure categories. Hence by not including these households in estimation of average cost would likely lead to serious overestimation of the sanitation cost. Second, distribution of missing values was not uniform across all types and categories of expenditure. Deleting or omitting missing values from WASH variables would have to be accompanied with a similar procedure regarding other expenditure variables. The latter procedure would have led to alteration of household's ranking (computed by overall expenditure level). The third option is not feasible, given lack of data on sanitation O&M expenditures; and this approach is covered in the 'Required expenditures' indicator (indicator option 3).

Figure C1 shows the distribution of zero and non-zero values of overall WASH variables in GLSS 6.

Figure C1.
Distribution of Partial WASH expenditure share across major cut-offs

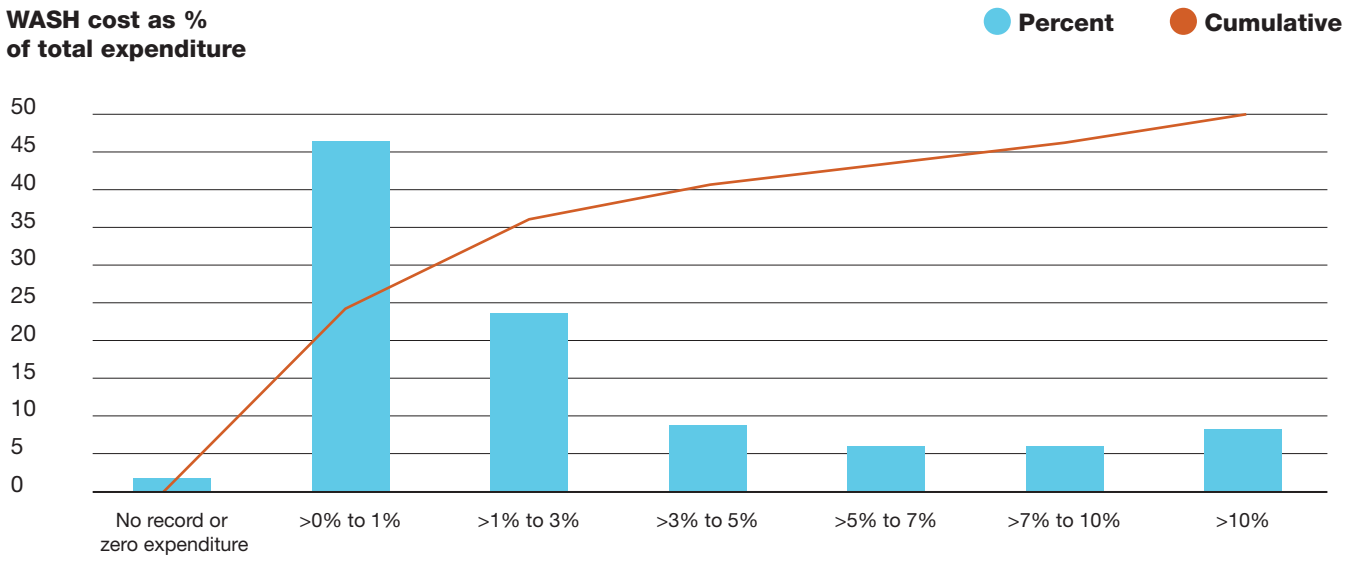

Figure 1 shows that about 1.3% of households reported either zero or no data for WASH expenditure. In the other datasets, the range varied from 2-4%.

If a household's WASH expenditure is estimated to include the monetary value of time spent to get water (round trip) then the formula will take the following form:

EXPwash_t = EXPw + EXPt/s + EXPh.p + (T*Ntr*Wm /480)*30.44 (2), where

Wm
A MINIMUM DAILY WAGE RATE (IN LOCAL CURRENCY PER DAY)

T
TIME SPENT FOR ROUND TRIP TO COLLECT WATER INCLUDING WAITING TIME; T=0 IF T<=10 MINUTES

Ntr
NUMBER OF ROUND TRIPS TO A SOURCE OF WATER PER DAY.

480
AVERAGE NUMBER OF HOURS WORKED PER DAY (TAKEN AS 8 HOURS, OR 480 MINUTES)

30.4
AVERAGE DAYS PER MONTH (365/12)

It is clear that **(2) > (1) if T >0**, so inclusion of time value shifts the household's WASH expenditure upwards.

India, November 10, 2018
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C4. Consumption expenditure by major categories and household characteristics[32]

There are 12 broad categories of consumption expenditure used in the WASH study. LSMS has a section titled *Household expenditures* that shows detailed records of all expenditures across food, non-durable goods, durable good, leisure, recreation and other items. These expenditures are grouped by categories. As before, expenditure for different items may be recorded for different time frames. For example, in most cases expenditure on food items is recorded for 14-day periods. Expenditures on durable and non-durable goods as well as leisure and recreation are often recorded for a month or for a year. Therefore, it is important to take into account the time period in estimating total annual equivalent expenditures. Total household expenditure was therefore calculated as the sum of all expenditures for all categories.

For estimations and for making required disaggregation, household characteristics were derived directly from the survey datasets. All surveys have the following variables: household size (number of household members), household's place of residence (rural or urban); household member's age and sex. Also, using LSMS datasets households can be grouped by level of their income that form income deciles or income quartiles. In this study, income deciles were calculated using ranking of household by their total annual expenditure per capita.

C5. WASH affordability indices formulas

WASH affordability indicators are described in section 3.2.1 of this report. How these indicators were computed is described below.

Partial WASH O&M expenditure (indicator option 2.1)

Partial O&M expenditure is calculated as a ratio of WASH expenditure variable (EXP wash) to total household expenditure. This ratio is expressed in percentage. As partial O&M expenditure is calculated for each household, an estimate for a country is a weighted mean of all households in the dataset. For example, O&M expenditure for Ghana is calculated using Table C4.

A. Partial WASH O&M expenditure (indicator option 2.1)

Partial O&M expenditure is calculated as a ratio of WASH expenditure variable (EXP wash) to total household expenditure. This ratio is expressed in percentage. As partial O&M expenditure is calculated for each household, an estimate for a country is a weighted mean of all households in the dataset. For example, O&M expenditure for Ghana is calculated using Table C4.

[32] Annex 1 provides all variable and construction of the new variables using GLSS 6

Table C4.
Input data to calculate partial WASH O&M expenditure, GLSS 6

NOMINAL VARIABLE	ITEM EXPEDITURE	GLSS6 FILE	CODE
Partical WASH O&M expediture	Expenditure on supply and miscellaneous services related to dwelling	Section 9 PART A	060 - 062
	Expenditure on sewerage	Section 9 PART A	59
	Avarage of amount of money HH pay for use of toilet facility AND amount of last bill	Section 7: HOUSING	17a, 17b
	Hygiene expenses on: washing soaps, bathing soaps, toilet papers and soaps	Section 9 PART B	180, 181, 186

B. Partial WASH O&M expenditure and time cost (indicator option 2.2)

Partial O&M expenditure and time cost is calculated as a ratio of WASH expenditure variable adjusted for the cost of fetching water (EXPwash_t) to total household expenditure. This ratio is also expressed in percentage. As partial O&M expenditure is calculated for each household, an estimate for a country is a weighted mean of all households in the dataset

C. Required O&M, capital and lump sum expenditure

In order to achieve basic WASH service level, a commitment for a certain level of expenditure for setting up, organizing, connecting, maintaining and running of WASH facilities and service is required. These expenditures can be broadly divided into three categories: i) operations and maintains, ii) capital, and iii) lump sum capital. The required cost estimates are produced in accordance with a different methodology that takes into account local conditions related to the whole value-chain of WASH service.

The required cost estimates are usually produced in USD term and for the current year. So, when the required cost estimates are available, they need to be converted into national currency of a country under the study. The conversion procedure is shown in the following four tables.

Table C5 shows cost estimates for achieving basic WASH service in Ghana for 2018. These estimates are in the US dollars

Table C5.
The 2018 estimate of the basic WASH cost in USD

REQUIRED COSTS PER SERVICE LEVEL		ANNUAL PER CAPITA COST				LUMP SUM CAPITAL PER CAPITA	
		Rural		Urban			
		O&M	Capital	O&M	Capital	Rural	Urban
Water	**Basic**	1	1.61	107.07	3.5	19.7	60
Sanitation	**Basic**	0.5	11.33	4.3	16.52	87.5	205.8
Hygiene	**Basic**	5	0.52	5.2	1.9	0.5	14.71

Table 5 reveals information about O&M, capital and lump sum per capita expenditures required to achieve basic WASH service level that is assumed to be available to a typical household in Ghana. The cost estimates are separately provided for urban and rural areas respectively.

Because the cost estimates in Table 15 are in the US terms, the average exchange rate of the US dollar to Cedis of Ghana for 2018 is to be used to express data in the table in the local currency in Table C6. The exchange rate data can be found in IMF or WB statistical resources in respective macroeconomic statistics branches.

In 2018, according to IMF, the official exchange rate of Ghana Cedis to per US dollar was 4.7.

Table C6.
The 2018 estimate in Ghana Cedis

REQUIRED COSTS PER SERVICE LEVEL		ANNUAL PER CAPITA COST				LUMP SUM CAPITAL PER CAPITA	
		Rural		Urban			
		O&M	Capital	O&M	Capital	Rural	Urban
Water	**Basic**	4.7	7.6	503.2	16.5	92.6	282.0
Sanitation	**Basic**	2.4	53.3	20.2	77.6	411.3	967.6
Hygiene	**Basic**	23.5	2.4	24.4	8.9	2.4	69.1

Table C6 shows required cost estimates per capita in Ghana Cedis for 2018. Table shows that required cost for basic WASH varies between rural and urban areas. Because LSM survey for Ghana is available for 2013, data in Table C3 needs to be deflated in order to reflect prices for that year.

One of the common ways of deflation is to use GDP deflator for different periods, in the Ghana case-study these periods are 2013 and 2018. Table C7 shows Ghana's GDP deflator and exchange rate for two periods.

Table Source:
The World Bank, 2018

Table C7.
Selected data on price levels and exchange rate in Ghana from 2013-2016

COUNTRY NAME	YEAR	GDP DEFLATOR (BASE YEAR VARIES BY COUNTRY)	OFFICIAL EXCHANGE RATE (LCU PER US$, PERIOD AVERAGE)
Ghana	2013	289.8	2.0
Ghana*	2018	576.1	4.7

If the base year is 2018, then change in the GDP deflator from 2013 through 2018 will be equal to 0.5. In other words, the overall price level in Ghana has increased 2 times over 5 years from 2013 to 2018.

Table C7 needs to be adjusted for change in price levels in order to derive the required cost estimates for 2013. Table C8 shows adjusted estimate of the required expenditure for achieving basic WASH service level in Ghana.

Table C8.
Adjusted 2013 estimate of the basic WASH cost in Ghana Cedis

REQUIRED COSTS PER SERVICE LEVEL		ANNUAL PER CAPITA COST				LUMP SUM CAPITAL PER CAPITA	
		Rural		Urban			
		O&M	Capital	O&M	Capital	Rural	Urban
Water	**Basic**	2.4	3.8	253.1	8.3	46.6	141.8
Sanitation	**Basic**	1.2	26.8	10.2	39.1	206.9	486.7
Hygiene	**Basic**	11.8	1.2	12.3	4.5	1.2	34.8

Table C8 shows input data for calculating WASH affordability indices for the basic service level based on GLSS 6. Following WASH affordability indicators – Indicator 3.1, Indicator 3.2 and Indicator 3.4 - are calculated based on data presented in Table C4. These input data have replaced data on per capita expenditure for water, sanitation and hygiene found/identified in the survey datasets.

i) Full operations and maintains expenditure for basic WASH service

Full operations and maintains expenditure for basic WASH service is calculated by the following formula:

REQo&m = Nhh * (REQ_Wo&m + REQ_So&m + REQ_Ho&m), where

REQo&m
FULL OPERATIONS AND MAINTAINS EXPENDITURE FOR BASIC WASH;

Nhh
HOUSEHOLD SIZE (OR NUMBER OF PEOPLE/MEMBERS IN A HOUSEHOLDS)

REQ_Wo&m
REQUIRED O&M EXPENDITURE FOR WATER

REQ_So&m
REQUIRED O&M EXPENDITURE FOR SANITATION

REQ_Ho&m
REQUIRED O&M EXPENDITURE FOR HYGIENE

Indicator 3.1 is calculated as is follows:

REQo&m = Nhh * (REQ_Wo&m + REQ_So&m + REQ_Ho&m), where

EXPtot
HOUSEHOLD ANNUAL TOTAL EXPENDITURE

ii) Full O&M and capital expenditure for basic WASH service capital

Full O&M and capital expenditure for basic WASH service is calculated by the following formula:

REQcapital = REQo&m + Nhh * (REQ_Wcapital + REQ_Scapital + REQ_Hcapital), where

REQcapital
FULL O&M AND CAPITAL EXPENDITURE FOR BASIC WASH;

REQo&m
FULL OPERATIONS AND MAINTAINS EXPENDITURE FOR BASIC WASH

Nhh
HOUSEHOLD SIZE (OR NUMBER OF PEOPLE/MEMBERS IN A HOUSEHOLDS)

REQ_Wcapital
REQUIRED CAPITAL EXPENDITURE FOR WATER

REQ_Scapital
REQUIRED CAPITAL EXPENDITURE FOR SANITATION

REQ_Hcapital
REQUIRED CAPITAL EXPENDITURE FOR HYGIENE

Indicator 3.2 is calculated as is follows:

Indicator 3.2 = 100* REQcapital / EXPtot, where

EXPto
HOUSEHOLD ANNUAL TOTAL EXPENDITURE

iii) Full O&M and capital and lump sum expenditure for basic WASH service capital

Full O&M and capital and lump sum expenditure for basic WASH service is calculated by the following formula:

REQfull = REQo&m+REQcapital+Nhh*(REQ_Wl/s+REQ_Sl/s + REQ_Hl/s), where

REQfull
FULL O&M AND CAPITAL AND LUMP SUM EXPENDITURE FOR BASIC WASH SERVICE

REQcapital
FULL O&M AND CAPITAL EXPENDITURE FOR BASIC WASH;

REQo&m
FULL OPERATIONS AND MAINTAINS EXPENDITURE FOR BASIC WASH

Nhh
HOUSEHOLD SIZE (OR NUMBER OF PEOPLE/MEMBERS IN A HOUSEHOLDS)

REQ_Wl/s
REQUIRED LUMP SUM CAPITAL EXPENDITURE FOR WATER

REQ_Sl/s
REQUIRED LUMP SUM CAPITAL EXPENDITURE FOR SANITATION

REQ_Hl/s
REQUIRED LUMP SUM CAPITAL EXPENDITURE FOR HYGIENE

Indicator 3.3 is calculated as is follows:

Indicator 3.2 = 100* REQfull / EXPtot, where

EXPtot
HOUSEHOLD ANNUAL TOTAL EXPENDITURE

11 Annex D. Countries with income and expenditure surveys since 2014

Low- and middle-income countries with a national survey that collects income and expenditure data, including WASH expenditure – covering period 2014-2020

COUNTRY	SURVEY NAME	LATEST YEAR
Afghanistan	Living Conditions Survey	2016-2017
Albania	Household Budget Survey	2015
American Samoa	Household Income and Expenditure Survey	2015
Armenia	Integrated Living Conditions Survey	2016
Bangladesh	Household Income and Expenditure Survey	2016-2017
Bolivia	Encuesta de Hogares	2018
Bosnia & Herzegovina	Household Budget Survey	2015
Brazil	Pesquisa de Orçamentos Familiares	2018-2019
Bulgaria	Household Budget Survey	2014
Burkina Faso	Enquête Multisectorielle Continue	2014
Burundi	Enquête sur les conditions de vie des ménages	2014
Cambodia	Household Socio-Economic Survey	2017
Cook Islands	Household Income and Expenditure Survey	2015-2016
Cape Verdi	Inquérito às Despesas e Receitas Familiares	2014-2015
Colombia	Gran Encuesta Integrada de Hogares	2015
Croatia	Household Budget Survey	2014
Egypt, Arab Rep	Household Income, Expenditure, and Consumption Survey	2015
Ethiopia	Socioeconomic Survey	2015-2016
French Polynesia	Household Income and Expenditure Survey	2015
Ghana	Living Standards Survey	2017
Guatemala	Encuesta Nacional sobre Condiciones de Vida	2014
India	Household Expenditure on Services and Durable Goods:	2014-2015
Indonesia	National Socio-Economic Survey	2016
Iraq	Rapid Welfare Monitoring Survey	2017
Kazakhstan	Household Budget Survey	2014
Kenya	Household budget survey	2016
Kiribati	Household Income and Expenditure Survey	2019
Liberia	Household Income and Expenditure Survey	2016
Malawi	Fourth Integrated Household Survey	2016-2017

COUNTRY	SURVEY NAME	LATEST YEAR
Maldives	Household Income and Expenditure Survey	2016
Mali	Enquête Agricole de Conjoncture Intégrée aux Conditions de Vie des Ménages	2017
Marshall Islands	Household Income and Expenditure Survey	2017
Mexico	Encuesta Nacional de Ingresos y Gastos de los Hogares	2018
Micronesia	Household Income, Consumption and Expenditure Survey	2014
Mongolia	Household Socio Economic Survey	2016
Mozambique	Inquérito sobre Orcamento Familiar	2019-2020
Namibia	Household Income and Expenditure Survey	2015-2016
Nepal	Annual Household Survey	2014-2015
Niger	National Survey on Household Living Conditions and Agriculture	2014
Nigeria	General Household Survey	2018-2019
Niue	Household Income and Expenditure Survey	2015-2016
Palau	Household Income, Consumption and Expenditure Survey	2014
Pakistan	Social and Living Standards Measurement Survey	2013-2014
Russian Federation	Household Budget Survey	2015
Rwanda	Integrated Household Survey on Living Conditions	2017
Samoa	Household Income and Expenditure Survey	2018
South Africa	Quality of Life Survey IV	2015-2016
Tajikistan	Household Budget Survey	2016
Tajikistan	Survey of WASH for Households and Schools	2017
Tanzania	National Panel Survey	2014-2015
Tonga	Household Income and Expenditure Survey	2015-2016
Togo	Questionnaire sur les Indicateurs de Base du Bien-être	2015
Tokelau	Household Income and Expenditure Survey	2015-2016
Thailand	Household Socio-Economic Survey	2017
The Gambia	Integrated Household Survey	2015
Tuvalu	Household Income and Expenditure Survey	2015-2016
Uganda	National Panel Survey	2015-2016
United Arab Emirates	Income and Expenditure Household Survey	2014-2015
Uzbekistan	Household Budget Survey	2017
West Bank and Gaza	Expenditure and Consumption Survey	2016
Zambia	Living Conditions Monitoring Survey VII	2015

Sources:
https://microdata.worldbank.org/index.php/home
https://www.ilo.org/surveyLib/index.php/catalog
https://catalog.ihsn.org/index.php/catalog
https://microdata.pacificdata.org/index.php/home
http://www.erfdataportal.com/index.php/catalog

Note: this list excludes European countries where Income and Living Surveys are regularly conducted:
https://ec.europa.eu/eurostat/web/income-and-living-conditions/quality/questionnaires

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