

## **Assessing the Affordability of Water, Sanitation and Hygiene: Cambodia Country Case Study**

UNICEF and WHO with the Expert Consultative Group on WASH Affordability<sup>1</sup>

### ***Executive Summary***

#### *Improving Access*

Affordability is an essential part of improving access to water, sanitation and hygiene (WaSH) products and services. The cost of access, whether that is a monthly bill or an investment in household infrastructure, is sometimes the largest barrier to improved access. Household budgets may only allow for access to water sources that are far from the home; or that carry some risk of being contaminated; or that are at risk of late deliveries or insufficient quantities of water; or that are at risk of drying up entirely, either seasonally or due to climate shifts. Intra-household budget allocations may not allow for safe, clean and dignified public latrines; limited access to credit or ability to save may hinder private latrine construction; it may also prevent proper treatment of wastes before disposal into the environment. Making prices and costs affordable is not always a sufficient condition, but is a necessary condition for improving access.

Yet, very little has been done to track affordability at the global scale; no single indicator, nor set of indicators has been adopted in order to elucidate the relationship between policies, interventions and household costs within the WaSH sector. While it is easy to see that affordability is an essential part of any effort meant to improve WaSH access, tracking affordability is complicated and presents a unique set of challenges. With that in mind, we present a comprehensive assessment of an exhaustive list of affordability indicators, in the hopes that our efforts may eventually lead to improved tracking, more focused efforts and increased transparency of this essential component of WaSH.

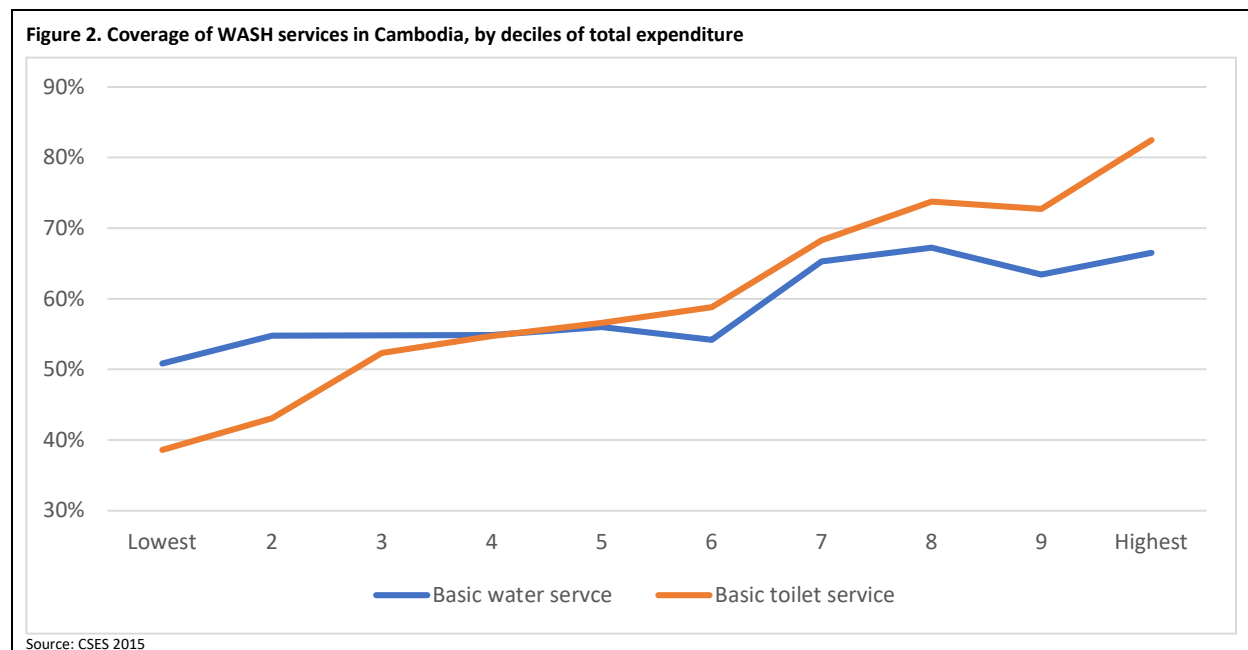
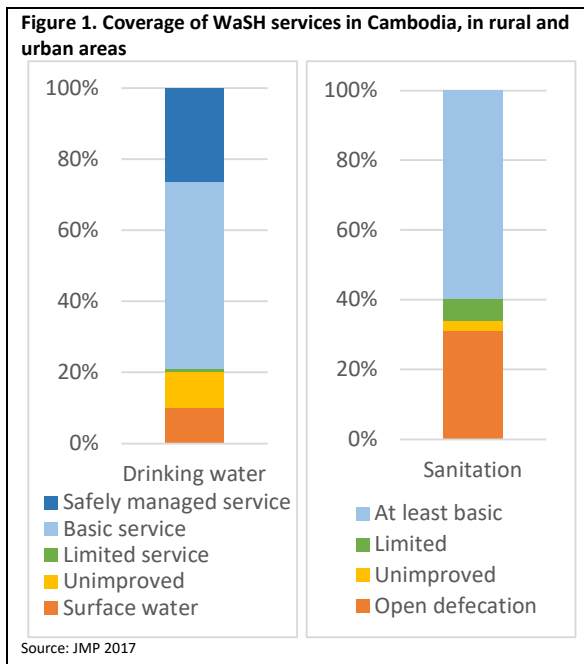
In order to assess our affordability indicators, we have applied them to six different countries, including Ghana, Mexico, Uganda, Pakistan, Cambodia and Zambia. This executive summary focuses on the case of Cambodia. Using data from Cambodia Socio-Economic Survey 2015 (CSES), we have data on access to WaSH services, some data on O&M expenditures for WaSH and total household expenditures.

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<sup>1</sup> See full report for list of expert group (“The Measurement and Monitoring of Water Supply, Sanitation and Hygiene (WASH) Affordability”). The authors of this country report were: Zachary Burt (UNICEF Consultant) conducted data analysis and drafted this report; Akmal Abdurazakov (UNICEF Consultant) conducted data extraction and data analysis; Guy Hutton (Senior Adviser for WASH, UNICEF New York) lead the study and contributed to data analysis and report drafting.

In Cambodia there is a wide gap in access between urban and rural areas. In 2017, 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 1).

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%; but the difference in coverage to basic sanitation access between the lowest and highest deciles of total expenditure was 44% (see Figure 2). As can be seen in Figure 2, while there is a positive correlation between total household expenditure and coverage of basic access for both water and sanitation, it is stronger for sanitation.



### Defining Affordability

When it comes to accessing WaSH services, affordability has three dimensions: (i) the price or cost of WaSH services; (ii) the spending power of the household; and (iii) the price or cost of other household needs. The interplay between these three dimensions is depicted 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 if there is a desire to categorise households.

**Table 1. Degree of vulnerability resulting from three dimensions of WaSH affordability**

Matrix	Welfare state or other source covers health, education, housing, pension, etc		Welfare state or other source does not cover health, education, housing, pension, etc	
	WaSH prices low	WaSH prices high	WaSH prices low	WaSH prices high
Low income	Not Vulnerable	Vulnerable	Vulnerable	Most vulnerable
Median income	Not Vulnerable	Not Vulnerable	Not Vulnerable	Vulnerable

Policies and programs can be designed to address one or more of these dimensions. Policies not aimed at these three dimensions may nonetheless have a deleterious, or beneficial, impact on them all the same. For example, if an urban piped-water network is

newly expanded into a peri-urban area that had previously only used private wells, the average cost of water service may go down. Likewise, if an urban core that already has intermittent piped water services is upgraded to continuous piped water services, the average cost of water may go up.

In order to better track intentional efforts and unintended consequences, we propose the use of affordability indicators. Such an indicator can be used to compare progress on WaSH affordability over time or between different countries, regions, cities and socio-economic strata. Indicators are useful to assess the impact of interventions focused on affordability; they can also be used to put pressure on service providers to make access to WaSH more affordable.

An indicator of affordability must also include a definition of what we mean by ‘access’. In the case of WaSH, any indicator of affordability should explicitly define the minimum level or type of access considered acceptable. The question is not just if households have the ability to pay for the access they have, but whether or not that access meets the requirements of the human right to water, or the Sustainable Development Goals (SDGs), or some other national policy goal. An affordability indicator which does not define minimum acceptable service levels will find lower levels of access to be more affordable; designing an affordability indicator which promotes risky, unreliable water sources, or undignified, unhealthy places for defecation, is not acceptable. For example, when expanding access to boreholes in drought-prone areas, it may be cheaper to drill shallow wells that dry up as the climate shifts; or in urban areas, it may be cheaper to provide free trucked water, or standpipes, to slum areas, and only build pipes in middle and high income neighborhoods. Likewise, unlined pit latrines are cheaper than septic tanks or lined pits, but in places with a high water table they may contaminate local wells; and community toilets may be cheaper when they don’t have proper lighting or an attendant at night, but in so doing they also become more dangerous, especially for women.

Affordability is a major determinant of whether WaSH access improves, or declines, over time. It is an important first step towards breaking down the determinants of access. Reliability and resilience are also important factors determining WaSH access over time. 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 backsliding in access. In the same way, as the climate shifts, it may become necessary to define minimum levels of resilience and reliability. For example, if the water utility operator in Phnom Penh reduces volumetric tariffs for piped water access, and the loss in revenues leads directly to insufficient funds for operations or maintenance, then this could lead to decreased reliability and resilience of piped water services. In this

scenario, an increase in affordability will have been due to a decrease in reliability and resilience, an undesirable outcome.

### *Design Categories for Affordability Indicators*

There are many affordability indicator options which to a lesser or greater extent capture the cost of access to WaSH, the spending power of households, the cost of other basic needs and the quality of access. We have grouped indicators based on method of calculation, creating four main categories as applied to the household level.

1. **Reported and estimated expenditures:** These indicators use reported expenditure on WaSH access, collected through household survey, or estimated expenditures based on the average cost of a defined minimum level of access, then divided by some estimate of household spending power.
2. **Revealed household preferences:** Observed preferences expressed through household willingness to pay (WTP) or aggregated demand for WaSH products and services. The relationship between price and demand is modeled, a minimum level of access is specified, and 'affordable access' is defined by the cost at which households demand at least that minimum level.
3. **Stated household preferences:** Reported preferences for WaSH access, exclusively WTP studies, modeling the relationship between prices and consumption. They typically involve an interview with the household member(s) responsible for WaSH access and budget decisions, posing a range of questions to elicit WTP estimates. A minimum level of access is specified, and 'affordable access' is defined by the cost at which households demand at least that minimum level.
4. **Comprehensive household poverty assessment:** Broad assessments of household poverty examine household wealth in the context of the range of basic needs they are expected to satisfy, and they include a number of approaches that examine the poverty line in relation to WaSH and the interplay between expenditures on different basic needs.

In this executive summary we will explore mainly design category 1, for which data are available for Cambodia: reported and estimated expenditures.

Note that household affordability cannot be looked at in isolation from overall affordability to society, given that subsidized services to make WaSH services more affordable to households needs to be paid from somewhere – e.g. cross-subsidies from businesses, cross-subsidies from other categories of household, or from the government – but that these subsidies might not be sustainable over time. If this is the case, cost shifting over time to the (poor) household might lead to WaSH services becoming less affordable. Second, WaSH service pricing might not currently take into account environmental considerations, such as pollution via fecal matter or wastewater not being treated, or extraction of water at unsustainable levels, which in the longer term will lead to higher priced services. Therefore, these issues need to be considered in the interpretation of the assessment of household-level affordability.

### *Assessment of Affordability Indicators*

There is unlikely to be any single indicator which entirely captures the full essence of the affordability of WaSH services for all countries and all settings within a country. Hence, it will be necessary to have a flexible approach to measuring affordability, based on the context and the data available. Our assessment includes three principals:

1. **Feasibility:** the ease of estimating an indicator, given data availability

2. **Validity:** the degree to which the definition of an indicator has encompassed each of the dimensions of affordability.
3. **Accuracy:** The degree to which we might expect that an indicator has captured the definition intended.

Our goal is not to select a single indicator that best meets these three principals for global usage, but to present a thorough assessment of the available indicators in six countries, and conclude with a detailed listing of the issues that should be taken into consideration. Ultimately, it may end with a subset of indicators for ready consideration for national and/or global monitoring.

#### *Design Category 1: Reported and Estimated Expenditures*

Household costs of WaSH expressed as a proportion of spending power is a category of affordability indicators that compares what they are spending, or might spend, on WaSH in relation to their total income or expenditure. Part of the design of each indicator is the definition of thresholds and cut-offs for different aspects of access which we have deemed might be relevant. This indicator category covers only the first two dimensions of affordability: WaSH prices and household income; it does not include the third dimension, which looks at the cost of meeting other basic needs.

We have identified three kinds of expenditure data that one might use for these types of indicators: option 1 is to use full, actual WaSH expenditures; option 2 is to use partial, actual WaSH expenditures; and option 3 is to use full, estimated WaSH expenditures (see Table 2). Actual WaSH expenditures are reported, and due to the limited questions in expenditure surveys they often cover only partial O&M expenses; and they represent the current level of access experienced by households (which either may not meet the minimum requirements of policy goals or they may exceed those minimum requirements). Estimated WaSH expenditures can be set at minimum acceptable levels of access, and used to modify reported data: for our indicator design, households with less than a basic level of access<sup>2</sup> had reported cost data replaced by our estimated cost of minimum access. Given the unavailability of full cost data sets, Option 1 indicators were not feasible at this time. For Option 2 and Option 3, we defined 2.1 and 3.1 as only including O&M costs; 2.2 and 3.2 as including O&M and time costs; 2.3 and 3.3 as including total capital costs; 2.4 and 3.4 as including annualized capital costs and O&M costs; and 2.5 and 3.5 as including annualized capital costs, O&M costs and time costs. Given the availability of data, 2.3, 2.4 and 2.5 were not feasible at this time. Indicators 2.2, 3.2 and 3.5 require an estimate of time expenditure, which was not part of our analysis for Cambodia. The remaining indicators have been used in the examples, below.

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<sup>2</sup> 'Basic access' here is defined as meeting the JMP definition for basic access for water, sanitation and hygiene.

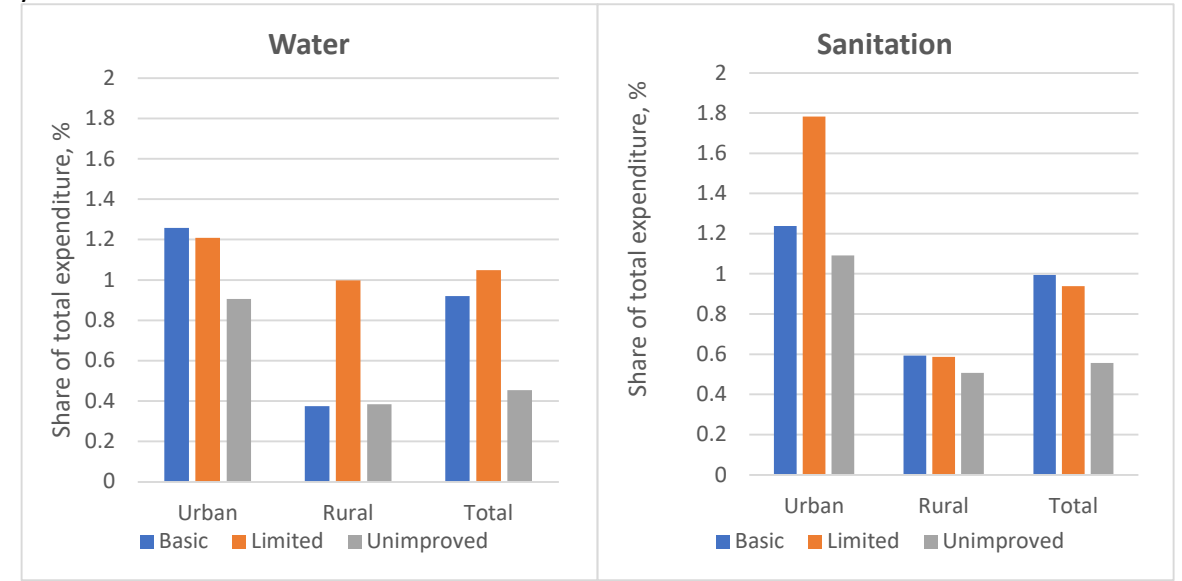
**Table 2. Summary of expenditure or cost items included in each indicator**

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
<b>Option 1: full actual expenditure</b>										
Option 1.1	✓									
Option 1.2	✓					✓				
Option 1.3			✓							
Option 1.4	✓				✓					
Option 1.5	✓				✓	✓				
<b>Option 2: partial actual expenditure</b>										
Option 2.1		✓								
Option 2.2		✓				✓				
Option 2.3				✓						
Option 2.4		✓			✓					
Option 2.5		✓			✓	✓				
<b>Option 3: full required expenditure</b>										
Option 3.1							✓			
Option 3.2							✓			✓
Option 3.3								✓		
Option 3.4							✓		✓	
Option 3.5							✓		✓	✓

These different types of WaSH cost data were then divided by a measure of household spending power. For these we found five possibilities: total annual income (A); disposable annual income (after taxes) (B); total annual expenditure (C); annual expenditure on discretionary items (D); and minimum wage rate (E). The third of these (C) is considered a more reliable estimate of household cash resources than reported income, so this was what we used in our example indicators. Using these affordability indicator definitions, we can then apply these indicators across different data stratifications.

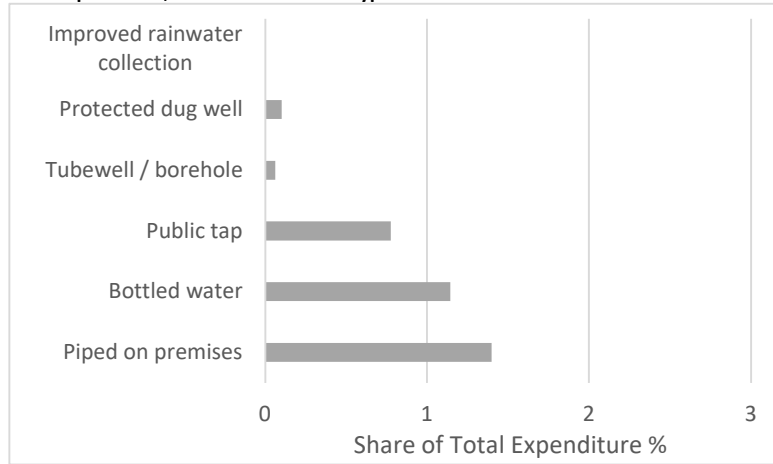
On average, expenditure on WASH services for any service level does not go above 3%, implying that each service level remains affordable for the average Cambodian household. But it should be noted that limited water access in rural areas and limited sanitation access in urban areas had higher shares of total household expenditure than more improved types of access (see Figure 3).

**Figure 3. Annual per capita expenditures for water and annual per capita expenditures for sanitation as shares of total expenditure, by household residence location**



Source: CSES 2015

**Figure 4. Annual per capita expenditures for improved water sources as shares of total expenditure, across water access types**

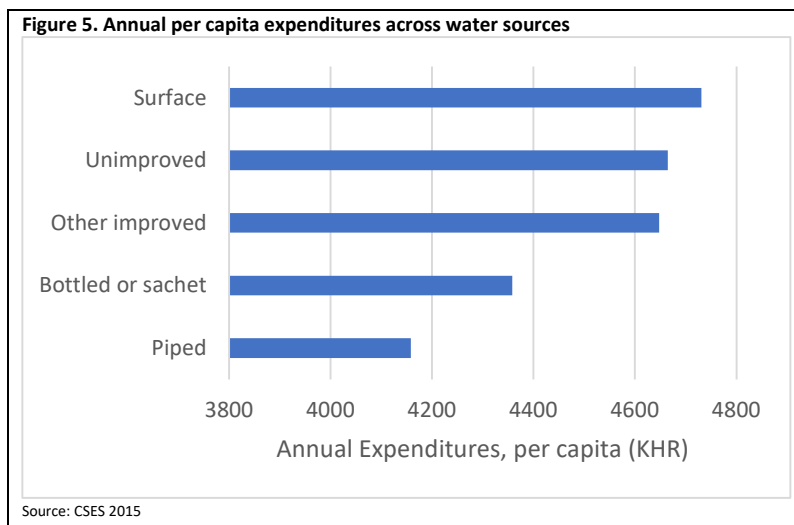


Source: CSES 2015

Breaking expenditures down by types of access, Figure 4 shows that piped water and bottled water take a larger share of total expenditures than rainwater harvesting and improved wells. In a similar analysis, we found that delivered trucked water and vended water are almost twice the expenditure share as piped water, while other forms of unimproved water access are a much lower share of total expenditure. The same analysis on sanitation showed that hanging latrines are more expensive than all

types of improved sanitation, and improved pit latrines are roughly the same expenditure share as having no private latrine.<sup>3</sup>

<sup>3</sup> 'None' in the CSES refers to having no private latrine in the home. Presumably the households with expenditures on sanitation in the 'none' category were spending money on a shared private latrine located outside the home or a public latrine.

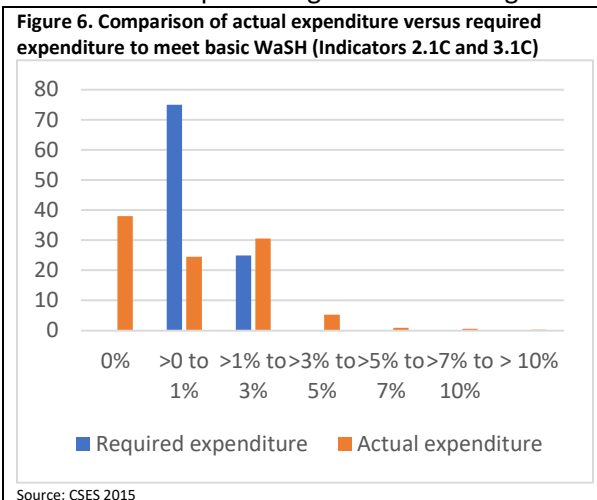


Surprisingly, surface water was the most expensive option. It might be the case that households are using a man-made community-maintained surface water reservoir, which is paid for through some kind of shared expense. The same logic may apply to all sources, other than bottle/sachet. In such cases, the piped water systems would likely have larger economies of scale, meaning that the larger the systems get, the lower the per unit cost, as the fixed initial capital investments

are spread among more and more people. In addition, while surface water reservoirs are likely maintained at the community level, piped water systems, especially in urban areas, are administered through a government or municipal organization, allowing for the possibility of subsidization through government revenues, and further decreasing the costs at the household level (see Figure 5).

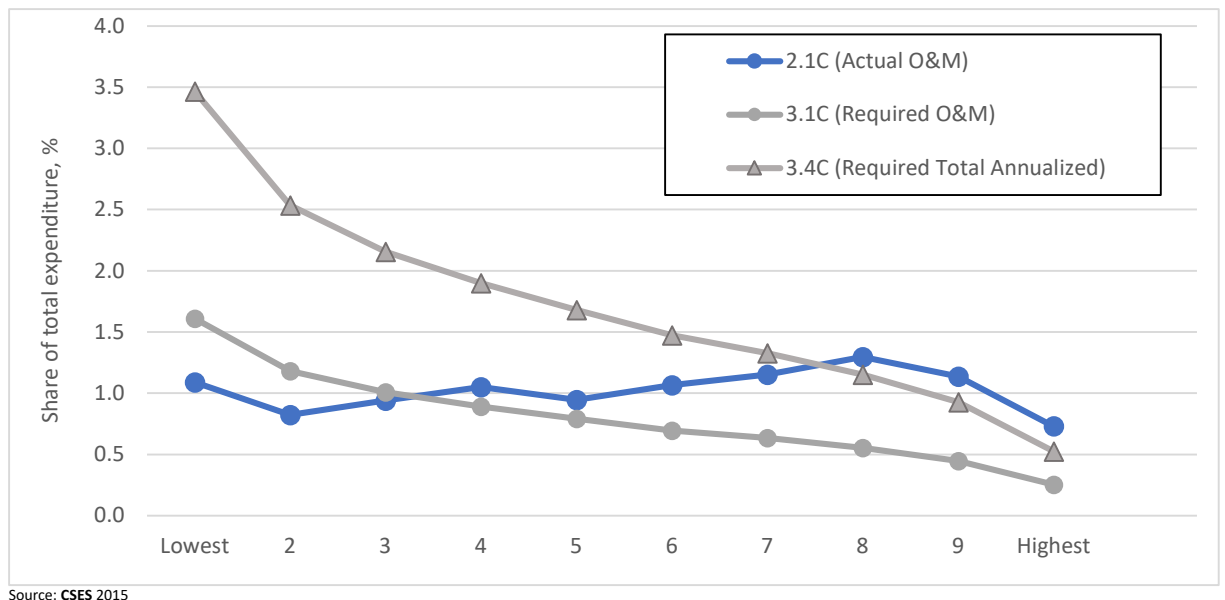
In Figure 6, we have tracked the frequency of occurrence for different levels of affordability indicators 2.1C and 3.1C. Without choosing a cut-off for the minimum percentage of total expenditure that might be considered affordable, this analysis shows the distribution of different percentage-levels. Looking at the

distribution of affordability indicator 3.1C, we see that the required cost of basic access is less than 1% of total expenditure for roughly three-quarters of households. For indicator 2.1C, 38% have reported zero partial costs, which is less than the required costs for basic access, 25% have reported partial costs at less than 1% of total expenditure, which meets the required costs of basic access for most households, and 38% were spending more than 1% of total expenditure, still indicating a high degree of affordability. The majority of households had actual expenditures equal to or higher than the expenses required for basic access (affordability indicator 3.1C - see Figure 6).



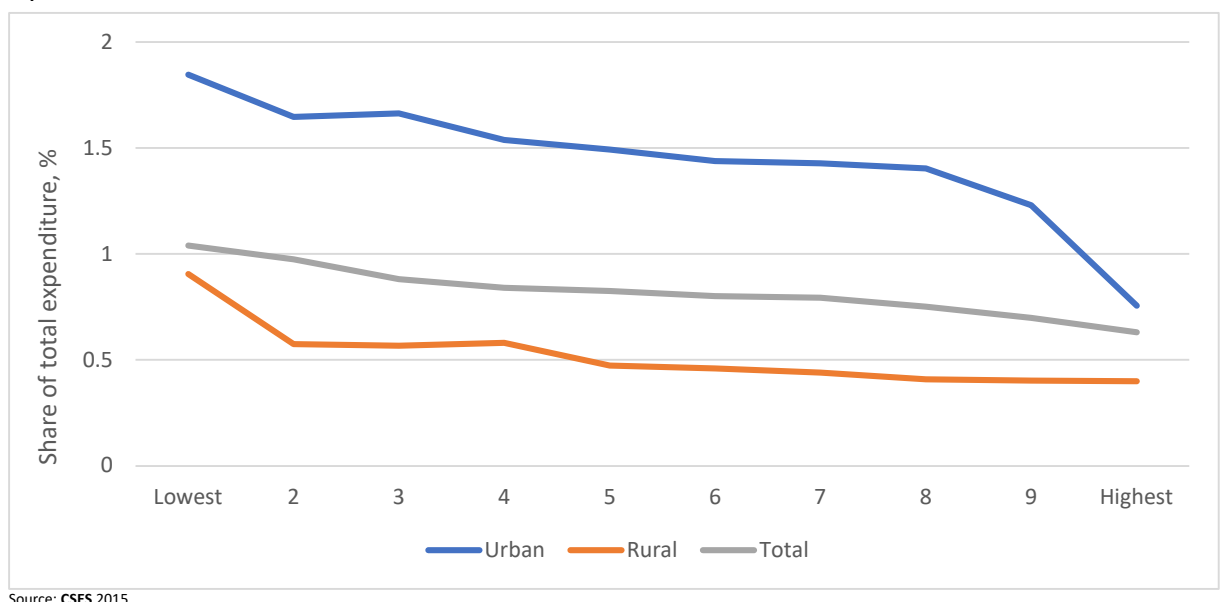


**Figure 7. Comparison of WaSH costs as percent of total expenditure under different indicators, by deciles of total expenditure**



Comparing actual O&M, required O&M and required total annualized expenditures in Figure 6, we can see that the average actual O&M expenditure reported for each decile was above the required O&M expenditure for basic access, for all except the bottom three deciles. Actual O&M expenditures were lower than for required total annualized expenditures (indicator 3.4C) for all except the three highest deciles (see Figure 7). This was a surprising result, as it would imply that (i) a large number of rich households are not using basic WASH access and (ii) these richer households are paying more for unimproved WASH services than the cost estimates we gathered for basic WASH access in Cambodia. For both of these assumptions to hold, seems unlikely, calling into question the validity of these results, and perhaps the validity of the original dataset.

**Figure 8. WaSH costs as percent of total expenditure (indicator 2.1C – Actual O&M) across urban and rural areas and by deciles of total expenditure**



In Figure 8 we have actual expenditures on WASH as a share of total expenditure, across rural and urban areas and deciles of total expenditure. As can be seen, although the percentage of expenditures is low in both rural and urban areas and relatively flat across income groups, it is consistently higher in urban areas than in rural areas. This may imply that any interventions aimed at improving affordability should start with the urban poor.

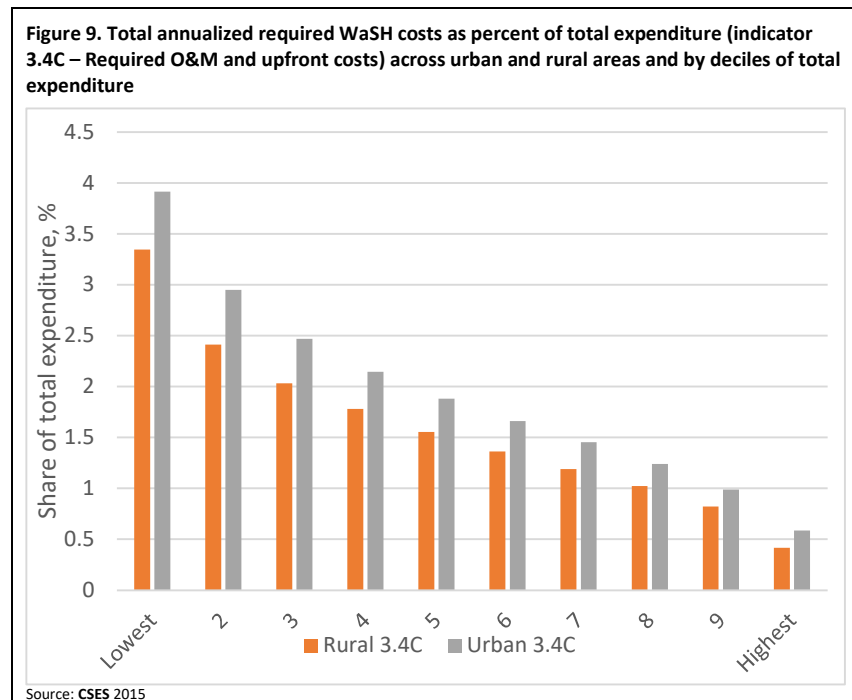


Figure 9 compares total annualized WASH costs as a percentage of total expenditure (indicator 3.4C), across urban and rural areas by deciles of total expenditure. As with indicator 2.1C, indicator 3.4C shows that WASH access is more affordable in rural areas. Unlike 2.1C, there is a strong negative correlation between the indicator and income level: households in the poorest decile ended up spending the largest proportion of their expenditures on WASH – on average nearly eight times as much as households in the

highest decile.

Looking at all possible affordability indicators that use a ratio of costs to spending power, we have tried to assess the feasibility, accuracy and validity of each. Despite being perhaps the most valid affordability indicator, data limitations make indicators which use full actual expenditures on WaSH access (Option 1) infeasible at present (except through a new set of survey questions). Affordability indicators which use partial actual expenditures, by definition, do not include all costs and are therefore less valid and less accurate. But in the case of Cambodia we do have data on partial actual expenditures, which make feasible affordability indicators under Option 2 and Option 3.

Setting a minimum level of access for an indicator is a way of ensuring that affordability goals are not achieved at the cost of improved access to WaSH. We incorporated this in affordability indicators 3.1 - 3.5 by estimating the required costs for basic access, and replacing the actual costs for any household that did not have at least basic access. While we would argue that this increases the validity of the indicators, it is possible that it also decreases its accuracy.

### *Enabling Environment*

The enabling environment is a broad, catch-all phrase that can include legal instruments, citizen voice, policies and programmatic measures. Such measures protect the poor from the cost of WASH services either directly or indirectly, either by lowering the costs of WASH (or other) services for households, or by increasing household income to pay for WASH services or other essential services. These measures cover

the first two dimensions of affordability, if the measures are WASH-specific. However, if the measures are not WASH-specific (e.g. a general household income support or change in prices of healthcare, education, food or rent), then it covers the third dimension. The analysis here contains information from the UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS), administered by WHO.

In Cambodia, there is no legal recognition of the human right to water and sanitation. A national water and sanitation policy has been approved and national implementation plans have been approved and partially implemented for rural drinking water and sanitation, and nationally for hygiene. But there is no national implementation plan for urban drinking water, and a national implementation plan for urban sanitation was only beginning to be developed as of 2019. The national target for sanitation is 100% coverage of basic sanitation by 2025, in both urban and rural areas. The national targets for water do not use JMP definitions for access, but they are also set for 100% coverage by 2025, in both rural and urban areas. For hygiene the goal is 100% access to handwashing facility, soap and water by 2025. As sourced from GLAAS, there is no government-led process to monitor progress towards these targets, and no formal joint sector review to assess progress. Furthermore, there is no regulatory authority responsible for the quality of service delivery. A regulatory authority does exist for the setting of tariffs, for both water and wastewater, but only for urban areas, not rural areas.

As of 2016/2017, a financing plan for meeting WASH targets has been developed, implemented and consistently followed for WASH access in schools. For water and sanitation in rural areas, and for hygiene access nationally, financing plans have been agreed, but insufficiently implemented. And for urban sanitation and drinking water financing plans have not yet been agreed, let alone implemented or followed. Cambodia has an official affordability scheme for urban drinking water, but nothing for urban sanitation nor for rural WASH in general. There is no publicly available monitoring of the distribution and nature of subsidies across income levels and social groups.

Potential future affordability indicators may need to track the distribution of costs over different income levels and social groups. For the time being, Cambodia does not track the equity of access, nor the distribution of costs and subsidies. It has in place measures to bring access to poor populations, but these measures address only drinking water access in urban areas. Community participation procedures for WASH in both urban and rural areas are officially defined by the government, although women's participation is only included explicitly for drinking water and sanitation in rural areas. Participation should give opportunity for WASH users to provide a certain degree of input and feedback, at least at the local level, but as of 2016/2017 these procedures were only partially implemented in rural areas and not implemented in urban areas.

### *Conclusion*

We find it important that an assessment is done when choosing which affordability indicator makes the most sense, and we argue that validity, feasibility and accuracy as we have defined them, are key criteria to be considered. In terms of judging what is affordable versus what is not affordable, the most valid indicator is one that includes all three dimensions of affordability; preference modeling meets this criteria, but unfortunately such models were not available for Cambodia. WaSH expenditure data and total household expenditure data are available, and affordability indicators based on a ratio of the former over the latter incorporates at least the first two dimensions of affordability. Cambodian households with basic water access spent, on average, 0.9% of their total annual expenditure on water, and households with

basic sanitation access spent, on average 1% of the total annual expenditure on sanitation, as captured in the CSES (2015).

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"<sup>4</sup>. While there does not appear to be an affordability issue for most households, including the majority of low-income households, there is still some difference in access and WaSH spending as a proportion of total expenditure between the poorest households and the richest, as can be seen by data on coverage and our affordability indicators, respectively.

*Recommendations - Data*

Data were available for Cambodia for time expenditures associated with water collection but no data was collected regarding 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. 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 3.

Table 2: Recommended indicators for better data regarding affordability

<b>Data needed to estimate indicators 2.1C-2.5C/3.1C-3.5C</b>
Hygiene partial O&M expenditure
Water capital expenditure
Sanitation capital expenditure
Hygiene capital expenditure
Number of trips per day to collect water
Time spent per day/month on urination, defecation & menstruation
Household time budgets for housework & leisure
<b>Reliability and Resilience of Access</b>
Last time the water facility broke down, how long did it take to have it fixed and working again?
Frequency of deliveries/availability
When was the last time the water facility broke down?
How has the availability of safe water for household consumption changed in your community since 2008?
Seasonal water access
Seasonal time to collect water
<b>Static Assessment of Demand (Consumption Level)</b>
Deficiency of water quantity
<b>Comprehensive Poverty Assessments</b>
Regular payment of water charges
Poor/non-poor status
Major reason for incomplete toilet coverage
Main constraints when trying to access safe water sources

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 and 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 tradeoffs 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 tradeoffs between affordability and reliability, resilience or intra-household equity. 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

<sup>4</sup> General Comment 15, The right to water (Twenty-ninth session, 2002), U.N. Doc. E/C.12/2002/11 (2003). paras. 26-27.

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. In addition, comprehensive poverty assessments, the fourth category of affordability require information such as poor/non-poor status, or regular payments of water charges. We recommend that such analyses be explored in the future, and if possible, some of the questions listed in Table 3, or other similar types of information, be integrated into future data collection efforts.

#### *Recommendations - Policy*

Increases in production efficiency might decrease costs, and should be pursued when possible, but in many cases the cost of access will need to be subsidized in order to make access more affordable for certain groups. Indeed, WASH access is currently subsidized in many locations around the globe. But it is important that subsidies are designed in such a way that they encourage improvement and expansion of access over time and have a net positive impact over all locations and social groups. Furthermore, it has been observed that subsidies do sometimes go to more privileged or better resourced households, while marginalized and poorer households are over-looked. Affordability is likely to be a barrier for the extension of basic WaSH access to all Cambodian households, and will be a major issue in any further movements up the service ladder to piped and safely managed services to all households, especially in rural areas and low-income urban areas. We would argue that adopting an indicator of affordability should be a priority for policy makers in the WaSH sector in order to make sure that subsidies are distributed in such a way that those who can least afford basic access are prioritized.