Measuring Water, Sanitation, and Hygiene in a Census

Select Topics in International Censuses[1]

Released November 2021

INTRODUCTION

In 2010, the United Nations General Assembly adopted Resolution 64/292, establishing a basic and universal human right to water and sanitation. Water, sanitation, and hygiene (WASH) practitioners have responded to that call, developing over 220 different WASH measurement frameworks and tools in the 10 years that have passed since the adoption of Resolution 64/292 (Ajroud et al., 2020; Schweitzer et al., 2014).

This technical note discusses advances in the measurement and reporting of WASH and provides actionable guidance for National Statistical Office (NSO) experts to follow as they prepare their census questionnaire.

SUSTAINABLE DEVELOPMENT GOALS (SDG) AND SURVEY INTEGRATION

The global transition from the 2020 Millennium Development Goals (MDG) to the 2030 SDGs involved a significant improvement in the nuance of how WASH was to be approached. While useful in building momentum towards improved water and sanitation, the MDGs were an imperfect match to the health-based goals that they sought to achieve (Thomas et al., 2018).

Transition from MDGs to SDGs included the addition of hygiene (World Health Organization [WHO]/United Nations Children's Fund [UNICEF], 2014) and an overall shift from increased access to infrastructure to health-focused sustained access to adequate services (General Assembly Resolution 70/1, 2015). SDGs 1 (Target 1.4) and 6 (Targets 6.1 and 6.2) directly apply to WASH practitioners and can be reviewed in Box 1 (United Nations, 2021).

Box 1.

WASH Sustainable Development Goals

Goal 1: End poverty in all its forms everywhere.

Target 1.4. "...ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services..."

Indicator 1.4.1. Proportion of population living in households with access to basic services.

Goal 6: Ensure availability and sustainable management of water and sanitation for all.

Target 6.1. By 2030, achieve universal and equitable access to safe and affordable drinking water for all.

Indicator 6.1.1. Proportion of population using safely managed drinking water services.

Target 6.2. By 2030, achieve access to adequate and equitable sanitation and hygiene for all, and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.

Indicator 6.2.1 Proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water.

Source: United Nations, 2021.

The typologies and recommended questions covered in this technical note are largely based on the expertise of the WHO/UNICEF Joint Monitoring Program (JMP) for

[1] This technical note is part of a series on Select Topics in International Censuses (STIC), exploring matters of interest to the international statistical community. The U.S. Census Bureau helps countries improve their national statistical systems by engaging in capacity building to enhance statistical competencies in sustainable ways.

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Water and Sanitation, supplemented with additional material from other sources representing international best practices. The JMP is the data custodian for the SDG 6.1 and 6.2 targets, and their recommendations have been adopted by many of the most prominent international survey programs (Thomas et al., 2018). The UNICEF-supported Multiple Indicator Cluster Survey (MICS), the USAID-supported Demographic and Health Survey (DHS), and the WHO-supported World Health Survey (WHS) have all adopted the JMP harmonized questions and "service ladders" that are described later in this technical note to enable international comparability in WASH data (WHO/UNICEF, 2018).

While this guide focuses on WASH data for Population and Housing Censuses (PHCs), census data integrated with national surveys and infrastructure-specific information management systems are the primary sources of information for global WASH tracking. Census WASH data processes should be intentionally designed to integrate with data easily and effectively from common surveys like the DHS (World Bank, 2017; Yu et al., 2016). For this reason, we wrote this technical note purposefully applying guidance for national surveys to PHCs, while making sure that the guidance excludes elements that are inappropriate for census data collection.

WASH DOMAINS

Service Ladders

In 2017, the JMP introduced service ladders to allow benchmarking and international comparability for progress towards the SDGs. The ladders expand on the improved/unimproved type classification of WASH, introducing additional criteria and nuance to the typology, while still allowing for reverse-comparability with MDG monitoring (WHO/UNICEF, 2018). In each of the following sections, we present the service ladder that corresponds to that area of WASH.

Water

Measurement of water access for drinking and personal hygiene in a census should focus on how a household accesses water, as well as the frequency of that access and the quality of that water. These questions are used to assess access to "a safely managed drinking water service" (WHO/UNICEF, 2014). The availability of piped water can also be useful in rural/urban area classification and assessment when population density alone (or in pairing with other variables) is insufficient (United Nations Statistics Division [UNSD], 2015).

This is generally enumerated at the housing unit level, but piped water access may be measured for collective living quarters as well to assess housing conditions based on the number of occupants (UNSD, 2015). Depending on national context, these questions are typically skipped for some hard-to-count populations including people experiencing homelessness, seasonal and secondary dwellings, vacant dwellings, and dwellings with persons not included in the census (United Nations Economic Commission for Europe [UNECE], 2015).

Water Supply System Classification

Classifications are based on source (improved, unimproved, or surface water), collection distance, water quality, and type of source.

Type of source is based on a detailed typology (Appendix A) that can be mapped to the water service ladder (Figure 1). While no categories should be removed, some countries choose to expand the typology of water supply systems to fit the local conditions.

Sanitation

Sanitation focuses on three interrelated topics. Those topics are toilet systems, sewage waste disposal for toilet systems, and solid waste (garbage) disposal.

All three topics are generally enumerated at the housing unit level, but some countries collect this data for collective living quarters occupants as well. For collective living quarters, the number and type of sanitation services available in relation to the number of occupants is useful to study housing conditions (UNSD, 2015).

Toilet System Classification

Classifications are based on a combination of the type of toilet facilities that are available, who those facilities are shared with, and how sewage waste is disposed.

As with water sources, type of source is based on a detailed typology (Appendix A) that can be mapped to the water service ladder (Figure 2). While no categories should be removed, some countries choose to expand the typology of non-flush toilets based on local usage patterns.

Sewage Waste Disposal

Sewage disposal information should be collected at the same time as questions about toilet access, reflecting the disposal systems to which those toilet systems are connected and the sufficiency for the toilet system and household size. To be considered "adequate," toilets and latrines must be connected to nonclogged sewage disposal systems (UNSD, 2015).

In addition to the disposal systems that toilet systems are connected to, these questions (Appendix A) should also ask whether systems with on-site storage (e.g., latrines, septic tanks) have ever been emptied and whether that waste was sent to a treatment facility or disposed in some other way.

Figure 1.
Water Service Ladder

SAFELY MANAGED	Drinking water from an improved water source that is located on premises, available when needed and free from faecal and priority chemical contamination
BASIC	Drinking water from an improved source, provided collection time is not more than 30 minutes for a round trip, including queuing
LIMITED	Drinking water from an improved source for which collection time exceeds 30 minutes for a round trip, including queuing
UNIMPROVED	Drinking water from an unprotected dug well or unprotected spring
SURFACE WATER	Drinking water directly from a river, dam, lake, pond, stream, canal or irrigation canal

Source: World Health Organization (WHO)/United Nations Children's Fund (UNICEF), 2018.

Figure 2.
Sanitation Service Ladder

SAFELY MANAGED	Use of improved facilities that are not shared with other households and where excreta are safely disposed of in situ or transported and treated offsite
BASIC	Use of improved facilites that are not shared with other households
LIMITED	Use of improved facilities shared between two or more households
UNIMPROVED	Use of pit latrines without a slab or paltform, hanging latrines or bucket latrines
OPEN DEFECATION	Disposal of human faeces in fields, forests, bushes, open bodies of water, beaches or other open spaces, or with solid waste

Source: World Health Organization (WHO)/United Nations Children's Fund (UNICEF), 2018.

Solid Waste Disposal

Solid waste (garbage) disposal refers to "the usual manner of collection and disposal of solid waste or garbage generated by occupants of the housing unit" (UNSD, 2015). While solid waste disposal tends to be a peripheral topic for most JMP guidance, it is an important topic for SDG tracking.

Solid waste management data can be useful for assessing access to basic services and for understanding patterns of urbanization and deprivation (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2019). This data can be used to identify areas where collection and garbage disposal is nonexistent, and to differentiate areas where residents rely on waste picking and informal disposal methods. Refer to Box 2 for the typology of solid waste disposal systems recommended by the United Nations (UN).

Hygiene

Hygiene is the newest facet of the three for inclusion in UN Development Goal tracking. Measurement of hygiene has continued to develop with the recent addition of menstrual hygiene and washing facilities.

Hygiene is generally enumerated at the housing unit level, but some countries collect this data for collective living quarters occupants. Recent changes to WASH recommendations include focus on menstrual hygiene for women who have had their period in the preceding year, however this may be inappropriate for collection in a census where the information is collected from a single interviewee speaking for the collective household (WHO/UNICEF, 2018).

Hygiene System Classification

Hygiene questions focus on the availability of facilities on the premises of each set of housing units. This can be expanded to include whether those facilities are for the sole use of the occupants. The recommended service ladder is available in Figure 3 and recommended questions are available in Appendix A.

Box 2.

Solid Waste Disposal System Classification

The recommended typology of systems by housing unit is:

- Solid waste collected on a regular basis by authorized collectors.
- Solid waste collected on an irregular basis by authorized collectors.
- Solid waste collected by self-appointed collectors.
- Occupants dispose of solid waste in a local dump supervised by authorities.
- Occupants dispose of solid waste in a local dump not supervised by authorities.
- Occupants burn solid waste.
- Occupants bury solid waste.
- Occupants dispose solid waste into river, sea, creek, or pond.
- Occupants compost solid waste.
- Other arrangement.

Source: United Nations Statistics Division (UNSD), 2015.

Figure 3.
Hygiene Service Ladder

BASIC	Availability of a handwashing facility on premises with soap and water
LIMITED	Availability of handwashing facility on premises without soap and water
NO FACILITY	No handwashing facility on premises

Source: World Health Organization (WHO)/United Nations Children's Fund (UNICEF), 2018.

ISSUES TO CONSIDER

Dwelling Classification

Conventional Dwellings

The definition of a "conventional dwelling" for defining housing units relies on WASH data, as it requires the housing unit to meet all the needs of the household including having piped water, a toilet, a fixed bath or shower, and a kitchen or other cooking space within the dwelling. It can be useful to report WASH statistics disaggregated based on subdividing occupied conventional dwellings using the core housing infrastructure to identify how basic the housing is (UNECE, 2015).

Unoccupied Dwellings

While many countries do not collect information on WASH infrastructure for unoccupied dwellings, such data may be useful for providing more detail on the total housing stock available (UNECE, 2015). When doing so a simplified modification may be used, and data should not be aggregated with occupied conventional dwelling figures.

Geographic Coordination

Census geographers should coordinate with water and sanitation authorities long before census mapping begins. This interaction is crucial for the NSO to be able to compare census data with water and sanitation authority data, avoiding issues with defining geographic units inconsistently between census and service provider systems (UNSD, 2015).

Common Data Collection Errors

Data collection errors can easily occur where local terms for WASH options differ from the terms used in the national census materials. To avoid this, NSOs can consider using standardized illustrations that are appropriate for the national/regional/local context to train enumerators and to clearly differentiate the options for respondents. Supported by the WHO/UNICEF JMP, Shaw (2015) developed a useful set of relatively standardized illustrations for use in WASH measurement (Appendix B).

DATA DISSEMINATION AND VISUALIZATION

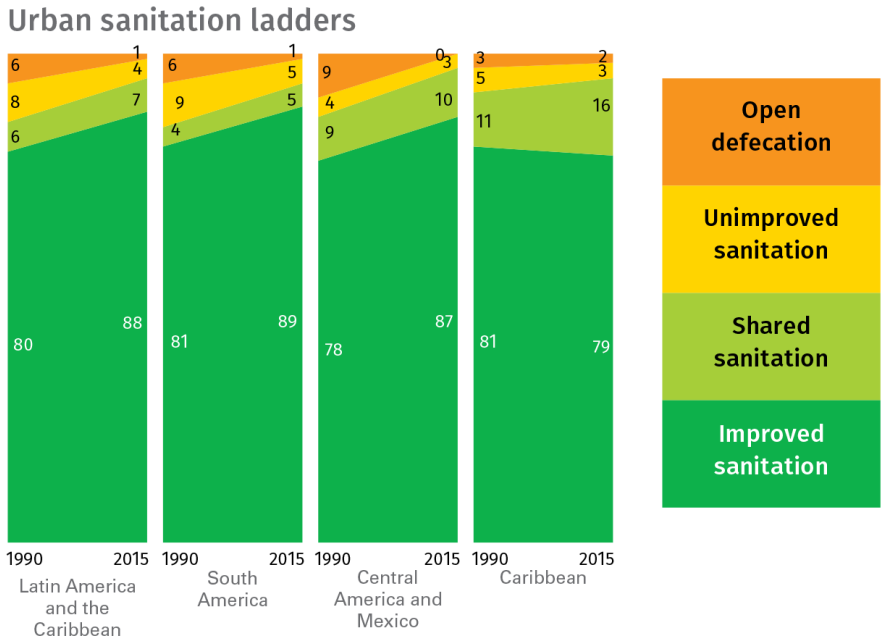
Dissemination

In disseminating WASH data, NSOs should seek to report information disaggregated on a wide range of dimensions. These products should highlight a multiplicity of forms of inequalities between and within groups while explicitly integrating spatial information.

Specifically, data should be disaggregated by (Martel, 2016; Queiroz et al., 2020; and UNSD, 2015):

- Urban/rural area (e.g., where the rural population is more than 25 percent of the total population or some other standard that is congruent with national census definition of "urban" and "rural").
- Informal urban settlements.
- Affordability of WASH services.
- Inter- and intrahousehold inequalities based on gender and disabilities.
- Household wealth: classified based on wealth quintiles, as that data are already collected and calculated as part of common household surveys such as MICS and DHS. This can take advantage of existing data when that data aren't also being collected as part of the national census.
- Subnational region: NSOs should consider comparing data between subnational regions at the same level within a parent administrative level, between child regions and their parent regions.
- Age.
- Race and ethnicity.
- Religion.
- Migratory status.

Figure 4.
Steamgraph Example



Source: World Health Organization (WHO)/United Nations Children's Fund (UNICEF), 2016.

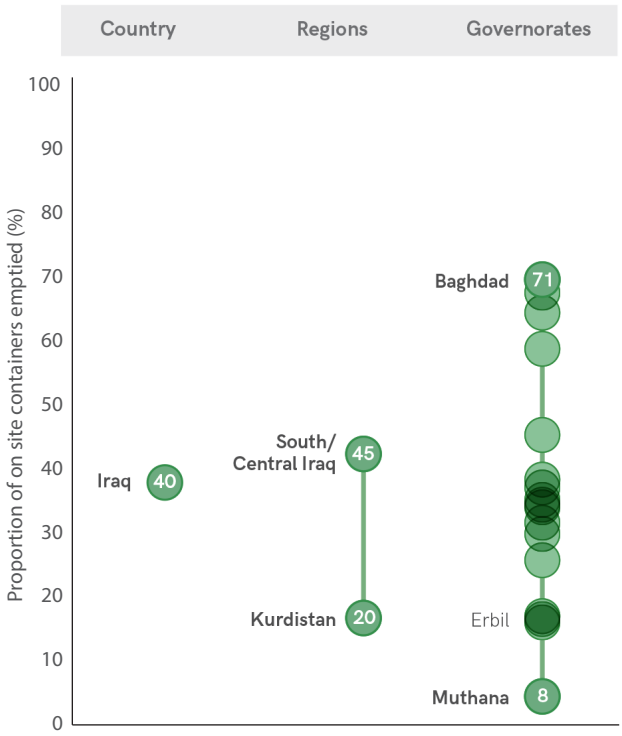
Open defecation is strongly correlated with extreme poverty and disproportionately affects poor and marginalized groups (WHO/UNICEF, 2014). For that reason, it should be analyzed and disaggregated intentionally to differentiate between wealth groups and disadvantaged areas (e.g., informal urban settlements). Child feces are considered especially infectious; it can be useful to disaggregate data on open defecation by age category. In surveys, disposal methods are often collected separately from statistics on open defecation, so co-disposal of child feces with household solid waste trash should be tracked by linking the potentially separate survey modules (WHO/UNICEF, 2019).

Visualization

One advantage of the JMP sanitation ladders is that they lend themselves well to streamgraphs (Figure 4), communicating change over time in a readily interpretable format. When nondemographic, geographic, or other categorical variables are compared, then this should be adapted to use stacked bar plots instead.

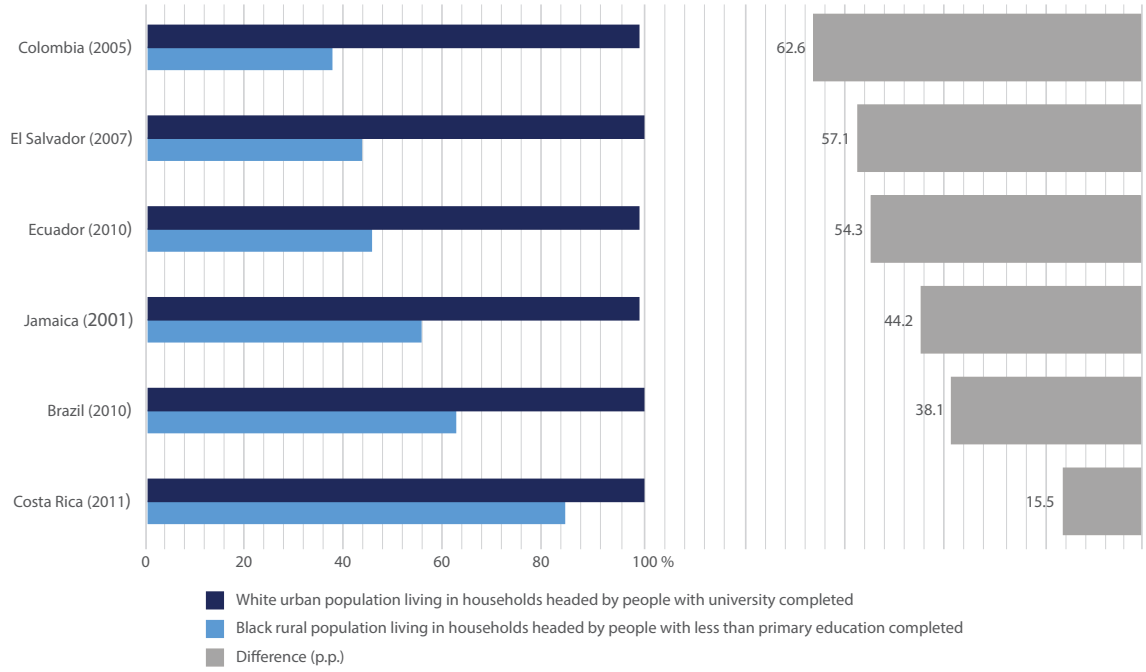
Another useful alternative is to use a range dot plot (Figure 5) that lets you show labeled maximum and minimum values for areas in a readily interpretable format,

Figure 5.
Range Dot Plot Example



Source: World Health Organization (WHO)/United Nations Children's Fund (UNICEF), 2019.

Figure 6.
Plotting Inequality Example
(In percent)



Source: Queiroz et al., 2020.

with the option of highlighting the mean value or data points of interest within the range of observed values.

For visualizing inequality metrics, it can be useful to display raw figures alongside figures that have been adjusted for inequality (Figure 6). This quickly and clearly communicates both the raw figures, the adjusted figures, and the degree of difference that is present.

Finally, thematic maps can be useful for showing spatial patterns of variation and of inequity. Some recommended thematic maps include: (1) percentage of population with access to safe water; (2) percentage of population with access to sanitation; (3) mapped spatial clustering and outlier analysis results; and (4) locality-level maps showing where there is no access to specific WASH services.

CONCLUSION

The 2010 adoption of United Nations General Assembly Resolution 64/292 was a watershed moment for the development of global WASH measurement, spurring a massive proliferation of nuanced WASH measurement frameworks. The 2015 SDG transition drove a further surge in activity within the WASH measurement community. The past 5 years have seen global calls for better integration of WASH data collection between censuses and surveys and rigorous development of best practices on how WASH data may be effectively analyzed and presented. This has included explicit focus on the multiplicity of ways that groups within and between nations may experience WASH in their daily lives. In writing this STIC, we have sought to distill that information into a usable and easily interpretable format.

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APPENDIX A: WASH TYPOLOGIES AND QUESTION EXAMPLES

Water

W1. Main drinking water source

What is the **main** source of drinking water for members of your household?	Piped water	
	Piped into dwelling 11	>>W5
	Piped into compound, yard or plot 12	>>W5
	Piped to neighbour 13	>>W4
	Public tap / standpipe 14	>>W4
	Borehole or tubewell 21	>>W3
	Dug well	
	Protected well 31	>>W3
	Unprotected well 32	>>W3
	Water from spring	
	Protected spring 41	>>W3
	Unprotected spring 42	>>W3
	Rainwater collection 51	>>W3
	Delivered water	
	Tanker-truck 61	>>W4
	Cart with small tank / drum 62	>>W4
	Water kiosk 72	>>W4
	Packaged water	
	Bottled water 81	>>W2
	Sachet water 82	>>W2
	Surface water (river, stream, dam, lake, pond, canal, irrigation channel) 91	>>W4
	Other (specify) 96	>>W3

W2. Secondary water source for users of packaged water

What is the **main** source of water used by members of your household for other purposes, such as cooking and hand washing?	Piped water	
	Piped into dwelling 11	>>W5
	Piped into compound, yard or plot 12	>>W5
	Piped to neighbour 13	>>W3
	Public tap / standpipe 14	>>W3
	Borehole or tubewell 21	>>W3
	Dug well	
	Protected well 31	>>W3
	Unprotected well 32	>>W3
	Water from spring	
	Protected spring 41	>>W3
	Unprotected spring 42	>>W3
	Rainwater collection 51	>>W3
	Delivered water	
	Tanker-truck 61	>>W4
	Cart with small tank / drum 62	>>W4
	Water kiosk 72	>>W4
	Packaged water	
	Bottled water 81	>>W5
	Sachet water 82	>>W5
	Surface water (river, stream, dam, lake, pond, canal, irrigation channel) 91	>>W4
	Other (specify) 96	>>W3

Source: World Health Organization (WHO)/United Nations Children's Fund (UNICEF), 2018.

W3. Location of drinking water source		
Where is that water collected from?	In own dwelling ..... 1 In own yard / plot ..... 2 Elsewhere 3	>>W5 >>W5 >>W4

W4. Time to collect drinking water		
How long does it take to go there, get water, and come back?	Members do not collect ..... 000 Number of minutes ..... ___ Don't know 998	>>W5 >>W5 >>W5

W5. Availability of drinking water		
In the last month, has there been any time when your household did not have sufficient quantities of drinking water when needed?	Yes, at least once ..... 1 No, always sufficient ..... 2 Don't know 8	>>W6 >>W6 >>W6

W6. Drinking water quality at the source		
Can you please show me where the members of your household collect drinking water so that I can test the water quality? *Conduct tests within 30 mins of collecting samples.* *Record 3 digit count of colonies* *If 101 or more colonies counted, record 101* *If not possible to read/results lost, record 998*	Number of *E. coli* detected in 100 mL sample Source water test ..... ___	>>S1

Note: W6 forms part of a water quality testing module applied to a sub-sample of 4-5 households per cluster. Samples are collected from the main source (point of collection) and tested for faecal contamination within 30 minutes of collecting the sample[9]. See expanded list for water quality testing in the household (point of consumption).

Source: World Health Organization (WHO)/United Nations Children's Fund (UNICEF), 2018.

Sanitation

S1. Sanitation facility

What kind of toilet facility do members of your household usually use?

If 'Flush' or 'Pour flush', probe: Where does it flush to?

If not possible to determine, ask permission to observe the facility.

Flush / pour flush		
Flush to piped sewer system	11	>>S2
Flush to septic tank	12	>>S2
Flush to pit latrine	13	>>S2
Flush to open drain	14	>>S2
Flush to don't know where	18	>>S2
Dry pit latrines		
Pit latrine with slab	22	>>S2
Pit latrine without slab / Open pit	23	>>S2
Composting toilets		
Twin pit with slab	31	>>S2
Twin pit without slab	32	>>S2
Other composting toilet	33	>>S2
Bucket	41	>>S2
Container based sanitation	42	>>S2
Hanging toilet / hanging latrine	51	>>S2
No facility / Bush / Field	95	>>H1
Other (specify)	96	>>S2

S2. Shared sanitation

Do you share this facility with others who are not members of your household?

Yes	1	>>S3
No	2	>>S3

S3. Location of sanitation facility

Where is this toilet facility located?

In own dwelling	1	>>S4
In own yard / plot	2	>>S4
Elsewhere	3	>>S4

S4. Emptying of on-site sanitation facilities

Has your (pit latrine or septic tank) ever been emptied?

Yes emptied	1	>>S5
Never emptied	2	>>H1
Don't know	8	>>H1

Source: World Health Organization (WHO)/United Nations Children's Fund (UNICEF), 2018.

S5. Disposal of excreta from onsite sanitation facilities		
The last time it was emptied, where were the contents emptied to? *Was it removed by a service provider?*	Removed by service provider to a treatment plant ..... 1 buried in a covered pit ..... 2 to don't know where ..... 3 Emptied by household buried in a covered pit ..... 4 to uncovered pit, open ground, water body or elsewhere ..... 5 Other (specify) ..... 6 Don't know 8	 >>H1 >>H1 >>H1 >>H1 >>H1 >>H1 >>H1

Hygiene

H1. Handwashing facility observation		
Can you please show me where members of your household most often wash their hands?	Fixed facility observed (sink/tap) In dwelling ..... 1 In yard/plot ..... 2 Mobile object observed (bucket/jug/kettle) ..... 3 No handwashing place in dwelling/yard/plot ..... 4 No permission to see ..... 5 Other reason (specify) 6	 >>H2 >>H2 >>H2 >>M1 >>M1 >>M1

H2. Water observation		
Observe availability of water at the place for handwashing. *Verify by checking the tap/pump, or basin, bucket, water container or similar objects for presence of water.*	Water is available ..... 1 Water is not available 2	>>H3 >>H3

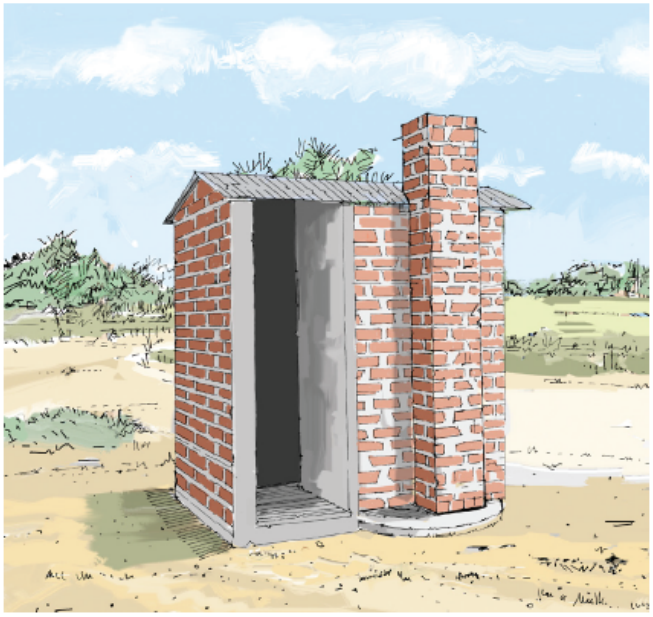
H3. Soap observation		
Observe availability of soap or detergent at the place for handwashing	Soap or detergent available ..... 1 Soap or detergent not available 2	>>M1 >>M1

Source: World Health Organization (WHO)/United Nations Children's Fund (UNICEF), 2018.

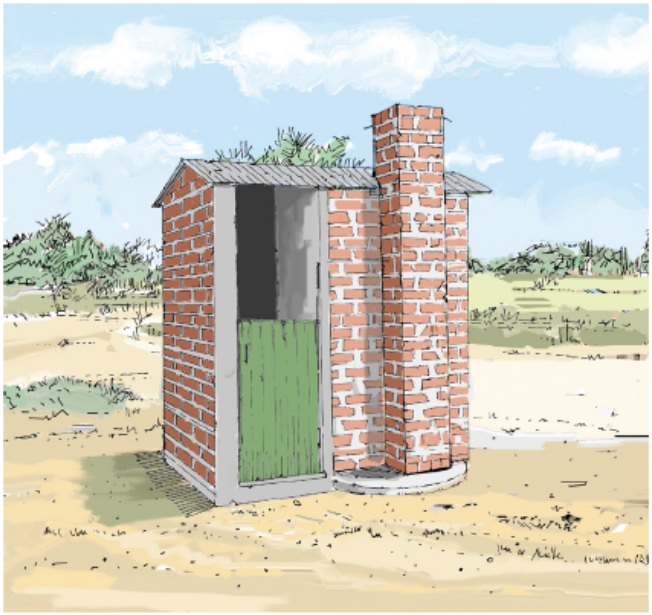
APPENDIX B: USING STANDARDIZED ILLUSTRATIONS

Example of illustrations for various forms of Ventilated Improved Pit Latrines (VIP)

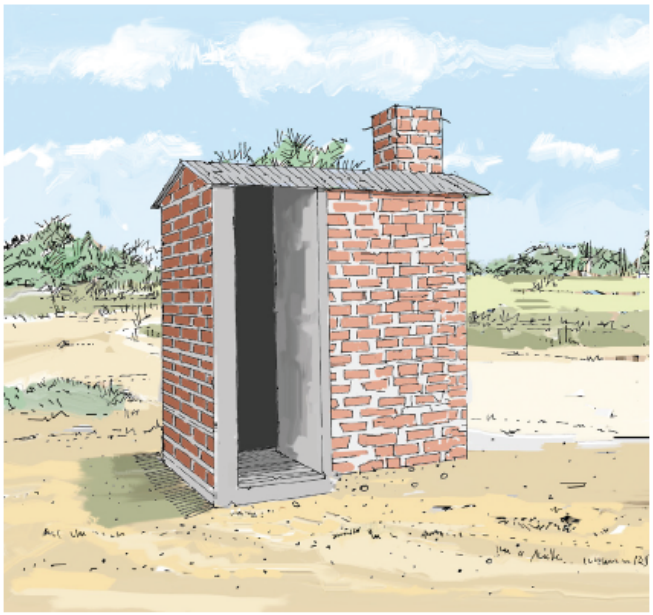
Blair VIP latrine 1



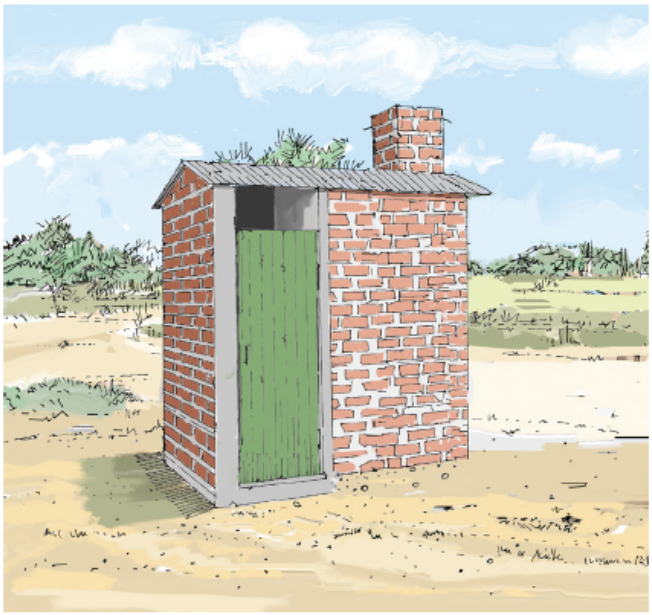
Blair VIP latrine 1 with half door



Blair VIP latrine 2



Blair VIP latrine 2 with door



Source: Shaw, 2015.

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