Access to drinking water: time matters

A. Cassivi, R. Johnston, E. O. D. Waygood and C. C. Dorea

ABSTRACT

Despite the reported achievement of the Millennium Development Goals (MDGs) with respect to drinking water, lack of access to water remains widespread worldwide. The indicator used there to measure access to water in the MDGs refers to the use of an improved water source. However, the amount of time spent in collecting water is high in countries where access to drinking water supplies located on premises is not common. 26.3% of the world's population did not have such access in 2015. Thus the need to travel to a water point, possibly queue, fill water containers, and carry them home is prevalent. The amount of time and effort used in water collection can be considerable, and household surveys increasingly provide data on collection time. This study aims to demonstrate the effect of adding a 30-minute collection time component to monitor access to drinking water. This study draws on household surveys from 17 countries to highlight the widespread burden of fetching water and its significant impact on estimates of coverage. The proportion of the population with access decreased by 13% on average for these 17 countries when collection time was added as a consideration.

Key words | accessibility, distance, drinking water, Millennium Development Goals, Sustainable Development Goals, water fetching

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INTRODUCTION

Target 7C of the Millennium Development Goals (MDGs) was to halve, by 2015, the proportion of the population without sustainable access to safe drinking water. The target was considered to have been met as the proportion of the world population with access to an improved drinking water source was reported to have increased from 76% in 1990 to 91% in 2015 (UNICEF & WHO 2015). The indicator used by the WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply, Sanitation and Hygiene to track this target progress was the proportion of the population using an improved drinking water source. An improved drinking water source was defined as one that is designed to provide protection from outside contamination, particularly faecal matter. Thus, this indicator of access to an improved water source only reflected the utilisation of a type of source (e.g., piped water, protected well, rainwater) and did not include any considerations related to the location or physical accessibility of the source. According to WHO & UNICEF (2017), 26.3% of the world's population did not use an improved water source on premises and still had to fetch water off-premises in 2015. Considering the aim of the Sustainable Development Goals (SDGs) for universal and equitable access (i.e., 100%) to water by 2030, it is important to consider the impact on this target of collection burden, in terms of time or distance. With respect to this, the indicator to monitor progress was set as the proportion of the population using safely managed drinking water services, which includes concepts of accessibility, availability and quality (WHO & UNICEF 2017). In this study, a 30-minute threshold is applied to consider the impact of the collection burden on the percentage of the population considered to have access to water.

Previous research has raised the issue of the weight of water with regard to collection time in many countries

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(Sorenson *et al.* 2011; Geere & Cortobius 2017). As women and children were found to be principally responsible for water collection, gender differences were highlighted (Graham *et al.* 2016). Raising significant inequality issues related to the task, variation in time to collect water was also observed among urban and rural areas (Geere & Cortobius 2017). Hence, Geere & Cortobius (2017) stated that fetching water constitutes an important barrier for sustainable development and household water security in developing countries. Lack of access to on-premises piped water can lead to the use of more distant alternative sources. When this happens the quantity of fetched water is likely to reduce in what has been described as the 'water plateau' phenomenon by Cairncross (1999). This is based on studies such as those by White *et al.* (1972) on water fetching observations in rural settings in diverse contexts. The relation between the quantity of water used by the household and the time taken to fetch it can be qualitatively described as non-linear with a steep decline (at roughly 3 minutes of collection time) in water used once the source is not on the premises. After this, the amount of water fetched is relatively constant, plateauing at 30 minutes, where a further decline is observed for longer collection times.

A 30-minute threshold has been applied in other water accessibility studies, which aimed at demonstrating the importance of time or distance to collect water and their potential impact on monitoring access to water (Devi & Bostoen 2009; Graham *et al.* 2016). In addition to monitoring safely managed drinking water, WHO/UNICEF JMP also used a 30-minute threshold for water service levels within countries. Off-premises improved water sources located within 30 minutes of the point of use are considered as a basic service. If the source is located above 30 minutes from the source, level of service is classified as limited (WHO & UNICEF 2017).

The aim of the present study is to describe access to water coverage paying consideration to the time needed to fetch water in countries with the lowest rankings when it comes to on-premises water. The objective of this study is to determine the effect of adding a time component to drinking water accessibility coverage estimation and thus strengthen its validity as an indicator.

METHODS

For this study, countries where the proportion of the population with access to piped water on premises was lower than 10% in the 2015 MDG Assessment report were selected, so as to focus on the countries where the time component is likely most relevant (UNICEF & WHO 2015). In total, 22 countries were found to meet this first selection criterion. In order to assess the most relevant situation, existing data of the most recent household survey from USAID Demographic and Health Surveys (DHS) or UNICEF Multiple Indicator Cluster Surveys (MICS) was used (UNICEF 2016; USAID 2016). Eritrea, Guinea-Bissau, the Marshall Islands, Myanmar and Papua New Guinea were then excluded from the present study due to data unavailability and, thus, 17 countries were included (Table 1).

The study is based on two variables that were disaggregated: the main source of drinking water used by the

Table 1 | General information on data used by country

Country	Population using piped water on premises (%)[a]	Data		
		Survey	Year	Sample (*n*)
Burkina Faso	8.0	DHS	2010	14 424
Burundi	7.0	DHS	2012	4 866
Central African Republic	1.6	MICS	2010	11 966
Chad	6.4	MICS	2010	17 668
Democratic Republic of the Congo	7.9	DHS	2014	18 171
Haiti	9.8	DHS	2012	13 181
Liberia	2.4	DHS	2013	9 333
Madagascar	7.0	DHS	2009	17 857
Malawi	7.9	DHS	2014	3 405
Mozambique	8.6	DHS	2011	13 919
Niger	8.7	DHS	2012	10 750
Nigeria	2.3	DHS	2013	18 546
Rwanda	9.2	DHS	2015	12 699
Sierra Leone	5.4	MICS	2012	11 923
South Sudan	1.8	MICS	2010	9 950
Togo	5.5	DHS	2014	9 549
Uganda	5.0	DHS	2011	9 033

[a]UNICEF & WHO (2015).

household, which is a categorical variable, and the time required to collect water from that source, presented as a continuous variable. The classification of improved and unimproved water source type was based on the new WHO/UNICEF JMP definition of improved sources (including water piped into dwellings, water piped to yard/plot, public tap or standpipes, tubewell or borehole, protected dug well, protected spring, rainwater, cart with a small tank/drum, tanker-truck, and bottled water) which differs from the ones initially used during MDG reporting in that packaged and delivered water are classified as 'improved sources' for SDG monitoring (WHO & UNICEF 2017). Households were also classified on the basis of reported round-trip travel time (including any time spent queuing) as using water supplies that are located on premises (*On premises*), within 30 minutes (*30 minutes or less*), or over 30 minutes from the point of use (*More than 30 minutes*). All analyses were made with an analytic population weighting to ensure an accurate representation of the national population. This weighting was generated by multiplying the number of *de jure* members of each household (i.e., those members that are usually present, regardless of whether they are present or absent at the time of the survey) by the existing household weighting variable (DHS/ICF 2006). All analyses were conducted with STATA MP version 14.

Table 2 | Collection time in minutes by 30-minute threshold and type of source

Country	Households with collection time >30 minutes (%)	Average collection time in minutes (standard deviation)		
			Type of source	
		National	Improved	Unimproved
Burkina Faso	15	20 (±19)	20 (±19)	20 (±20)
Burundi	26	28 (±25)	26 (±24)	35 (±26)
Central African Republic	33	33 (±40)	32 (±44)	36 (±31)
Chad	31	37 (±48)	30 (±40)	44 (±54)
Democratic Republic of the Congo	33	32 (±31)	27 (±33)	38 (±28)
Haiti	23	28 (±34)	22 (±30)	33 (±37)
Liberia	11	17 (±19)	17 (±21)	17 (±15)
Madagascar	4	14 (±38)	9 (±20)	18 (±43)
Malawi	17	19 (±23)	18 (±24)	25 (±25)
Mozambique	27	35 (±70)	23 (±67)	44 (±71)
Niger	35	43 (±54)	35 (±47)	58 (±63)
Nigeria	17	21 (±29)	19 (±28)	24 (±31)
Rwanda	32	30 (±28)	27 (±27)	39 (±30)
Sierra Leone	10	16 (±19)	14 (±21)	20 (±16)
South Sudan	37	39 (±52)	36 (±44)	45 (±63)
Togo	17	22 (±29)	17 (±22)	30 (±37)
Uganda	40	44 (±49)	42 (±49)	49 (±47)

RESULTS AND DISCUSSION

Across all countries in this study, results show that up to 40% of the national population needs more than 30 minutes to fetch water irrespective of the type of water source used by the household (Table 2). In over half of the countries examined, more than one household out of four lives at over 30 minutes (round-trip) of a water source. About half of the countries show an average collection time higher than 30 minutes. The national average time to collect water is lowest in Madagascar, taking 14 minutes, and reaches 44 minutes in Uganda. Results from disaggregation by type of source show that the average time to collect improved sources of water is lower or equivalent than for unimproved sources. These findings suggest that the households who must travel further are also often using unimproved sources. Standard deviations show an important variation in collection time within each country, which could demonstrate high inequalities in terms of access to water.

The average travel time to reach an improved water source remains high in most countries studied. The collection time needed to fetch water within the population who have access to an improved water source is shown in Figure 1, which indicates that large numbers of people live in households where the collection burden is over 30 minutes. Proportions of the population fetching water from an improved source at a distance of over 30 minutes range from 2% of the population in Madagascar to 38% in Uganda. Thus it can be seen that by simply taking into account this threshold a non-negligible proportion of the population should be considered as not having good access to water.

As mentioned, volumes of water used are lower as the distance to sources increase and thus moving a source of

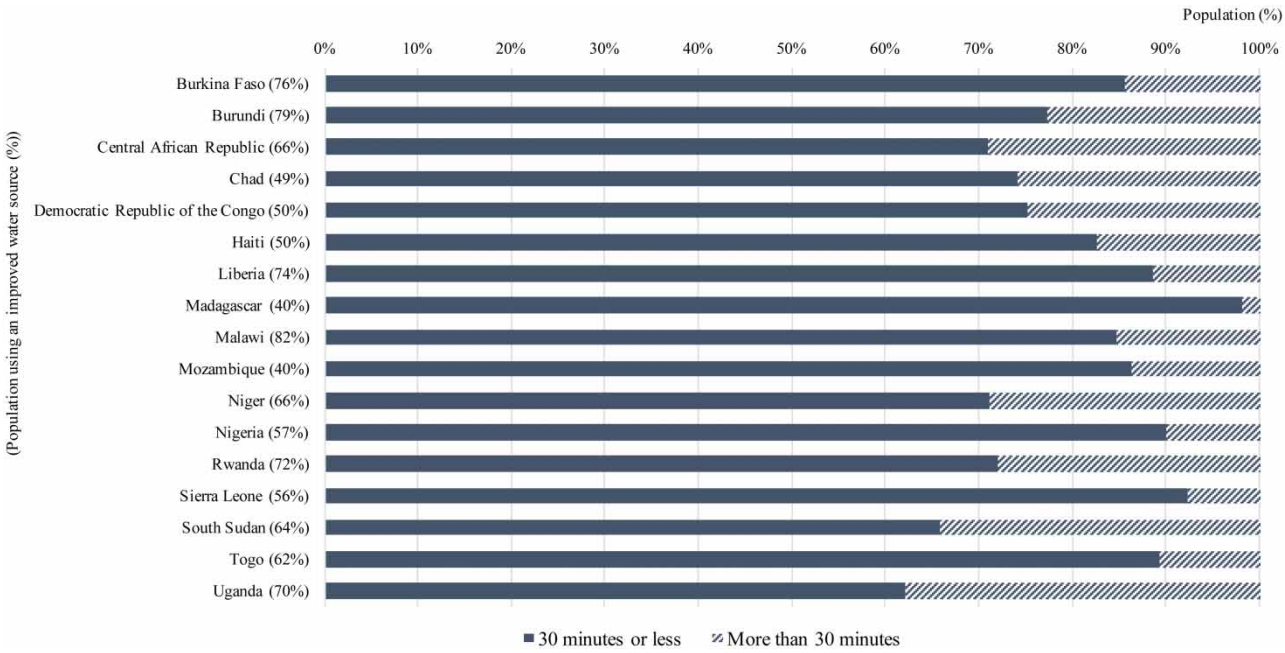

Figure 1 | Collection time needed to fetch water from an improved water source classified with a 30-minute threshold.

water to a location within 30 minutes' journey time will not necessarily enhance water consumption as much as the installation of water sources within the residence. These assumptions justify the necessity to enhance access to water and reduce distance when the time to fetch water is higher than 30 minutes, in order to reach universal access to water by 2030, as proposed in the SDGs.

Further to simply having access to an improved water source, the collection burden appears to be an essential variable that needs to be considered in order to ensure an

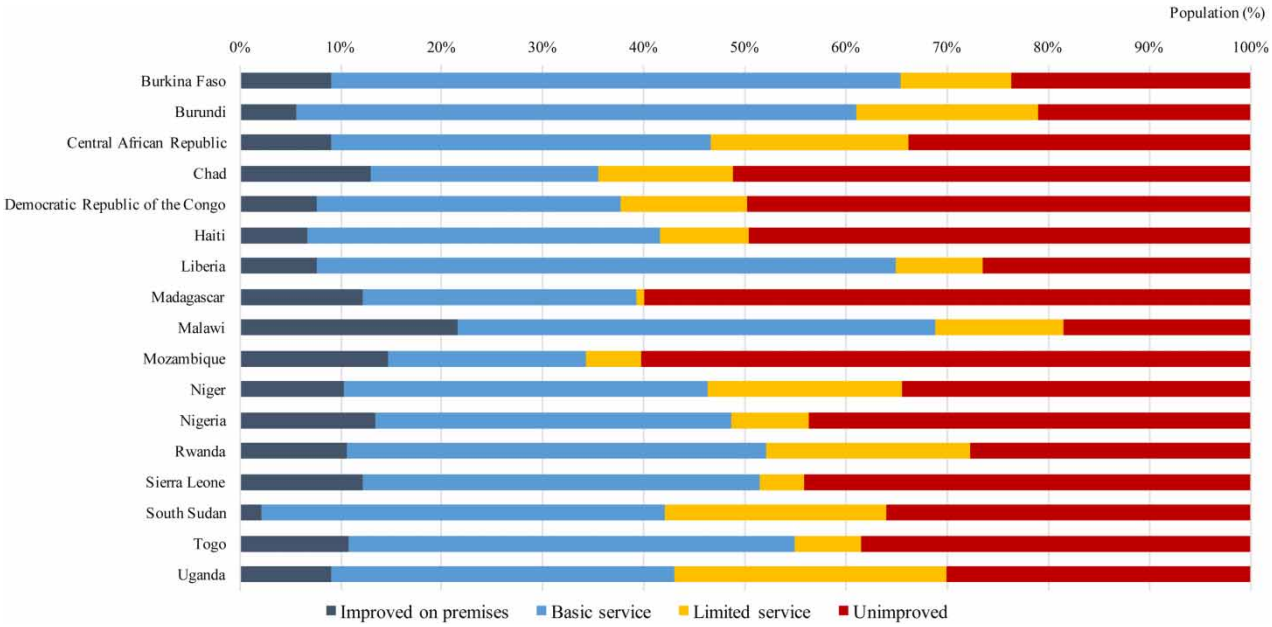

Figure 2 | Water service levels according to new WHO/UNICEF JMP classification, namely: Improved on premises; Basic (improved ≤ 30 minutes); Limited (improved > 30 minutes); Unimproved.

accurate picture of access to water. The disaggregation of the population in each country according to a water service level classification (which here refers to the type of source used and the collection time) can be seen in Figure 2. In order to further analyse the impact of time and improved source type, results were classified into levels of service defined by WHO & UNICEF (2017): *Improved on premises*, including improved water sources located at 0 minutes from the point of use; *Basic service*, referring to improved water source located between 1 minute and 30 minutes, inclusive; *Limited service*, including improved water sources located farther than 30 minutes and; *Unimproved*, which refers to all unimproved water sources irrespective of the collection time. The population using improved sources is therefore composed of the populations using *Improved on premises*, *Basic service* and *Limited service*. If one were to take the distance threshold of the improved water source as being located at no more than 30 minutes' round-trip of distance from the point of use, only *Improved on premises* and *Basic service* could be used to monitor access to water. Comparing both indicators shows a significant impact in terms of accessibility, demonstrated by the *Limited service* population of Figure 2 which directly demonstrated the change in the indicator. The population having *Limited service* ranges from a low of 1% to a high of 27% of the national populations and could reflect important problems of access for these populations.

Figure 2 shows that in all countries examined more than one household out of four either uses an unimproved water source, or an improved source with a burden of over 30 minutes' collection time (i.e., *Limited service*). In the previous measure of access to water (MDG), the proportion of the population identified as having *Limited service* would have been considered as having access. In eight countries (Central African Republic, Chad, Democratic Republic of Congo, Haiti, Madagascar, Mozambique, Togo and Uganda), more than half of the population use either an unimproved source or an improved water source located further than this 30-minute threshold. The results demonstrate that when a threshold of 30 minutes is used, 1% to 27% of the population of these 17 countries would be considered as not having access to improved water sources.

This problem requires attention, as reducing the collection burden required to fetch water is essential to enhancing water quantity available for households and improving general health and quality of life (Mara & Feachem 1999; Overbo *et al.* 2016). Further research is required to identify the areas and segments of the population where the time to access water is most problematic. A future study could use the size of the population without water on premises as the selection criteria, rather than a percentage, to best target areas that would benefit the largest number of people. Occurring inequalities must be reduced to ensure sustainable development in developing countries. This would be an important next step in targeting those areas or groups that would likely require investment and resources to improve their access to water in order to reach universal access by 2030.

LIMITATIONS

Certain limitations related to MICS and DHS data reliability must be stated. First, the variables used are self-reported values which are not necessarily objectively accurate with respect to time. However, we consider that self-reported travel time remains valid as a subjective measure of the relative burden imposed by water fetching. Second, estimations related to water collection time do not take into account trip frequency, and neither the mode of transport used nor the road conditions are stated. Moreover, it is not known how much of the time to collect water is queuing time, and whether that might also affect frequency or quantity. Finally, estimations shown might differ slightly from the WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply, Sanitation and Hygiene, because the present study was based on the last available DHS or MICS survey, while JMP used linear regression projections with all available data for a country.

CONCLUSIONS

This analysis demonstrated the impact that included an adjustment for the burden of collecting water from off-premises sources has on the picture of water access. First,

it showed (Figure 1) the proportion of the population who must walk over 30 minutes to access water. Next, combining time and quality, Figure 2 highlights the proportion of the population with limited access where previously they were considered as having access. The proportion of the population with access decreased by 13% on average for these 17 countries when time was added to improved and unimproved classification. Adding a distance threshold when monitoring access to water is essential to indicate water service level. Considering potential health implications related to the quantity and quality of water collected, further attention should be directed toward fetching water and source accessibility. Findings emphasise the need for a complete indicator to take into account the collection burden in order to ensure access to a sufficient quantity of clean water within the home as intended in the SDGs.

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