Rural and Urban Household Drinking Water Services in Sustainable Development Goal Regions, 2015-2020

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Abstract

BACKGROUND

Achieving the Sustainable Development Goal (SDG) target 6.1 implies that both rural and urban (RU) households have access to "safely managed drinking water services" by 2030. Hence, this study assessed households' access to drinking water services in RU areas of SDG regions, 2015-2020.

MATERIALS AND METHODS

The study adopted the descriptive cross-sectional design, using secondary data harvested from the Joint Monitoring Programme (JMP), 2021 report, which contained data on water services for RU areas in SDG regions for 2015 and 2020, which is available at "https://data.unicef.org/resources/progress-on-household-drinking-water-sanitation-and-hygiene-2000-2020." The study population consisted of 234 countries, areas or territories, recognized by the United Nations and classified into eight SDG regions. The analyses of the data were undertaken using percentages and t-test statistics.

RESULTS

The results showed that four of the eight SDG regions were projected to miss target 6.1 by 2030. The study established inequality in basic water services between RU areas. Generally, better services were reported in the urban area in almost all the SDG regions. The t-test results (t_7 = 2.774, p = 0.028, α = 0.05) and (t_7 = 2.461, p = 0.043, α = 0.05) showed significant disparity in RU household water services in SDG regions in 2015 and 2020, respectively. Similarly, the t-test analysis (t_7 = -3.130, p = 0.017, α = 0.05) showed significant inequality in the national household water services in SDG regions between 2015 and 2020.

CONCLUSION

The researchers recommend that SDG regions that were identified to miss target 6.1 should scale up their activities so that every SDG region would be carried along.

Keywords: *Drinking Water Services, Household, SDG Regions, Rural and Urban Area*

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Introduction

Sustainable Development Goal (SDG) 6.1 focuses on "achieving universal and equitable access to safe and affordable drinking water for all by 2030". By implication, target 6.1 can only be said to have been achieved if everyone irrespective of their social, economic and political status has unrestricted access to "safely managed drinking water services (drinking water from an improved source that is accessible on premises, available when needed and free from faecal and priority chemical contamination)" [1].

Target 6.1 is quite enthusiastic and seeks to ensure that no one is left behind. This is

because the benefits of having an adequate water supply for sound health, good educational outcomes and socioeconomic growth have been well recognized and established in the literature [2-5]. For instance, the World Health Organization (WHO) noted that inadequate water services are mainly responsible for the prevalence of waterborne diseases like diarrhoea among children less than five years [6]. An estimated 829,000 people die yearly from diarrhoea disease, which is caused by unsafe drinking water, hygiene and sanitation services [7]. Similarly, different studies have linked students' poor learning outcomes; poor cognitive development, stunting and absenteeism from school to poor water supply [8-11]. This realization probably led to the declaration of "water as a fundamental human right by the United Nations General Assembly in 2010".

Despite the declaration, water provision for a reasonable number of the world's population still lagged behind demand. Although much increase has been recorded in water provision through the various efforts at different levels globally, from 2000 till date; however, significant gaps remain to be covered. For example, from 2015-2020, about 26% of the world population lacked reasonable access to "safely managed water services" in 2020, decreasing only by 4% basic points from the 30% level in 2015 [5]. This figure does not suggest that every SDG region or country has equal coverage. Disaggregation of the water coverage revealed several levels of disparities between SDG regions, countries, and RU areas; rich and poor. For instance, between 2015-2020, urban water coverage increased to 86% from 85%, while rural coverage increased to 60% from 53% [5]. These figures show a gap in service of 32% and 26% to the advantage of urban areas for 2015 and 2020, respectively. In all eight SDG regions, safely managed drinking water coverage was lower in rural areas than in urban centres in 2020, with various degrees of disparities. For example, the highest inequality was reported in sub-Saharan Africa (SSA), where urban coverage was 54% against 13% for rural, a service difference of 41%. Next to SSA were Latin America and the Caribbean SDG region, with water services of 53% and 81% for RU areas, respectively [5].

This disparity indicates that some persons seem to be left behind, especially among the rural population. Apart from variation in water coverage between RU populations, the service levels also vary widely. For example, a study in South Africa reported that in rural areas the people lacked piped water on premises and they rely on public standpipes located outside their homes; while in the urban areas, all the households had water piped into their homes [12]. In addition, the study noted that "only the stored drinking water in the rural community was contaminated". Similarly, another study revealed that the urban population having the same level of income as their rural counterparts has better access to drinking water. Also, the number of rural higher-income households with a water supply at home is comparable to lower-income urban households. This situation has increased the cost of water supply to the poorer households making them spend as much as the richer households for water supply [13].

In addition to the obvious disparity existing between RU populations in water services, there are also many intra-RU disparities in almost all countries worldwide, whether developed or developing. For example, a study asserted that rich urban households have higher (about 329%) access to safe water services compared to their poorer urban counterparts [14]. This indicates that the wealth or income level of a household is a major determinant of access to "safely managed drinking water services". Apart from wealth differentials, racial discrimination has also been recognized to be responsible for observable disparities in water services in the

United States, where "households headed by people of colour are almost 35% more likely to lack piped water as compared to white, non-Hispanic households" [3].

The JMP report has shown that the world may miss target 6.1 because of the poor rates of global annual water provisions [5]. For example, globally, an estimated 2 billion people lacked access to "safely managed water services" in 2020. This figure however includes about 1.2 billion people with access to "basic water services (drinking water from an improved source, provided collection time is not more than 30 minutes for a round trip, including queuing)", 282 million with "limited services (drinking water from an improved source, for which collection time exceeds 30 minutes for a round trip, including queuing)". Others are 367 million with "unimproved services (drinking water from an unprotected dug well or unprotected spring)" and 122 million who still use "surface water (drinking water directly from a river, dam, lake, pond, stream, canal or irrigation canal)", the worst source of drinking water, due to its high level of contamination that can cause pathogenic diseases. This shows clearly that the world is currently off track towards meeting target 6.1 unless present rates of global water provisions are quadrupled [5]. Therefore, the study focused on assessing the RU household drinking water services in SDG regions to know the existing gap and rate of water provision required in each region to accelerate the global march towards meeting target 6.1.

Method of Study

Study design

The study assessed RU household drinking water services in SDG regions from 2015 to 2020. The descriptive cross-sectional study design, which involved the manual extraction of secondary data from the JMP report for 2021, was adopted. The report contains household water services for rural, urban and national for 234 countries, areas or territories that were grouped into eight SDG regions [5]. The eight SDG regions with the number of countries classified in them are: "Australia and New Zealand (2); Central and Southern Asia (14); Eastern and South-Eastern Asia (17); Europe and Northern America (53), Latin America and the Caribbean (51); Northern Africa and Western Asia (25); Oceania (21) and Sub-Saharan Africa (51)" [5]. These regions constituted the sample units for data collection and analysis.

Data collection

Data for the study consist of household water services for rural, urban and national, for the eight SDG regions for 2015 and 2020. The service ladders considered for this study were "at least 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), and surface water (drinking water directly from a river, dam, lake, pond, stream, canal or irrigation canal)" [5]. Although target 6.1 monitoring indicator 6.1.1, is measured on the "proportion of the population using safely managed drinking water services" [1], however, this measure was not adopted in assessing and comparing water services between the SDG regions because only five of the eight regions had sufficient data for "safely managed drinking water services" [5].

The water services data were obtained from the publicly available JMP report for 2021. This report was accessed online from "(https://data.unicef.org/resources/progress-on-household-drinking-water-sanitation-and-hygiene-2000-2020)" on 23rd February 2022. The water service data in each SDG region using the various service levels ("at least basic, limited, unimproved & surface water") for rural, urban

and national for 2015 and 2020 were manually extracted from the report and analyzed to compare service progress in SDG regions between RU areas for 2015 and 2020 and national from 2015-2020.

Data analysis

The statistical analyses used were both descriptive (tables & percentages) and inferential (Student's t-test), with the aid of SPSS, version 26. The data were arranged and presented in the tables to facilitate a comparison of water services between RU households and national in the SDG regions. Using the yearly rate of change in water services from 2015-2020, as contained in the 2021 data set of the JMP report, the basic water services were estimated for 2030 for each SDG region. This was done to know the SDG regions that would most likely meet or miss target 6.1, based on current levels of annual growth from 2015-2020.

The Student's t-test statistic was used to test whether there was a significant difference between RU household water services in SDG regions for 2015 and 2020, respectively. It was also used to test whether there was a significant difference in the national household water services for "at least basic water services" in SDG regions from 2015-2020. The t-test analyses were carried out at the 0.05 alpha levels.

Results

Rural and urban household drinking water services in 2015

The RU household drinking water services in SDG regions for 2015 were determined to know the service levels in each region at the commencement of the SDGs. The 2015 baseline data served as a benchmark to measure the progress towards the realization of target 6.1 across all regions. The service status for each region is presented in Table 1. The table reveals that in all SDG regions, households used the service ladder from at least basic to surface water. The proportion of urban households using "at least basic drinking water services" in the SDG regions ranges from 84% to >99%, with a global average of 96%.

Table 1:
Rural and Urban Household Drinking Water Services in 2015

S/N	SDG Region (No. of countries)	At least basic (%)		Limited (%)		Unimproved (%)		Surface water (%)	
		Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
1	Australia and New Zealand (2)	>99	>99	<1	<1	<1	<1	<1	<1
2	Central and Southern Asia (14)	94	86	3	5	3	7	<1	2
3	Eastern and South-Eastern Asia (17)	97	85	<1	2	2	12	<1	2
4	Europe and Northern America (53)	>99	97	<1	<1	<1	2	<1	<1
5	Latin America and the Caribbean (51)	99	86	<1	2	1	7	<1	6
6	Northern Africa and Western Asia (25)	96	82	3	9	<1	6	<1	3
7	Oceania (21)	92	44	1	2	4	21	2	33
8	Sub-Saharan Africa (51)	84	44	8	15	6	26	2	15
9	World (234)	96	79	2	5	2	11	<1	4

Source: Adapted from [5]

The highest service levels (>99%) were recorded in Australia and New Zealand, Europe and Northern America; while the least coverage was reported in SSA, accounting for a 15% service gap. The service level in the rural area ranges from 44 to >99%, with a global mean of 79%. Similar to the situation in the urban area, Australia and New Zealand had the most coverage, while SSA and Oceania had the lowest (44%) coverage each, which produced a 55% service gap. This indicated that the level of inequality in basic water services among the SDG regions was higher in rural areas.

Rural and urban household drinking water services in 2020

The household drinking water services in RU areas in 2020 are shown in Table 2. The provisions of basic water services in SDG regions in urban centres ranged from 87->99%, with three SDG regions (Australia and New Zealand, Europe and Northern America and Northern Africa and Western Asia) having >99% of their population in urban centres with access to "at least basic water services". The lowest figure of 87% access in urban centres was recorded in SSA, with a global average of 96%. This trend follows a similar pattern to the situation in 2015. However, the inequality in services has been reduced to 12% (87->99%) from 15% (84->99%) in 2015. The SDG region with the highest urban growth rate in water services between 2015-2020 was SSA, with a 3% (84-87%) growth; while the service growth in Australia and New Zealand, Europe and Northern America, Northern Africa and Western Asia SDG regions remained unchanged (see Tables 1 & 2). In the rural area, basic water services range from 47->99%, with Australia and New Zealand reporting the highest range, while Oceania had the least range, which follows a similar pattern in 2015, with a global mean of 82%. However, just like the case in urban centres, the gap in service between the highest and the lowest has reduced by 3% to 52% in 2020.

Table 2:
Rural and Urban Household Drinking Water Services in 2020

S/N	SDG Regions (No. of Countries)	At Least Basic (%)		Limited (%)		Unimproved (%)		Surface water (%)	
		Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
1	Australia and New Zealand (2)	>99	>99	<1	<1	<1	<1	<1	<1
2	Central and Southern Asia (14)	95	89	3	5	2	5	<1	1
3	Eastern and South-Eastern Asia (17)	98	89	<1	2	2	8	<1	1
4	Europe and Northern America (53)	>99	98	<1	<1	<1	1	<1	<1
5	Latin America and the Caribbean (51)	>99	90	<1	1	<1	4	<1	4
6	Northern Africa and Western Asia (25)	96	85	3	10	<1	3	<1	3
7	Oceania (21)	93	47	<1	3	4	22	3	29
8	Sub-Saharan Africa (51)	87	49	7	17	5	23	1	11
9	World (234)	96	82	2	6	2	9	<1	3

Source: Adapted from [5]

National household drinking water services in 2015 and 2020

The national (combined RU) household drinking water services for each SDG region in 2015 and 2020 are presented in Table 3. The data on national water services produced a single value that shows the progress rate in each SDG region between 2015-2020. The annual growth rate for the provision of basic water services between 2015-2020 was used to project the expected level of services for each SDG region by 2030.

In 2015, the national household basic water services for the SDG regions range from 55->99%, with a global average of 88%. Following a similar pattern to the disaggregated RU figures for 2015 and 2020, Australia and New Zealand also had the highest regional figures, while Oceania had the lowest. This represents a service gap of 44% between the highest range and the lowest. The levels of national water services in 2020 followed a similar pattern to what was obtained in 2015, with a range of 57->99%. Just as in 2015 the lowest range for the national basic water services was recorded in Oceania, while Australia and New Zealand, Europe and Northern America had the highest, with a global mean of 90%. The service gap in 2020 was 42%, which was a 2% reduction from 44% in 2015.

The findings also revealed that in SSA and Oceania, the population using unlimited surface water services was still remarkable. For example, in 2020, 18% and 23% of the population in Oceania used unimproved and surface water, respectively; while in SSA, it was 16% and 7%, respectively. This class of people should be targeted to reduce the risk associated with the consumption of poor-quality water.

Table 3:
National Household Drinking Water Services for 2015 and 2020

S/N	SDG Region	At least basic (%)		Limited (%)		Unimproved (%)		Surface water (%)		The annual rate of change (basic)	At least basic (%)
		2015	2020	2015	2020	2015	2020	2015	2020		2030
1	Australia and New Zealand	>99	>99	<1	<1	<1	<1	<1	<1	0.01	100
2	Central and Southern Asia	89	91	4	4	6	4	1	<1	0.45	95.5
3	Eastern and South-Eastern Asia	92	94	<1	<1	6	4	1	<1	0.64	100
4	Europe and Northern America	99	>99	<1	<1	<1	<1	<1	<1	0.03	100
5	Latin America and the Caribbean	96	97	<1	<1	2	1	1	<1	0.34	100
6	Northern Africa and Western Asia	90	92	5	6	3	1	1	1	0.41	96
7	Oceania	55	57	2	2	17	18	26	23	0.31	60.1
8	Sub-Saharan Africa	60	65	12	13	18	16	10	7	0.99	74.9
9	World	88	90	3	4	6	5	2	2	0.42	94.2

Source: Adapted from [5]

Discussion

The household water services in the RU area for 2015 show that in all SDG regions except Australia and New Zealand which had equal service coverage of >99%, drinking water services for "at least basic" was higher in the urban area than the rural area. The highest level (48%) of service disparity between RU areas in the SDG regions was reported in Oceania, which was closely followed by Sub-Saharan Africa (SSA); while the lowest (0%) was measured in Australia and New Zealand. Although the use of surface drinking water has reduced appreciably globally, however, of the estimated world population of 7.4 billion people in 2015, 4% (about 296 million) and <1% (about 74 million) of the RU population, respectively still depend on this poor source of drinking water. Similar to the case with "at least basic water services," Oceania and SSA accounted for 50% (about 148 million) people of the 296 million that still use surface water globally in rural areas. In Oceania, 33% and 2% of the RU population used surface water respectively; while in SSA, it was 15% and 2% for the RU area, respectively. This indicates that Oceania and SSA exerted negative pressure on the world's progress towards meeting SDG target 6.1, especially in rural areas. The t-test result ($t_7 = 2.774$, $p = 0.028$, $\alpha = 0.05$) further indicated that significant differences exist between RU household's drinking water services in SDG regions in 2015, which agrees with earlier studies that have established disparity in water service provision between RU areas [15-16].

The continuous use of surface water and other unimproved water sources in all the SDG regions, especially in the rural areas of Oceania and SSA could have constituted more serious health repercussions than anticipated. For example, in 2016, it was reported that over 500 million deaths attributed to diarrhoea in SSA had the consumption of contaminated water as one of the main risk factors [17]. The situation may have been more severe because over 50% of used water sources were faecally contaminated in Africa, exposing the population to a high risk of diarrhoea infection [18].

In 2020, household water services in RU areas follow similar trends in 2015. For example, Oceania also reported the highest level of inequality of 46% (47-93%) between RU water services for “at least basic;” while Australia and New Zealand equally reported the lowest inequality of 0% (>99->99%). In all other SDG regions, water services were better in the urban area than in the rural areas. However, the levels of disparities in water services between RU areas have reduced in all the SDG regions except Australia and New Zealand which had no disparity. Although in the rural area of the SDG regions, SSA reported the highest basic water services from 44-49%, a 5% increase, which is more than the 3% global mean growth rate from 2015-2020, however, the 2030 projected coverage indicated that the region would still report a reasonable number of her rural population without at least basic water access by 2030. This estimate substantiates the submission that in SSA, RU water inequalities have existed for decades [19]. This means that the rural water services in most of the SDG regions were still very unsatisfactory in 2020. By implication, a large number of the global population in rural areas stands the risk of being left behind, which could constitute a serious threat to the actualization of the water target by 2030. A similar projection by the JMP report for 2021 affirms this position, as it noted that globally, billions of people would lack access to "safely managed household drinking water" by 2030 unless the current rate of water services quadruples [5].

Although the percentage of the world's rural population using surface water in 2020 had reduced to 3% from 4% in 2015, however, in Oceania and SSA, the percentage was still very

high at 29% and 11%, respectively in 2020 (see Table 2). These two SDG regions still accounted for about 124 million (53%) of the world population (234 million) that used surface water in 2020 in rural areas, which was more than 50% in 2015 [5]. This is probably due to the high population growth rate without a commensurate increase in rural water services in both Oceania and SSA. This assertion was substantiated by the submission that water service provision in urban areas lagged behind population growth and that globally, in 2017, the population without "at least basic water services" was more than in 2000 [20].

The 4% each reduction recorded in both SSA and Oceania SDG regions between 2015-2020 was considered to be insufficient to eliminate surface water usage by 2030, which constitutes a serious potential threat to the actualization of target 6.1. Since the commencement of the SDG in 2015 till 2020 (five years later), the service gap reduction rate has been unsatisfactory as the inequality between the SDG regions was still very high, which dimed the expectation of reducing water service inequalities in all SDG regions and countries by 2030. This assertion was substantiated by the t-test result ($t_7 = 2.461$, $p = 0.043$, $\alpha = 0.05$), which indicated that the p-value of 0.043 was lower than the alpha value at 0.05 significance level. This indicates a significant difference between RU household water services in SDG regions in 2020. By implication, not everyone is being carried along in water provisions as there was a disparity between SDG regions in the RU area, from 2015-2020.

The national household basic water services in each SDG region experienced one form of change or the other between 2015-2020; however, the change in all SDG regions was 2% or less, except in SSA where a 5% change was recorded. Hence, only SSA, Eastern and South-Eastern Asia, and Central and Southern Asia had yearly growth rates for "at least basic water services" that were above the global mean of 0.42%. Based on current coverage and annual growth rate, only four SDG regions (Australia and New Zealand, Eastern and South-Eastern Asia, Europe and Northern America, Latin America and the Caribbean) were estimated to attain 100% population coverage for “at least basic water services” by 2030. Although SSA reported the highest (1%) yearly rate of growth in basic water services between 2015-2020, it would only achieve a projected 74.9% coverage by 2030 due to its level of coverage (65%) in 2020. This means that SSA needs to increase its yearly growth rate by about 4% if it hopes to attain 100% basic service coverage of its population by 2030. Other SDG regions that have been projected to fail to attain 100% service coverage by 2030 were Central and Southern Asia, Northern Africa and Western Asia, and Oceania. Although Oceania had the worst coverage (57%) for basic water services in 2020 and is also estimated to have the least coverage (60.1%) by 2030, its rate of annual growth between 2015-2020 was just 0.31%. At this level of annual growth, it will take Oceania 130 years from 2020 to attain 100% coverage, which is also subject to the annual population growth rate.

The four SDG regions that were estimated to have less than 100% coverage exerted severe drawbacks on the estimated average world coverage to 94.2% by 2030. Based on these estimates for at least basic water coverage, it is very clear that projections using “safely managed drinking water services” would produce results far below the projections on “at least basic water services” because it is at the peak of the monitoring water service ladder. Although the t-test ($t_7 = -3.130$, $p = 0.017$, $\alpha = 0.05$) shows a significant difference in the national household basic water services in SDG regions between 2015-2020, which indicate progress; however, the population coverage was still below the expected, if target 6.1 is to be

achieved by 2030 in all SDG regions. This indicates that the world would fail to attain target 6.1 by 2030, unless the yearly growth rate increased dramatically by at least 10 folds in some SDG regions, especially, Oceania. This projection confirms the submission that the world is off track in achieving SDG 6 on water and sanitation, as the estimated gap between global water demand and supply would reach 40% by 2030 based on current practices [21]. If the present situation remains, it could trigger severe health and socioeconomic challenges, which would impact negatively on sustainable economic growth and development.

Study strengths and limitations

The study further established that inequality exists in RU household water services to the advantage of the urban area in the SDG regions. The service projection by 2030 has revealed that a large number of the global population would still lack basic drinking water if current annual growth rates of provision remain the same in the SDG regions. Despite the findings of the study, it should be noted, however, that the analyses and projections of the water services in the SDG regions were based on data on "at least basic water services," as against the "safely managed water services," which is the monitoring indicator for target 6.1. This was done because only five SDG regions had sufficient data on "safely managed water services." Therefore, the projections made on basic services would be an underestimation if they were based on "safely managed water services" because it is a more ambitious monitoring indicator for target 6.1. However, the projections made based on "at least basic water services," gave an insight into the current progress towards the achievement of target 6.1.

Conclusion

Findings from the study have shown that in 2020, four SDG regions are on the right path to ensuring that all their respective citizens have access to at least basic drinking water services. However, another four SDG regions, especially Oceania and SSA still have much ground to cover to attain 100% coverage. In all SDG regions, except Australia and New Zealand, the basic water coverage level was less in rural than urban areas. Also, surface water usage was still significantly high in Oceania and SSA rural areas. These findings show that disparities exist between RU water provisions in most SDG regions to the advantage of the urban area. Using the current coverage levels and annual growth rate for at least basic water services, it was projected that the four SDG regions that still have much to cover would fail to attain SDG 6.1, which would invariably make the world miss the set target; since attaining the target 6.1 means that all persons the world over would have access to "safely managed drinking water services by 2030". The researchers recommend that much attention should focus on SDG regions that still have low coverage and concerted efforts should be made to abridge the existing gap in RU water services so that no location or person is left behind.

References

1. **WHO.** Safely managed drinking water - thematic report on drinking water. Geneva, Switzerland: *World Health Organization*, 2017
2. **Ohwo O and Agusomu TD.** Assessment of water, sanitation and hygiene services in sub-Saharan Africa. *European Scientific Journal*. 2018;14(35): 308-326
3. **Meehana K, Jurjevich JR, Chun NMJW and Sherrill, J.** Geographies of insecure water access and the housing–water nexus in US cities. *Sustainability Science*. 2020; 117 (46), 28700–28707
4. **Mutono N, Wright JA., Mutembei H, Muema J, Thomas M, Mutunga M, and Thumbi S M.** The nexus between improved

water supply and water-borne diseases in urban areas in Africa: a scoping review. AAS Open Research. 2021; *4*, 27. https://doi.org/10.12688/aasopenres.13225.1

5. **WHO and UNICEF**. Progress on household drinking water, sanitation and hygiene 2000-2020: Five years into the SDGs. Geneva: World Health Organization (WHO) and the United Nations Children's Fund (UNICEF); 2021.
6. **WHO.** Diarrhoeal Disease: Key Facts, https://www.who.nt/news-room/fact-sheets/detal/darrhoeal-disease; 2017.
7. **WHO.** Drinking water: Key facts. (Online) https://www.who.int/news-room/fact-sheets/detail/drinking-water; 2022.
8. **Dillingham R and Guerrant RL**. Childhood stunting: Measuring and stemming the staggering costs of inadequate water and sanitation, *The Lancet*. 2004; 9403: 94–95
9. **Prüss-Üstün A, Bos R, Gore F and Bartram J.** Safer Water, Better Health: Costs, Benefits and Sustainability of Interventions to Protect and Promote Health, *World Health Organization*, Geneva. 2008
10. **UNICEF**. Water, sanitation and hygiene (WASH) in schools: A companion to the child friendly schools manual, https://www.unicef.org/publications/files/CFS_WASH_E_ web.pdf, 2012
11. **Ohwo O.** Status of water, sanitation and hygiene facilities in public secondary schools in Yenagoa, Nigeria. *World Journal of Social Sciences and Humanities*. 2019; 5(3), 176-183
12. **Khabo-Mmekoa C, and Momba, M**. The impact of social disparities on microbiological quality of drinking water supply in Ugu District Municipality of Kwazulu-Natal Province, South Africa. *International Journal of Environmental* Research and Public Health. 2019; 16(16), 2972. https://doi.org/10.3390/ijerph16162972
13. **Soares LCR, Griesinger MO, Dachs JNW, Bittner MA and Tavares S**. Inequities in access to and use of drinking water services in Latchild-friendly the Caribbean. *Pan Am J Public Health.* 2002; 11(5/6), 386-396
14. **Armah FA, Ekumah B, Yawson DO, Odoi JO, Afitiri A and Nyieku FE.** Access to improved water and sanitation in sub-Saharan Africa in a quarter century. Heliyon 4. 2018; e00931.doi:10.1016/j.heliyon.2018.e00931
15. **Roche R, Bain R and Cumming O.** A long way to go-estimates the combined water, sanitation and hygiene coverage for 25 sub-Saharan African countries, *PLoS ONE*. 2017; 12(2): e0171783.doi:10.1371/journal.pone.0171783E
16. **Ohwo O.** Dimensions of inequality in urban and rural water, sanitation and hygiene services in sub-Saharan Africa. *European Scientific Journal*. 2019; 15(8): 144-162
17. **GBD 2016** Diarrhoeal Disease Collaborators: Estimates of the global, regional, and national morbidity, mortality, and aetiologies of diarrhoea in 195 countries: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet Infect Dis*. 2018;18 (11):1211–1228. 10.1016/S1473-3099(18)30362-1
18. **Bain R, Cronk R, Hossain R,** *et al*.: Global assessment of exposure to faecal contamination through drinking water based on a systematic review. *Trop Med Int Health.* 2014;19(8):917–927. 10.1111/tmi.12334
19. **Adams EA and Smiley SL**. Urban-rural water access inequalities in Malawi: implications for monitoring the sustainable development goals. *Natural Resources Forum*. 2018; 42(4): 217-226.
20. **UNICEF**. Snapshot of global and regional urban water, sanitation and hygiene inequalities, 2020, New York. https://www.unicef.org/media/91561/file/Sn

apshot-of-global-and-regional-urban-water-sanitation-and-hygiene-inequalities.pdf
21. **World Economic Forum.** We're helping to close the gap between global water demand and supply. N.d. https://www.weforum.org/impact/closing-the-water-gap