



A systematic review on water accessibility and safety in Ghana: The plausibility to achieve Sustainable Development Goal 6.1 by 2030

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DOI: <https://dx.doi.org/10.4314/ajhs.v36i1.6>

Abstract

BACKGROUND

Water is essential in everyday life hence, there is a need for it to be available in quality and quantity to all. This study aimed to review relevant published studies on water accessibility and safety in Ghana from 2015 to 2022 to determine the plausibility of Ghana achieving Sustainable Development Goal 6.1 by 2030.

METHODOLOGY

A systematic review was conducted based on the PRISMA guidelines using four databases including ProQuest, Science Direct, Web of Science and Scopus. Studies with data on specified keywords and published in English from January 2015 to June 2022 were included in this study. Duplicated titles were removed and the title, abstract and full text of remained studies were reviewed by two independent coders. Thematic analysis was conducted to identify themes.

RESULTS

Ten studies met the criteria and the majority of them used qualitative design (60%). Five main themes were identified including; causes of water contamination, the prevalence of waterborne diseases, types of water sources, implemented policies and challenges for policy implementation. The government implemented policies to provide safe and potable drinking water for the citizen and now, about 72% of the population have access to treated pipe water. Some challenges facing implemented policies include political interest in illegal mining, inadequate waste disposal facilities, and poverty.

CONCLUSION

This study shows that Ghana can achieve Sustainable Development Goal 6.1 which is "Access to clean and affordable water for all" by 2030. The government, public health organizations and stakeholders should work together to alleviate the challenges faced in achieving this goal.

Keywords: Water access, Water safety, Systematic Review, Sustainable Development Goal, Ghana

[*Afr. J. Health Sci.* 2023 36 (1): 42-52]

Introduction

Access to clean and potable water is a basic human need. Water makes up about 70% of the earth yet, not everyone has access to clean and potable water and development (7).

The United Nations (UN) Sustainable Development Goals (SDG) 6.1 aim to achieve universal access to safe and affordable water for consumption by 2030 (11). Water resources are an important part of development as it is a crux part of the infrastructure, food security,



employment, health promotion etc. Water-related ecosystems provide habitats for animals and some human settlements and have benefits such as transportation, irrigation, employment, and energy source (11). Nevertheless, due to urbanization, climate change, industrial and population growth, and water resources are beginning to be overwhelmed and there is a reduction in providing natural functions due to high levels of pollution. According to the United Nations (2018), if water sources and the environment continues to be polluted and degraded, the world will lose about 45% of its gross domestic products, and 40% of the global grain production in the year 2050 this is because all these depend heavily on water and water sources and continuous pollution will cost us to lose our livelihood.

Since the implementation of SDG 6.1, the poor and marginalized populations mostly low-income countries have had challenges in achieving this goal (11). If proper policies and actions are not implemented, there will further be an increase in disproportionately exacerbating rising inequalities.

Ghana is a low-income country situated in West Africa that is facing challenges in achieving this SDG. It is primarily rural with about 56.5% of the population living in a rural setting (7). Water management in Ghana is still a challenge and it is estimated that two in five Ghanaians do not have access to clean potable water or lack the funds to pay for pipe-borne water (2). About 32% of households rely on freshwater sources like rivers and streams for domestic purposes (3).

The Ghana Ministry of Sanitation and Water Resources (MSWR) published in their report that from 2015 to 2021, about 72% of the citizens have access to treated water even though some communities share a community pipe or borehole compared to about 20% of accessibility in the 1990s to early 2000s (6). The 2030 agenda by the UN has set the target for countries to improve their water resources which will improve global health.

This study aimed to assess the possibility of Ghana achieving SDG 6.1 which is access to safe drinking and affordable water for all by 2030, to appraise the policies implemented by the government and the challenges facing implemented policies.

Methodology

Search strategy and criteria for selection

This systematic literature review used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline. Four databases were used to search articles, including ProQuest, Science Direct, Web of Science and Scopus. These databases chosen were based on their accessibility as well as being frequently used by other researchers in the study topic. The following keywords were used in the databases for relevant studies. (Ghana AND (“Sustainable Development Goals” OR SDG) AND (water’ OR “water access”” OR ‘sources of water”) AND (“Unclean water’ OR “water contamination” OR “water pollution”) AND (‘water consum* OR ‘Use* OR ‘potable water”) AND (‘Water policies OR “water Governance” OR ‘agencies’).

Articles with data on keywords, published in English from January 2015 to June 2022 were included; while studies not available as full text as well as systematic reviews published in other languages were excluded.

Selection Process

The papers passed through various selection processes and were critically appraised. They were imported onto an Excel file and duplicates were removed through screening of the titles. Abstracts and full texts were reviewed using the exclusion criteria to eliminate irrelevant papers. The preliminary search retrieved two hundred and eighty (280) papers which included organizational reports, conferences, grey literature, government records on sources and consumption of water in Ghana. The total number of papers retrieved after the exclusion criteria were applied was

thirty- nine (39) papers. Further screening was done to eliminate irrelevant papers which retrieved Sixteen (16) papers. Ten (10) papers were relevant to the systematic literature review. This has been summarized in the PRISMA Flow chart presented in Figure 1.

Data extraction and critical appraisal

The quality of the relevant articles was assessed using the Critical Appraisal Skills Program (CASP) appraisal tool checklist for qualitative studies. The study should be able to answer at least two of the three questions; 1) Are the study results valid? 2) What are the study findings? 3) What is its applicability to the local population? Additionally, the strengths and weaknesses of the studies and individual findings were analyzed. The study

designs and sampling methods of the studies were appraised with the checklist to consider if they were appropriate and answer the questions.

A paper was found to be of poor quality when that paper failed to answer any of the Critical Appraisal Skills Programme (CASP) checklist was answered. These papers were eliminated and not included in the relevant papers. A Data Extraction table was designed using Microsoft Excel to extract relevant information from the included articles which were thoroughly read. The table captured relevant information about the publication year and country, title, the aim of the study, data collection methods and their key findings. All these were recorded in the table data extraction table in Table 1.

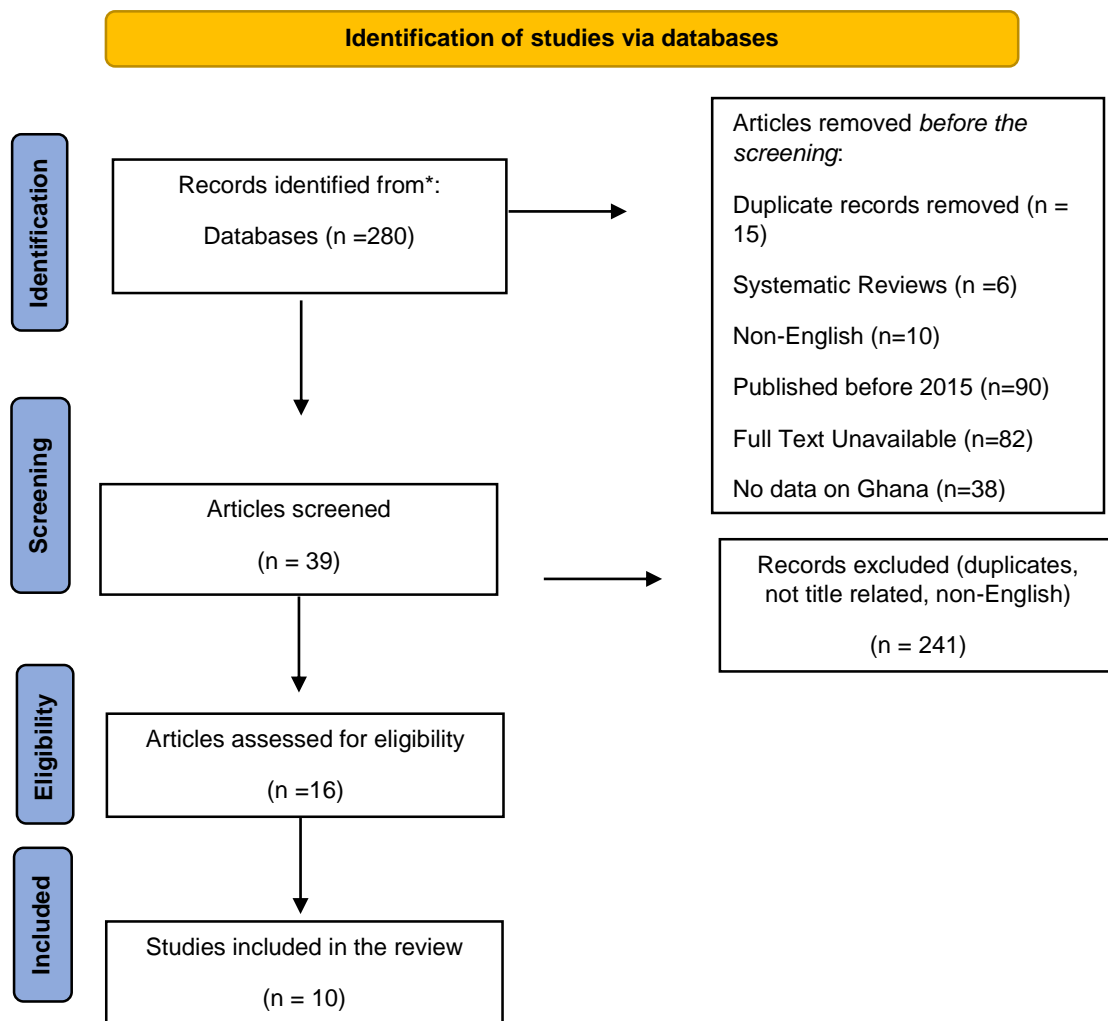


Figure 1:
Flow diagram of included studies



Table 1:
Data extraction used for the studies

Study information	Study objective	Data collection (Type of Study/ data collection method/sampling methods)	Key Findings
Kosinski <i>et al.</i> , 2016 Amasaman, Ghana	To understand water use and water infrastructure in a Schistosomiasis- endemic community in Ghana: A case study of Amasama, Ghana.	Mixed method study Questionnaires were used to collect data Convenience sampling	<ul style="list-style-type: none"> • Surface water is mostly contaminated with human waste. • 32% of the household reported using river water for domestic purposes. • 10.5% use bore-holes and 53.8% of households use both river and boreholes. • Schistosomiasis is perceived in 89.3% of households.
Seidu, A., 2021 Ghana	To assess how children's stools are safely disposed of in Ghana using evidence from a 2014 survey and demographics.	Quantitative study Questionnaires were used to collect data Random sampling	<ul style="list-style-type: none"> • Three-quarters of mothers disposed of faecal matter of their children into water bodies due to inadequate toilet disposal facilities. • The prevalence of safe child stool disposal in water is 24.5%
Owusu <i>et al.</i> , 2016 Ghana	To assess Ghana's water resource management and the prospects for the country.	Qualitative study Questionnaires were issued Convenience sampling	<ul style="list-style-type: none"> • Various groundwater development programs have resulted in the drilling of more than 10,000 boreholes • 56.6% of the population live in rural areas with deprived access to safe drinking water. • Illegal mining activities of minerals have destroyed water bodies in Ghana. • A task force has been set up by the government to arrest culprits who engage in illegal mining activities damaging water bodies.
Ministry of Sanitation and Water Resources, 2019 Ghana	This report is to show the laid down medium-term expenditure framework for 2019-2022 by the Ghana government.	Qualitative study Face-to-face interview Convenience sampling	<ul style="list-style-type: none"> • The government has allocated a huge financial budget to provide potable clean water to households and implemented policies to ensure efficient management of water resources through Integrated Water Resources Management. • Budgetary allocation to promote creative and innovative research in the production and use of improved technologies and approaches for the effective provision of water and sanitation services.



Antwi-Agyei <i>et al.</i> , 2016 Accra, Ghana	To assess the faecal matter of farm workers exposed to contaminated water in Accra, Ghana	Quantitative study Questionnaires were used Convenience sampling	<ul style="list-style-type: none"> Irrigation water was highly contaminated with E-coli at a rate of 84% which exceeds the WHO water quality standard. All the workers had a high level of E-coli in their faeces.
Long <i>et al.</i> , 2015 Ghana	To understand the Social Context and the quality of water of a small-scale mining community in Ghana.	Qualitative study Face-to-face interview Convenience sampling	<ul style="list-style-type: none"> 47% of the respondents use well or boreholes as a source of water and most of these drinking water sources are contaminated with chemicals from small-scale mining
Schuster <i>et al.</i> , 2020 16 Low and middle-income countries	To assess the far-reaching consequences of water insecurity on infant feeding practices and infant health across 16 low and middle-income countries.	Qualitative study Questionnaires were used to collect data Snowballing sampling	<ul style="list-style-type: none"> Water insecurity was perceived to directly affect breastfeeding and no-breastfeeding Respondents made a connection between using water and increase infectious diseases in their infants.
Martel <i>et al.</i> , 2019 Ghana	To assess urogenital Schistosomiasis knowledge among primary and junior high school	Quantitative study Questionnaires were used to collect data Convenience sampling	<ul style="list-style-type: none"> 50% of the respondents know about the disease and have had an infection. Educational programmes are being introduced in these endemic areas to reduce the infection rate.
Yeboah <i>et al.</i> , 2022 Tano-North, Ghana	To assess the quality of water and health risk assessment of the intake of water from point water sources in Tano- North Municipality Ghana.	Qualitative study Questionnaires were issued Purposive sampling	<ul style="list-style-type: none"> Microbial Risk assessment shows a potentially high risk of infections due to high microbial load and the presence of coliforms and E-coli in the source of the drinking water in the municipality.
Yeleliere <i>et al.</i> , 2018 Ghana.	To review the quality of Ghana's water resources and management with a particular focus on freshwaters.	Qualitative Study Face-to-face interview Purposive sampling method	<ul style="list-style-type: none"> Poor quality of fresh water is due to pollution from sewage, and the leaching of fertilizers and pesticides. The water resource commission set laws to foresee and implement strict laws regarding water pollution. Challenges such as political interests are faced by the commission in enforcing laws.



Results

General characteristics and nature of the reviewed studies

Ten studies were considered for this review. The results of the relevant studies revealed that most of the studies on water accessibility in Ghana were conducted in 2016 (30%), followed by the year 2019 with 20% of the study and 2015, 2018, 2020-2022, each comprising of 10% of the study. This finding is presented in Table 2.

The results revealed that the majority of studies were qualitative studies (60%) followed by quantitative studies (30%) and mixed methods (10%). The sampling method used most was convenience sampling (60%), followed by purposive sampling (20%), random sampling (10%) and snowballing sampling method (10%) respectively. Questionnaires mostly used the data collection

method (70%) while 30% used the face-to-face interview to collect data (Table 3).

Themes identified

Five main themes were identified including; causes of water contamination, the prevalence of waterborne diseases, types of water sources, implemented policies and challenges for policy implementation (Table 4).

Theme 1: Causes of water contamination and diseases

The main causes of water contamination identified were indiscriminate disposal of faecal matter, refuse and chemicals from illegal mining and leached fertilizers into the water bodies. The results show that about three-quarters of the causes of water, contamination was from faecal matter (3, 9, 13).

Table 2:
Distribution of study reviewed based on the Year (n=10)

Year of Study	Frequency	Percentage
2015	1	10
2016	3	30
2017	0	0
2018	1	10
2019	2	20
2020	1	10
2021	1	10
2022	1	10

Table 3:
Distribution of studies based on study design, type of study and data collection method (n=10)

Variables	Frequency	Percentage
Study design		
Qualitative study	6	60
Quantitative study	3	30
Mixed methods study	1	10
Sampling methods		
Convenience Sampling	6	60
Purposive Sampling	2	20
Snowballing Sampling	1	10
Random sampling	1	10
Data collection methods		
Questionnaires	7	70
Face-to-face interviews	3	30



It was also found that illegal mining and chemicals from leached fertilizers pollute the water sources, especially in rural areas (4, 7). This has led to the presence of disease-causing organisms like *Escherichia coli* (E-coli), *Schistosoma sp* and coliforms to be found in most of the water sources in Ghana (1, 3, 12).

Theme 2: Prevalence of waterborne diseases

The consumption of unclean water has led to a high rate of waterborne diseases. There is a high prevalence of Schistosomiasis with a rate of about 89% (3). Additionally, other studies show a prevalence of E-coli infection as high as 60% (1, 5, 8, 12). The demographic that suffers from these health effects the most are school children because they swim in these freshwater bodies and consume them as well (5).

Theme 3: Type of water sources

Different types of water sources were identified in relevant studies which were mostly boreholes, rivers, lakes, and pipes. Most of the populace used both boreholes and river sources for domestic purposes with a prevalence of 53.8% (3). Furthermore, other studies also supported this data and showed that about 80% of water consumption is for domestic purposes and is sourced from boreholes, standing pipes and rivers (4, 7, 13).

Theme 4: Implemented policies

According to implemented policies set to achieve SDG 6.1, the results show that budgetary allocations from the government

have been pumped into this initiative and more than 10,000 boreholes and standing pipes to provide portable and safe water for communities (5, 6, 7). Also, a task force team has been set up in areas endemic to illegal mining to arrest people indulging in this activity on the water bodies. Proper farm fertilizer and chemical handling programmes have been implemented to educate farmers on the proper management of fertilizers and farm chemicals so as not to contaminate water bodies by leaching into them (7).

Theme 5: Challenges for policy implementation

Political interests in illegal mining, poverty and inadequate proper waste disposal systems are challenges hindering implemented policies to meet SDG 6 (9, 13). However, sensitization programmes on the dangers of illegal mining are being done to educate the citizens to desist from the act, and policies to improve the livelihood of citizens such as job creation, education and provision of proper waste disposal system are being set up to alleviate these challenges.

Additionally, the percentage of the types of water sources was 53.8% for boreholes and freshwater sources combined, Boreholes were 47% and freshwater sources only 32%. The percentage of the negative health effects of water contamination and the percentage of disease-causing organisms in water sources was found to be 89.3% for Schistosomiasis and 50% for E-coli infections (Table 5).

Table 4:
Themes identified from relevant studies

Themes	Frequency	Percentage
Causes of water contamination and diseases	7	33.3
Prevalence of waterborne diseases	5	23.8
Type of water sources	4	19
Implemented policies	3	14.2
Challenges to policy implementation	2	9.5



Discussion

This systematic review focuses on water consumption in Ghana, and it assesses the sources of water for consumption, the prevalent rate of the citizens who currently have access to clean, potable and affordable water, the causes of pollution of water and its negative health effects on the citizens as well as policies implemented by the government to achieve SDG 6.1 by 2030.

There was a high rate of contamination with disease-causing organisms in freshwater sources. At least one person in a household has a history of a water-borne disease like an E-coli infection. Different factors accounted for the high rate of pollution with some being inadequate toilet facilities, illegal mining activities, and indiscriminate disposal of waste in the water bodies. Government organizations, health agencies and stakeholders are implementing policies and budgetary allocations to provide clean and potable water to the citizens and alleviate the underlying challenges of these policies.

Numerous papers have been published on water management in low-income countries. From the finding of this systematic literature review, it was evident that Ghana is mostly rural and peri-urban with most people living in rural settings (7). About 32% still consume water directly from rivers, streams and lakes (3). Comparing statistics from the early years to the 2000s, there is a significant improvement in water sources as 53.8% use boreholes and 72% of the citizens have access to both standing pipes and boreholes (6). This was attained

because of budgetary allocations from the government and financial aid from the World Bank Ghana and other donor agencies.

From the findings, between 2015- 2016 there was a high prevalence rate of negative health effects in Ghana for the consumption of unclean water with Schistosomiasis recording the highest rate of 89.3% and this was because school pupils especially waded through and swim in rivers (3). Also, irrigation water used to irrigate crops for food consumption had a high bacterial load of E-coli about 84% which is above the WHO contamination limit (1). Additionally, the high contamination rate of the sources affects breastfeeding mothers and their ability to produce quality breast milk as well as prepare hygienic meals for their infants. The study was conducted across 16 low-income countries and provided the findings which were reviewed (8). Data provided by (3, 4 and 13) showed that the main cause of pollution in water sources in Ghana to date is the disposal of human stool in water bodies, chemicals from illegal mining and the leaching of chemicals from fertilizers into the water sources. To curtail the high prevalence of waterborne infections, a sensitization and education programme on Schistosomiasis and E-coli infections in endemic areas was launched and by 2019 infection rate had decreased by 50% (5).

It can be inferred from the findings in the systematic review that there has been the implementation of policies to oversee water management, and usage and to provide potable water for the citizens.

Table 5:

Percentage of water sources and the negative health effect and disease-causing organisms found in water sources

Factor	Percentage
Water Source	
River /lake/ streams (freshwater)	32
Bore-hole	47
Both fresh water and bore-holes	53.8
Negative health effects	
Schistosomiasis	89.3
E-coli infections	50



Task forces and committees have been set up with laws arresting offenders apprehended for disposing of waste and human stool in water sources, illegal miners, and farms not practising proper irrigation practices (5, 6, 13). Budgetary allocation and loans have been pumped into the agenda to achieve SDG 6.1. About \$125 million has been allocated to increase potable water access from 2019 to 2022 (6, 10).

Even though the government of Ghana has designed and implemented policies to achieve SDG 6.1, it can be inferred from the findings that some challenges are being faced to successfully achieve this goal. The main challenge hindering this goal is political interest in illegal mining activities (13). Also, the high poverty rate and inadequate toilet facilities are a menace making the implemented policies difficult to enforce as published (9).

Strengths and Limitations

This systematic literature review was undertaken driven by the strength that it has provided data that will add to the literature. Other strengths which stem from this review are, it has to assess published literature to identify the causes of contamination of water sources in Ghana and implemented policies to achieve SDG 6.1 and through this, it can be inferred that Ghana as a low-income country can achieve this goal. Additionally, the review conducted a rigorous literature search on 4 top scientific databases that publish concise and accurate data and used systematic guidelines in the review. However, some limitations of this review can be said that the published data concentrated on only two major negative health effects leaving others like cholera, dysentery etc. Another limitation is most of the studies were done in Accra and few in other parts of the country which gives limitations to generalizing the findings.

Conclusion

Access to clean and affordable water is a basic human right. The United Nations SDG 6.1 is one of the goals which countries aim to

achieve by 2030. Ghana is a low income situated in West Africa and also aims to achieve this goal by 2030. Most of the communities are rural and their water sources for consumption are mainly freshwater and the rate of contamination of the water is high. This systematic literature review assessed 10 relevant papers published data published in 4 scientific databases on Ghana and it identified that these freshwater bodies are mainly contaminated by indiscriminate disposal of human stools, rubbish and chemicals used in illegal mining in these water bodies. This has given rise to some negative health effects like Schistosomiasis and E-coli infections. To check these factors, governments and other agencies have implemented laws and task forces to arrest people found indulging in these activities. However, these implemented policies are facing challenges like political interests in illegal mining, inadequate disposal systems for refuse and stools and poverty.

Even though Ghana is facing challenges with implemented policy, water supply in communities has been improved from 2015 to 2021 and about 72% of the citizens have access to clean and affordable water. It can therefore be inferred that Ghana can achieve Sustainable Development Goal 6.1 by 2030.

Recommendations

Policies have been implemented to check the rate of water contamination however, these policies face some challenges.

To alleviate these challenges, some recommendations can be considered to achieve SDG 6.1. Firstly, there should be an increase in awareness of the dangers of illegal mining and the negative health risk from the mining chemicals both to human and aquatic life. With this awareness, locals will be informed and refuse politicians who approach them with offers to indulge in illegal mining. Also, laws are supposed to be enforced to persecute politicians and community leaders who are culprits in this act. Additionally, it can be recommended that government need to partner



with organizations and agencies to provide adequate toilet facilities in communities and proper waste disposal systems should be set in place. Thus, citizens will not dispose of human stools and waste in water bodies.

Due to the high rate of poverty, it is recommended that the government subsidize the cost of water in the country so people can afford safe and treated water. Lastly, procuring logistics is a hindrance together with a good road to far rural areas. Public health personnel and agencies can advocate and solicit equipment from donor organizations in high-income countries. Also, the use of media outlets like radio, and television as well as the use of social media in the form of advertisements and short documentaries on their platforms to reach a larger audience across the country to sensitize and educate them to achieve the SDG by 2030.

Disclosure

The authors declared no conflict of interest. No funding was received for this study.

Acknowledgement

The authors would like to thank Dr Masoud Mohammadnezhad for his immense guidance and support.

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