LEVELS OF ACCESS TO WATER AND THEIR IMPACTS ON THE QUALITY OF LIFE

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ABSTRACT

Structured abstract: to evaluate the effects of different conditions of accessibility to drinking water in rural population.

Purpose: the way in which water is supplied at home directly influences the health of its inhabitants. In 2017, eight out of ten people living in rural areas did not have access to basic drinking water services or safely managed water services, of which nearly half lived in least developed countries and rural areas.

Method/design/approach: a systematic review was carried out, through metadata analysis, selection of methodologies adopted and the relationships established by the authors between different conditions of access to water and hygiene and health, well-being, water quality, time and cost. The main methodologies adopted are questionnaires and univariate statistical analysis, applied in an associated or not.

Results and conclusion: the closer the rural household is to the water collection point, the better the conditions for developing their productive activities. High indoor plumbing costs, especially for individual catchment solutions, may force some households to use unsafe sources of water supply. It was possible to identify the impacts of the lack of internal plumbing and the difficulty of accessing water in rural communities.

Research implication: understand and highlight the relationship between internal plumbing and its possible effects on humans, especially in rural areas.

Originality/value: it can provide subsidies for public policies on internal plumbing, assisting in the construction of indicators that guide the elaboration and evaluation of these policies.

Keywords: Water Access, Accessibility, Rural Sanitation, Hygiene, Health.

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NÍVEIS DE ACESSO A ÁGUA POTÁVEL E OS IMPACTOS GERADOS NA QUALIDADE DE VIDA

RESUMO

Objetivo: avaliar os efeitos das diferentes condições de acessibilidade à água potável em populações rurais.

Referencial teórico: a maneira como ocorre o abastecimento de água no domicílio influencia diretamente a saúde dos seus habitantes. Em 2017, oito em cada dez pessoas que moram na zona rural não tinham acesso a serviços de abastecimento de água potável básicos ou serviços de água gerenciados de forma segura, dos quais, quase a metade viviam em países menos desenvolvidos e em áreas rurais.

Método: foi realizada uma revisão sistemática, analisando metadados, metodologias adotadas e as relações estabelecidas pelos autores entre diferentes condições de acessibilidade à água e higiene e saúde, bem-estar, qualidade da água, tempo e custo. As principais metodologias adotadas são questionários e análise estatística univariada, aplicados de maneira associada ou não.

Resultados e conclusão: quanto mais próximo o domicílio rural está do ponto de coleta de água, melhores são as condições para desenvolverem suas atividades produtivas. Custos altos com canalização interna, especialmente para as soluções individuais de captação, podem forçar algumas famílias a utilizar fontes inseguras de abastecimento de água. Foi possível identificar os impactos da ausência de canalização interna e a dificuldade de acesso à água em comunidades rurais.

Implicações da pesquisa: entender e evidenciar a relação entre a canalização interna e os seus possíveis efeitos no ser humano, principalmente em áreas rurais.

Originalidade/valor: pode fornecer subsídios para as políticas públicas sobre canalização interna, auxiliando na construção de indicadores que orientem a elaboração e avaliação dessas políticas.

Palavras-chave: Acesso à Água, Acessibilidade, Saneamento Rural, Higiene, Saúde.

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1 INTRODUCTION

In July 2010, the United Nations General Assembly, through Resolution 64/292, recognized access to clean and safe water, as well as sanitation as a right for all (UNITED NATIONS, 2014). With this, member countries of the United Nations (UN) adopted the Millennium Development Goals (MDGs), with specific targets by the year 2015, among them, the 7c goal, which was achieved earlier than expected, specifically, in the year 2010, where there was a reduction of the population that did not have access to drinking water and basic sanitation by half (WORLD HEALTH STATISTICS [WHS], 2015).

As of the MDGs, the World Health Organization (WHO) Joint Monitoring Program for Water Supply and Sanitation (JMP) has become responsible for monitoring progress towards the 2030 Sustainable Development Goal (SDG) targets. Thus, in 2018, metrics were applied to assess the levels of drinking water services, which take into account their accessibility, availability and quality.

A water service is considered to be accessible when it meets the following conditions: the time between collection and the point of collection of the water (considering the round trip) should not exceed 30 minutes, or the supply point should be within the residence or lot, available in sufficient quantity and free of contamination (United Nations International...
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Children's Fund [UNICEF] & World Health Organization [WHO], 2018a). In this case, when there is access to water in a safe and accessible manner, the benefits to human health and well-being become greater, which does not happen when the water collection point is found over greater distances or even when there is no availability of water. And, one way that can solve the problems in terms of water supply, is the use of geotechnologies and software, as well as assisting in the decision-making and fulfillment of the goals of the SDG (Aragão et al., 2022).

Access to water near or within the home saves users time, which can result in economic benefits for the family, as well as reduced physical effort and a reduction of inequality in relation to education (Cairncross & Valdmanis, 2006; Hutton et al., 2007). In Mexico City, the impact of precarious access to water in education was identified, where girls and women are prevented from attending school because of the need to seek water over long distances (San Miguel, 2018).

In addition to the availability of water adequately, the existence of basic hand washing facilities impacts the adoption of better hygiene habits, which consequently reduces the transmission of diseases by water transport (Wang & Hunter, 2010; Subaiya & Cairncross, 2011; WHO, 2019), as exemplified by the study conducted by Pickering and Davis (2012) in 26 African countries, where it was identified that populations with higher access to water showed lower rates of diarrheal diseases in adults and children. Because of its importance, access to basic home services is one of the indicators of SDG 1, which refers to poverty eradication (UNICEF & World Health Organization [WHO], 2018a).

Thus, the way in which water supply occurs at home directly influences the health of its inhabitants. The JMP report (WHO, 2019) shows that there is great inequality in accessibility, availability and quality in basic drinking water services. As of 2017, eight out of ten people living in rural areas did not have access to basic drinking water services or securely managed water services, of which almost half lived in less developed countries and rural areas (WHO, 2019). Water supply services considered basic are those where less than 30 minutes is spent between return and return to obtain water and whose source is from the supply network, being deep or shallow well, as well as mine, spring, spout, rainwater or mineral water (WHO, 2019).

Given that adequate accessibility and infrastructure provide a better quality of life for the population, and that there are still many who need improvement in access, it is necessary to propose projects and public policies aimed at reducing this deficit, including access to water within the lot or home. Furthermore, it is fundamental to understand the relationship between internal channeling and its possible effects on humans, especially in rural areas. In this context, the study aims to evaluate the effects of different conditions of accessibility to drinking water in rural and low-income populations.

2 METHODOLOGY

To conduct the investigation of water access levels and overall impacts on the quality of human life, a systematic review was applied based on studies by Snyder (2019) and Comforto et al. (2011). The selection and evaluation of the articles, including the review ones, were available in Portuguese and English in the Scopus database, with topics related to the conditions of accessibility to water supply in rural communities "within 30 minutes" (considering round trip) or "on site", as presented by the JMP (UNICEF/WHO, 2018a). To form the theoretical basis, the reports of UNICEF, WHO and WHS were also consulted.

First, the search was conducted from the keywords "piped water" and "accessibility" and their English correspondents ("Piped water" and "accessibility"). From this, other keywords were identified that, when combined, returned works that contribute to the proposed objective. In Figure 1a you can see the combinations of descriptors used and the result, totaling 45 articles. It should be noted that in 2011, no published article was found on the subject treated.
Figure 1b presents the route of the search for articles, carried out in three sequential stages: screening, eligibility and inclusion in the selection of articles to be evaluated. In the first stage (triage), repeated articles were eliminated evaluating titles, keywords and abstract. In the second stage (which deals with eligibility), starting from the reading of the introduction and conclusion of each article, we filtered those that contained relevant information. Finally, for the final selection of the articles, they were read in full, evaluating the exclusion criteria: i) not suitable for the theme, and ii) they did not address aspects related to the presence or absence of water pipes in the household, in the lot or 30 minutes away for collection.

In the end, the following metadata of the selected articles were collected: title, objectives, methodology, area of study, country of research, authors and year. In addition, it was verified, the different relationships established by the authors between different conditions of accessibility, hygiene and health, well-being, water quality, indices, convenience and time savings, cost (tariff and price), seasonal variability/availability, attitudes and intentions in relation to the storage, conservation and consumption of water. Also, the applied methodologies for the analysis of the results were observed, classifying them as to their nature in qualitative, quantitative or qualitative-quantitative, and verifying whether primary or secondary data were used, in order to summarize by means of descriptive statistics.

3 RESULTS AND DISCUSSIONS

From the systematic review, 45 articles were selected considering the period from 2011 to 2020. With regard to the limitations of the research, with the exception of 2015, a gradual increase until 2017, from which a decrease in the articles found occurred, is presented in Figure 2.
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Of the evaluated studies, 60.0% were performed from primary data (Figure 3). Of these, almost all, 48.9% used as methodology the application of questionnaires and univariate statistical analysis, 8.9% were followed up only with interviews and application of questionnaires, and 2.2% of the articles included water quality analyzes. Furthermore, 40.0% of the articles had their results based on secondary data, of which 13.3% were the result of bibliographic searches for data collection and exclusively qualitative analyzes, while 26.7% were the result of the observation and statistical comparison of secondary quantitative data consulted in national or regional surveys. In the scenario presented, the researches are related to the survey and analysis of data in almost its entirety, therefore needing applications, which aim at improving the quality of life of the populations.

Still in time, the rural areas of Latin America show few studies related to the theme, representing 6.6% of the search, on the other hand, the African continent represents 40.0% of the studies. Thus, it is observed, the need to encourage research in rural areas, particularly in Brazil, where no articles were found that dealt with the association between access to water and quality of life.

Figure 2 - Distribution by year of publication of the articles found in the survey for the time cut-off from 2011 to 2020

Source: Prepared by the authors (2022).

Figure 3 - Collection and methods of analysis of primary and secondary data of selected articles

Source: Prepared by the authors (2022).
As for the themes, the greatest results were for the theme of health and hygiene (71.7%), followed by the theme of convenience of access to water and saving time (61.1%), as can be seen in Figure 4. The other studies covered the theme of cost and willingness to pay (PAD) (33.3%), intermittency in water supply (22.2%) and water quality (47.8%). It should be noted that the total exceeds 100%, since in the same article may have worked more than one theme.

Figure 4 - Quantification of the topics researched in the articles evaluated in the present study
Source: Prepared by the authors (2022).

3.1 Health and Hygiene

As to the theme of health and hygiene, 71.7% of the studies related the effect of the situation of access to water to hygiene habits, since families with households with water pipes present better hygiene habits and consequently an improved health condition, when compared with those who do not have easy access, showing that hygiene conditions are closely associated with proximity of the water collection point to the home (Kayser et al., 2013; Garriga & Foguet, 2013; Shaheed et al., 2014; Graham et al., 2016; Bizuneh et al., 2017). The effort made during water transport in all age groups can facilitate the development of spinal pain and further aggravation in the health situation of rural residents (Graham et al., 2016; Bizuneh et al., 2017). Thus, not having access to water adequately compromises the nutritional status of families (Torlesse et al., 2016), does not guarantee safe water, but also undermines the subsistence aspects necessary for the maintenance of life. This occurs because, there are groups of older individuals inserted into the family environment, they do not have the physical capacity to transport water, especially over long distances (Geere & Cortobius, 2017). Therefore, weaker individuals have less capacity to transport water, contributing less to the collection of water when it is not located within the lot and with unequal access to water, suffer more from the damage to health.

As far as children are concerned, they may be undernourished (Bbaale, 2014), not only because of water contamination or lack of hygiene habits, but also because of exposure to latrines. Thus, it was found that the chance of exposure to childhood diarrhea was 1.72 times higher in the absence of hand washing facilities near the latrine or cesspools, compared to the environment in which it is present (Soboks Gari et al., 2020). Therefore, it is necessary to install adequate collection points of sewage, as well as the habit of washing hands. This habit, in turn, is often hampered and even rendered unfeasible by the absence of consistent water
sources, with the presence or otherwise of piped water at the site (Kayser et al., 2013; Jenkins et al., 2013; Bizuneh et al., 2017).

The amount of water and proximity to water collection points proved to be more important for the reduction of diarrheal diseases than the quality of the water consumed. In places where water was delivered to families in plastic barrels pulled by wagons, characterizing a more laborious obtaining of water, it was found that the probability of diarrhea among children approximately doubled (Bizuneh et al., 2017). In this way, an adequate infrastructure accompanied by good hygiene practices is indispensable, as these actions can minimize water-borne diseases (Roberts et al., 2012; Ravindra et al., 2019). In addition, washing hands with soap and water is among the most economical interventions to reduce disease transmission, identified as the top priority for hygiene monitoring and for meeting the SDG targets (WHO, 2018b). Thus, the literature evaluated shows the impact of easy access to water on improving health conditions, especially in children.

3.2 Water quality

Almost half of the studies (47.1%) related the quality of the water and the conditions of access, since, in suitable circumstances, there may be an improvement in the habits of hygiene, integrity and quality of the water to be used by the families. The lack of water collection points in the lot or inside the house, can influence the water storage, as well as resulting in contamination due to impurities contained in the environment and by vectors (Shaheed et al., 2014).

Studies addressing unsafe water storage and handling practices have been associated with high counts of bacteria “indicating fecal contamination” in the collected water. Thus, it can be observed that there is a close relationship between hygiene, water safety and health. It is presumed that if water consumed by a family is channeled, the presence of pathogenic microorganisms will decrease, since it extinguishes the storage of water in unreliable containers, as well as exposure to the external environment, i.e. points of consumption channeled in the perimeter of the household will be reliable enough, eliminating the need for storage.

On the other hand, Augier et al. (2016) and Ravindra et al. (2019) noted from a review study that improving access to water does not ensure that it is drinkable. This occurs due to rust and leaks that happen in the pipes, making the contaminated water, by compounds like iron and magnesium, reach home. In the case of rural communities and small towns suffering from this type of contamination, the delay may be greater compared to urban areas, due to the difficulty of access to these places (Wright et al., 2014).

When this happens, the praise by the protagonists for the use in rural communities ends up being lower, as soon as it becomes necessary, the monitoring frequently to better accept public water. Thus, it is reaffirmed by Long et al. (2018), that ensuring access to drinking water does not increase water consumption, since there may be negative perceptions about the safety or taste and odor of tap water, coming from scrap pipes, accompanied by inadequate monitoring of the water consumed.

In cases of inadequate infrastructure and lack of suitability for access to water, the inhabitants themselves can implant measures that mitigate the impacts of the supply of water of an improper quality, for example boiling of the water, or even physico-chemical treatments. Regardless of whether there is access to water within the lot/residence or not, an intradomiciliar treatment, prior to consumption, should be performed, preferably adopting some disinfection practice (Gawel & Bretschneider, 2017). Thus, Torlesse et al. (2016) consider domestic water to be “treated” when the family reports that it has been boiled, bleached, filtered or disinfected by the sun. Therefore, access to information, training and training on the various techniques and processes available for the treatment and safe storage of water is indispensable (Ravindra...
et al., 2019). Therefore, the literature shows that studies aimed at education and training on intra-household practices are fundamental to guarantee the safety of the water consumed, even in situations of easy access to treated water, since habits and local customary can impact on its correct treatment and storage.

3.3 Intermittency and water scarcity

In many studies, contamination arising from water storage is related to interruptions in the supply of water and seasonal issues, even though households have internal pipes in the batch, or even a water collection point closer to the place of consumption. Frequently, problems of intermittency and scarcity, discussed in 22.2% of the articles, cannot be avoided, and it is not possible to guarantee safe access to water.

In addition to the problems brought to basic needs, the lack of continuity in water supply can negatively influence a family's daily activities, such as planting gardens and family hygiene, thus, communities that have continuous supply and piped water, present greater uses of household appliances, growing vegetables, and improve personal hygiene habits (Fan et al., 2013). It should be noted that water scarcity provides low productivity at work, lower education, and may lead to a simpler and more regulated life (Onarheim et al., 2016).

Water scarcity can result in other drawbacks. The fact that women play the role of household and household administrator in situations of water scarcity is common for women, according to Magesa and Pauline (2019), to develop the activities on their own, without the assistance of other family members, which places a burden on women and girls in families.

With regard to health-related issues, interruptions in channeled (or not) water supply cause residents of rural areas to store water for hours or even days, which increases contamination by water-borne diseases such as cholera (Shah et al., 2012; Ravindra et al., 2019), a situation also discussed in the item "Health and Hygiene". Although intermittency influences the use of safe water sources, such indicator was not included in the official calculation of indicator 6.1.1 for the country, established by ANA (2022), and should therefore be investigated. Finally, water demand is a crucial factor in planning access to the service and should be assessed (Fikri et al., 2023). Demand studies associated with the adoption of innovations in scarcity regions can avoid unsafe access to water, as solutions such as the one studied by Schmitt, Tahim and Tavares (2020) have wide acceptance by the population.

3.4 Convenience of access to water for time savings

For many families, the convenience of getting water closer to home means more than health-related benefits. This relationship between internal plumbing and the convenience of access to water was found in 61.1% of the articles surveyed. This condition is extremely important, since when there is no water collection point for supply at a distance of less than 30 minutes, the demand for water imposes additional costs of time and physical effort on the families (Arouna & Dabbert, 2012), depending mostly on water from other sources, such as lakes, public ponds and streams, which costs them a waste of time in collecting water for domestic use. Thus, the way supply occurs within the perimeter of the residence positively influences family income (Rautanen et al., 2014; Suparman et al., 2016; Geere & Cortobius, 2017). It should be noted that only two articles had internal channeling as their main focus, among them, only one related to happiness indices with economy and time.

This means that for these families there is no option for collecting water at points closest to their dwelling. However, even in a scenario with better water supply points, families end up choosing to collect water of dubious quality in nearby locations (Mahasuweerachai & Pangjai, 2018; Tantoh & Mckay, 2020), mainly aiming to spend less time and effort. In addition to
saving time and the burden of long-distance water collection, which are usually carried out by women and girls, they suffer from lower family productivity and school attendance, which may favor the risk of sexual harassment during walking (Geere et al., 2010; Shaheed et al., 2014; Augie et al., 2016).

The benefits of piped water are evident. In a discussion paper with 32 representatives from 12 drinking water systems in May 2013, they all said that it used to take more than half an hour to get water and that none of them had a garden because of the difficulties encountered. After receiving piped water by gravity near their homes, all had gardens and six responded that they increased the number of their animals on their properties (Rautanen et al., 2014).

It is then noted that the quality of life of rural residents is closely related to the level of access to water, that is, the closer the household is to the point of water collection, the better the conditions are for developing their productive activities, adding income for their sale. In addition, it is expected that the cultivation of food products will improve the nutritional conditions of families, increasing the willingness to work and perform activities.

3.5 Cost of an improved water supply solution and Willing to Pay (DAP)

Of the selected articles, 33.3% discussed the influence of the cost involved in the different types of supply and how it affects the different parts of society. Thus, purchasing power is a determining factor for access to an internal water supply facility and consequently, the benefits in relation to health and quality of life are greater (Arouna & Dabber, 2012). Income is seen as the predictor of access to improved water facilities (Garriga & Foguet, 2013; Joshi et al., 2014), which cannot be celebrated by more remote and low-income populations, with internal channeling ranging from 1.7% to 4.1% for rural communities with more than 4000 inhabitants (Kulinkina et al., 2016). This is due to the high cost of installation when compared to other forms of supply (Roberts et al., 2012; Garriga & Foguet, 2013; Kulinkina et al., 2016; Akinyemi, Mushunje, & Fashogbon, 2018; Tantoh & Mckay, 2020). This was reaffirmed by Tantoh & Mckay (2020) who found that out of 108 households, 71 of them were unable to pay the fees for channeling and 54% could not contribute regularly to the monthly rate of one dollar.

Therefore, the alternative to recoup the costs of investments and community participation in rural water supply projects could be a way to ensure service by better sources with piped water in the residence, lot or backyard, there are obstacles; such as the functional sustainability of the water system due to the difficulty of recovering investments and lack of financing mechanisms (Kulinkina et al., 2016; Barde, 2017).

The cost of accessibility reaches other levels such as digging and building a well in the backyard or land, which may not be accessible to families with lower purchasing power, as well as public water sources that involve some use fee (Misinde, 2017). For the time being, these higher prices to be paid for system connections may force poor families to return to traditional alternative sources with higher public health risks (Arouna & Dabber, 2012; Suparman et al., 2016). Thus, among the searches found, it was seen that internal channeling as a priority as to the willingness to pay only in an article, raising the need to explore the present theme.

4 CONCLUSION

Among the themes and how different conditions of access to water can interfere with the quality of life, the present study concludes that:

- The theme of health and hygiene represents 71.7% of the research, thus, it can be observed, that water has an influence on human health, since in contact with substances and pathogenic organisms can lead to the illness of the population;
- When associated with factors such as intermittency, the collection of water over long distances can affect its quality, as well as jeopardizing hygiene habits, can be seen in 22.2% of the studies;
- The 61.1% of the studies found that deal with the convenience of access to water, show how the economic benefits of the family can be directly related to saving time in the collection of water, making possible the expansion of activities such as education and health and hygiene care. Especially for women and children, who are mostly responsible for domestic services.
- The relationships between the different levels of access to water (on-site and 30 minutes away) and the influence on the living conditions of rural and low-income populations, such as health and hygiene, quality of water consumed, saving time for water collection and cost.

However, in none of the studies was internal plumbing treated directly in a way associated with several factors of influence on quality of life, such as those addressed in this work and even that in Brazil no studies of this nature were identified in the research base used (Scopus).

It is recommended that more studies analyze the direct relationship between the presence of internal plumbing and the factors associated with it, such as the incidence of diarrhoeal diseases, frequency of hand washing and saving of time in rural areas, mainly in Brazil, because of its intense social inequality. In addition, aspects such as intermittency and the cost for safe access to water should be investigated and linked to the existence or otherwise of internal plumbing. Even when there is adequate access to water, work must be carried out to educate and adapt to the cultural aspects of the population that will receive the water, since it may have different organoleptic patterns from the water previously used, which may lead to rejection of the population.

It is essential to design and implement infrastructure and public policy projects in rural areas in order to reduce the lack of internal channeling in households, ensuring the benefits that this structure brings to rural residents. Such projects and infrastructure may use the aspects of degree of illness, costs associated with the construction of infrastructure, willingness to pay and safe access to water in the construction of indicators for assessing the effectiveness of policies and projects. Further studies are recommended to analyze the direct relationship between the presence of internal plumbing and associated factors such as: incidence of diarrhea, frequency of hand washing and time savings.
Table 1- Distribution in their respective themes of the articles used in the research

<table>
<thead>
<tr>
<th>Article Title</th>
<th>Health and Hygiene</th>
<th>Water quality</th>
<th>Convenience of access to water (time saving)</th>
<th>Improved supply cost and DAP</th>
<th>Intermittency and water scarcity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piped water consumption in Ghana: A case study of temporal and spatial patterns of clean water demand relative to alternative water sources in rural small towns</td>
<td>X</td>
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<tr>
<td>What Determines Access to Piped Water in Rural Areas? Evidence from Small-Scale Supply Systems in Rural Brazil</td>
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<td>Maternal education and child nutritional status: evidence from Uganda</td>
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<td>Decent Living Standards: Material Prerequisites for Human Wellbeing</td>
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<td>Water quality laboratories in Colombia: A GIS-based study of urban and rural accessibility</td>
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<td>Does Piped Water Improve Happiness? A Case from Asian Rural Communities.</td>
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<td>Going beyond basic access to improved water sources: Towards deriving a water accessibility index</td>
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<td>Does Global Progress on Sanitation Really Lag behind Water? An Analysis of Global Progress on Community- and Household-Level Access to Safe Water and Sanitation</td>
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<td>Factors Affecting Domestic Water Consumption In Rural Households Upon Access To Improved Water Supply: Insights From The Wei River Basin, China</td>
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<td>Water use, treatment and sanitation practices in rural Chandigarh areas and their relationship with waterborne diseases</td>
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<td>Why “improved” water sources are not always safe</td>
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<td>Quality matters: incorporating water quality into water access monitoring in rural Malawi</td>
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<td>Opportunities to improve domestic hygiene practices through new enabling products:</td>
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<td>Rural estimates households’ willingness to pay for water supply improvements: a Benin case study using a seminonparametric bivariate probit approach</td>
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<tr>
<td>Domestic Water Service Delivery Indicators and Frameworks for Monitoring, Evaluation, Policy and Planning:</td>
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<td>An Analysis of Water Collection Labor among Women and Children in 24 Sub-Saharan African Countries</td>
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<td>Understanding the Challenges of Improving Sanitation and Hygiene Outcomes in a Community Based Intervention: A Cross-Sectional Study in Rural Tanzania</td>
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REFERENCES


Wang, X., & Hunter, P. R. A. (2010). Systematic review and meta-analysis of the association between self-reported diarrheal disease and distance from home to water source. The American
