From Potable Water to Drinking Water: A Conceptual Clarification Based on Individual Boreholes in African Peri-Urban Areas

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ABSTRACT

The rapid urbanization of Sub-Saharan African cities is accompanied by the massive expansion of peri-urban areas, which are often characterized by limited access to hydraulic and sanitation infrastructure. In response, many households rely on individual or community boreholes to obtain water. However, these boreholes are frequently constructed under inadequate technical and regulatory conditions, raising doubts about whether the extracted water meets the standards of "potable water." This article explores the conceptual distinction between "potable water" and "drinking water," examines the technical shortcomings of boreholes in peri-urban contexts, and draws implications for water governance. Based on fieldwork conducted in N'Djamena's 9th district (Gassina, thesis) and on literature concerning urban groundwater in Africa, the study highlights the need to consider water from unregulated boreholes as "drinking water" — that is, water consumed but not necessarily guaranteed as potable — in order to inform more realistic public policies.

Keywords : potable water, drinking water, individual boreholes, peri-urban areas, water quality

INTRODUCTION

Sub-Saharan Africa is experiencing rapid and often unplanned urbanization, marked by the accelerated expansion of urban peripheries. These peri-urban areas — which accommodate a significant share of urban population growth — often remain poorly equipped with essential infrastructure, particularly water supply and sanitation networks. This structural dynamic increases the vulnerability of populations to water-related and sanitary risks, forcing many households to resort to alternative water supply solutions, among which domestic boreholes play a central role [1].

In many urban agglomerations, individual and community boreholes have become the main source of "local" water supply : they provide relatively immediate and autonomous access to water in the absence of, or as a complement to, the public distribution network. However, the use of these water points raises critical questions of quality : the technical characteristics and governance of boreholes strongly determine the safety of the extracted water. Several reviews and field studies have shown that water from shallow aquifers or poorly protected boreholes often exhibits high levels of microbial contamination (coliforms, E. coli) and, in some cases, exceeds recommended thresholds for chemical contaminants (nitrates, iron, manganese), particularly in areas where on-site sanitation is inadequately managed [2].

From a normative and health standpoint, the notion of "potable water" is associated with strict requirements for safety and compliance with guideline values defined by national authorities and the World Health Organization (WHO). These requirements involve analytical controls (physico-chemical and bacteriological) and quality management systems (monitoring, Water Safety Plans) to certify the absence of health hazards. In many peri-urban contexts, such conditions of control and certification are not met for most private boreholes — which raises both terminological and policy issues : referring to such water as "potable" when it is neither analyzed nor guaranteed creates a false sense of safety [3].

The technical shortcomings of boreholes that explain this gap between use and standards are multiple and well documented. First, borehole depth: accessing aquifers protected by impermeable layers often requires deeper drilling than what is empirically achieved; manual or shallow boreholes tend to tap vulnerable horizons exposed to surface infiltration. Second, the absence of sealing or cementation in the upper part of the borehole and its proximity to potential pollution sources (latrines, pits, waste dumps) promote contaminant migration into the captured aquifer. Finally, the lack of regulation and monitoring (systematic bacteriological testing, registration, and maintenance) prevents quality traceability and the implementation of targeted corrective measures. These technical factors, combined with extreme weather events (heavy rainfall, flooding) and anthropogenic pressures, explain the frequent exceedance of health standards reported in the literature [2].

From a governance perspective, the peri-urban situation reveals a double deficit: on one hand, limited institutional capacity to control and regulate the growing number of private boreholes; on the other, the inadequacy of risk management instruments (for example, the implementation of Water Safety Plans – WSPs for small-scale groundwater systems) in informal contexts. Recent studies suggest adapting risk-based approaches (WSPs, transition management, integrated water resource management) to better protect groundwater resources in peri-urban environments and to prioritize pragmatic interventions — such as physical protection of borehole heads, safety distances, targeted analyses, and domestic treatments [4].

In light of these realities, the dichotomy between "potable water" (a normative status) and "drinking water" (a practical reality) acquires analytical and operational significance. The concept of "drinking water" allows the identification of an intermediate category — water that is effectively consumed but not certified — and helps guide graduated responses: strengthening monitoring, adopting household treatments (chlorination, filtration), improving siting and sanitation practices, and progressively integrating boreholes into the regulatory framework. In sum, recognizing this distinction is a necessary step toward designing realistic and health-protective public policies in peri-urban areas [3].

METHODOLOGY

General Approach and Analytical Framework

The methodological approach adopted in this article is based on a cross-analysis combining (i) data from Gassina's (2023) doctoral thesis on N'Djamena's 9th district, and (ii) a comparative review of recent studies on the quality of peri-urban borehole water in Sub-Saharan Africa.

This approach follows a qualitative and analytical-comparative perspective aimed at confronting local empirical data with a regional scientific corpus in order to clarify the conceptual and operational status of "drinking water" versus "potable water."

The objective is not merely descriptive but hermeneutic and normative : to question the uses and social representations of water based on technical indicators (depth, sealing, microbiological quality, proximity to latrines) in order to redefine relevant analytical categories within the peri-urban African context.

Conceptual Distinction between "Potable Water" and "Drinking Water"

Potable Water : A Strict Sanitary Standard

The term potable water refers to water intended for human consumption that must be rendered harmless from a sanitary perspective—meaning it must present no recognized risk to human health from biological, chemical, or physical contamination. It must, in principle, meet strict technical and regulatory criteria: clarity, transparency, absence of abnormal taste or odor, colorless appearance, and above all, compliance with guideline values or regulatory standards for key contaminants (e.g., E. coli, fecal coliforms, nitrates, heavy metals, fluorides, etc.) [3,5].

Internationally, the World Health Organization (WHO) has published Guidelines for Drinking-water Quality defining reference thresholds for numerous parameters to ensure that water is genuinely safe for consumption [3,5].

At the national level, the legislation of several African countries (including the Chadian Water Code and Société Tchadienne des Eaux) excludes the qualification of "potable" for water not subjected to appropriate testing and controls; potable water implies certified conformity, traceability, and ongoing quality monitoring.

Thus, to qualify as "potable," water must not only meet microbiological and physicochemical standards but also be integrated within a system of management, control, and maintenance. This rigorous framework ensures that regular consumption presents no health risk [3].

Drinking Water : A Practical and Usage-Based Category

The term drinking water refers to water that is actually consumed by households, regardless of whether it meets potability standards. In other words, it is a category of use rather than a certified quality status. It is often used to describe available water resources in contexts where so-called "potable water" (in the strict regulatory sense) is not accessible [1,2].

In peri-urban areas not adequately served by reliable public networks, individual or community boreholes become the main source of water supply. This water is used for drinking, cooking, hygiene, and other domestic purposes—hence the label "drinking water." However, such water does not necessarily meet the sanitary guarantees attached to potable water : compliance with thresholds, monitoring, maintenance, and source protection are often lacking [2,4].

The distinction is crucial : calling water "potable" when it has not been analyzed or monitored creates a false sense of safety. Conversely, labeling it "drinking water" acknowledges its use while implicitly signaling that it may not be entirely safe [2,4].

This conceptual nuance is particularly relevant since the literature shows that domestic borehole water in peri-urban contexts often displays technical or sanitary deficiencies—leading to the following discussion.

Technical Shortcomings of Individual Boreholes and Justification for the "Drinking Water" Category

Deficient Technical Characteristics

Numerous studies conducted in Sub-Saharan Africa reveal that individual or semi-collective boreholes often fail to comply with construction and protection standards necessary to ensure "potable" water quality. The most commonly documented deficiencies include:

- Insufficient depth: To reach aquifers protected from contamination, a recommended depth of 70–100 m is often cited. However, many manual or domestic boreholes range between 20 and 56 m, leaving them vulnerable to surface infiltration. This shallow depth is identified as a critical contamination factor in peri-urban settings. For example, a review of urban groundwater in SSA reports that shallow aquifers often have "very poor" quality [2,6].
- Lack or insufficiency of sealing/cementation: Proper casing or cementation of the upper borehole section is essential to isolate the usable aquifer from potentially polluted shallow layers (runoff, latrines, pits). The absence of such protection favors direct contaminant infiltration [2].
- Improper siting relative to pollution sources : A minimum distance between boreholes and latrines, septic tanks, garbage dumps, or runoff zones is widely recommended. However, field studies often find this distance not respected—for example, in western Cameroon, the average latrine-to-borehole distance was 8.7 m, far below recommended standards [2].
- Inadequate borehole head protection : The cover, concrete slab around the casing, check valve, distance from infiltration sources, and soil slope for runoff drainage are often neglected, further increasing vulnerability [2].

Compromised Physicochemical and Microbiological Quality

These construction and siting deficiencies translate into water quality results that frequently fail to meet potability criteria:

- Microbiological contamination : Several studies report the presence of fecal coliforms, E. coli, and other microorganisms in poorly protected boreholes. For example, in Juba (South Sudan), surface-water

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infiltration was identified as a likely cause of heavy contamination [6]. In Mbarara (Uganda), boreholes showed E. coli levels exceeding standards, indicating real health risks [6].

- Chemical or geochemical contamination : Groundwater may also contain high concentrations of nitrates (from latrine effluents), metals (iron, manganese), or other undesirable constituents. A systematic review in Ethiopia and Kenya found that chemical risks are often overlooked under the assumption that groundwater is “safe” [6].
- Emerging pollutants: A study in Kabwe (Zambia) detected traces of pharmaceutical residues in urban groundwater, underscoring the complexity of contamination in urban and peri-urban zones [6].
- Correlation between aquifer vulnerability and water quality: The study Urban Groundwater Quality… found that basement aquifers with low storage are particularly vulnerable to contamination, making it unlikely that extracted water qualifies as “potable” [5,6].

Health Risks Associated with Consumption

The use of untreated or uncontrolled borehole water carries significant health risks. For example:

- The World Health Organization reports that in the African Region, at least 1.8 billion people use a supposedly potable water source contaminated with fecal matter [3].
- A study in Adama (Ethiopia) found that although several parameters met standards, others (e.g., insufficient residual chlorine) indicated persistent risks even in “good-quality” water [6].
- In these contexts, households often adopt domestic treatments (chlorination, filtration, boiling), but such measures are frequently insufficient to ensure long-term safety [2,4].

Conceptual Approach : Why “Drinking Water” Rather Than “Potable”

Based on the accumulated evidence, several conclusions emerge:

- Visual clarity, transparency, or absence of abnormal taste does not guarantee the absence of pathogens or chemical contaminants.
- The lack of systematic analysis or control of most boreholes prevents affirming that they provide “potable” water in the strict sense.
- The category “drinking water” acknowledges actual use while highlighting that safety is not necessarily guaranteed [2,4].
- Using the term “potable water” in such contexts may foster a false sense of sanitary security while risks persist.

Consequently, the conceptual distinction is not only useful but necessary: it clarifies (i) the safety level of the resource, (ii) the nature of required interventions (source protection, monitoring, domestic treatment), and (iii) realistic quality expectations in constrained peri-urban environments [2,4].

Implications for Water Governance and Policy in Peri-Urban Areas

Formally recognizing an intermediate category of “drinking water” — between “untreated, uncontrolled raw water” and “certified potable water” — carries several major implications for planning, management, and policy:

- It enables adapted, pragmatic objectives : in areas with limited access to certified potable water, focus can shift to household-level treatment (chlorination, filtration), and user education, rather than attempting full potabilization networks that are often unaffordable.
- It encourages strengthened quality control for individual and community boreholes: regular bacteriological and physicochemical analyses, certification/authorization systems, monitoring of borehole head protection, and minimum distances from latrines.
- It supports the integration of tools such as Water Safety Plans (WSP) adapted to small-scale peri-urban boreholes. A recent review shows that while WSPs are recommended, their application to peri-urban boreholes in Africa remains very limited due to institutional, technical, and socio-cultural constraints.

- It facilitates differentiated actions according to source typology: public network, protected deep borehole, or vulnerable domestic borehole—thus improving resource allocation and enabling context- and risk-specific policies.

By implementing this distinction, policymakers can better prioritize interventions, allocate investments more efficiently, and develop regulatory and monitoring frameworks adapted to the peri-urban realities of developing regions.

DISCUSSION

Conceptual Distinction and Key Issues

The concept of "potable water" is grounded in a strict sanitary norm: water must be suitable for human consumption, free of health hazards, and certified through analytical monitoring. In practice, however, in many peri-urban neighborhoods, public networks are incomplete, and individual boreholes multiply as primary sources of supply. The use of such water creates a discrepancy: while it is "drinking water," it does not always meet potability criteria. Recognizing this reality through the term "drinking water" clarifies the gap between normative status and actual use, avoiding the illusion that everything consumed is "potable."

Technical Deficiencies and Vulnerabilities

Individual boreholes are often characterized by insufficient depth, poor sealing, excessive proximity to pollution sources (latrines, pits, runoff), and almost no quality control. These factors lead to frequent non-compliance in water quality : microbiological contamination (coliforms, E. coli), and physicochemical parameters exceeding thresholds (nitrates, iron, manganese). Literature reviews and field studies (notably Gassina) confirm that this situation is widespread in peri-urban Africa.

Health Impacts and Governance Challenges

The consumption of vulnerable borehole water entails risks of waterborne diseases. In the absence of certification or systematic control, governance of these resources remains weak. Instruments such as Water Safety Plans are rarely applied in informal settings. A pragmatic approach — one that considers the "drinking water" category — allows for realistic transitional policies toward truly potable water, through domestic treatments, borehole protection and validation, and institutional strengthening.

The Case of N'Djamena's 9th District

According to Gassina, access to drinking water in this peri-urban area has become structured around individual boreholes, but the technical quality of these structures, their siting, and lack of monitoring are insufficient to ensure potability. This study illustrates the gap between the aspiration for reliable water access and the actual local conditions, reinforcing the argument that consumed water cannot automatically be considered "potable" in such contexts.

CONCLUSION

The distinction between potable water and drinking water is more than terminological—it reflects the concrete gap between sanitary requirements and access realities in peri-urban settings. Recognizing that much borehole water consumed is merely "drinking water" means acknowledging that it is not always guaranteed "potable" and that specific interventions are needed.

Public policies should move toward gradual improvement: improving borehole construction (depth, sealing, siting), implementing quality monitoring, promoting household treatments, and integrating these sources into governance frameworks. Ultimately, the goal is to transition from vulnerable drinking water to truly potable water—requiring technical, institutional, and urban approaches tailored to the African peri-urban context.

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