

Management of health sector actions in drought situations

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Abstract *Water is essential for the socio-economic development of a region and also for the survival of human beings. Water scarcity has direct and indirect impacts on the environment, the economy and human health. It can change the profile of morbidity and mortality of diseases, as well as having an impact on the supply of services that are essential public to the quality of life. This study aims to contextualize the occurrence of drought in Brazil, its effects on human health, as well as actions to be developed by the health sector to reduce the risk to those living in affected areas, with an emphasis on the monitoring of the quality of drinking water. This is a descriptive, qualitative study with a documental basis. The documents that were researched were related to initiatives by the Health Surveillance Secretariat of the Ministry of Health up until 2014. It is necessary to strengthen the performance capacity of the Unified Health System (SUS) in order to develop timely responses to reduce the risk to public health.*

Key words *Natural disasters, Drought, Environmental health, Monitoring of quality of drinking water*

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Introduction

A disaster is defined as the result of adverse events, which can be natural or man-made, on an ecosystem that is considered to be vulnerable, causing human, material and/or environmental damage, as well as consequent economic, environmental and social losses. From a public health perspective, disasters are defined by their effect on people and on the infrastructure of health services¹.

Drought is a weather phenomenon which is caused by insufficient rainfall; it is characterized by causing a sustained reduction of existing water resources in a given region, for a prolonged period of time. Drought is a period of low rainfall, or the lack of rain, in which soil moisture loss is greater than gain¹.

Drought is considered to be one of the major natural disasters and its impacts are aggravated when it is associated with precarious livelihoods and the socio-economic vulnerability of a specific population. Therefore, droughts have greater impact on poor or developing regions, where the conditions and determinants of health are already committed.

Disasters caused by prolonged drought affect millions of people, contributing to hunger, poverty and malnutrition. They also cause outbreaks of infectious and respiratory diseases, among other health problems, as well as influencing the human migration process. This type of scenario can place immense stress on the normal routine of health services and infrastructures, particularly at times when they are most needed.

In Brazil, disasters associated with drought are characterized by the fact that often cover large areas and affect various cities at the same time. Their effects on human health are numerous and they can change the morbidity and mortality profile of people living in affected areas².

To reduce the impacts of this type of event on health services it is essential to develop actions to strengthen the ability of public health services to deal with emergencies associated with drought in order to ensure the provision of services and the reduction of health risks.

Because droughts are not events that occur abruptly, the Health Departments of the states and municipalities in Brazil should have action plans in place, including scenarios based on the historic occurrences of droughts, an inventory of existing resources, and they should be able to identify what resources are required for a timely response. This whole process extends the perfor-

mance capability of the SUS to reduce the vulnerability of the population and of health services.

Thus, the organization of guidance documents to support the participation of the health sector in emergencies is fundamental for the management of information, for the evaluation of lessons that are learned, and to improve the work process both continuously and permanently.

This study aims to contextualize the occurrence of drought in Brazil, the effects of these disasters on human health, and the actions to be undertaken by the health sector to reduce the risk of exposure of the population in affected areas, with an emphasis on the development of monitoring actions in relation to the quality of water for human consumption.

The drought context of Brazil

The number of naturally occurring disasters worldwide has grown dramatically in recent decades, causing thousands of injuries and deaths each year and damaging the physical and mental health of millions of people³⁻⁵.

Drought is characterized as an extensive disaster because it takes place slowly and silently without short-term visible and structural impacts. This feature differentiates it from other types of natural disasters, which arise abruptly and cause visible damage immediately, such as storms, earthquakes and floods, which are defined as intensive disasters⁵⁻⁷.

For this reason, droughts are difficult to measure and it is hard to define when they begin and how long they may last. Furthermore, although they are climatological events, their impact depends on the conditions of vulnerability of the areas and the people they affect⁸.

Because it is difficult to identify the impacts and the needs arising from drought, it is essential to understand the behavior of such disasters and to have prior knowledge of their geophysical, environmental, social, economic and political characteristics, as well as the health profile of the population in the affected areas.

In order to examine the scenario of natural disasters in Brazil in the period 2003-2014, and more specifically the droughts that occurred during that period, this study considered the events that were declared by the Federal Government to be a state of emergency or a state of public calamity.

As can be seen in Graphic 1, most of the states of emergency or public calamities recognized as such by the Federal Government in Bra-

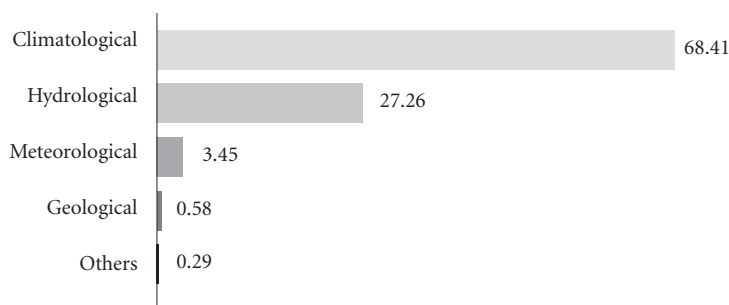
zil were climatological events (68.41%), involving drought-related processes, forest fires, hailstorms, frost, and cold and heat waves, followed by hydrological events (27.26%), which resulted in flooding of various types (gradual and sudden) and large movements of earth (landslides)⁹.

Graphic 2 shows the spatiotemporal distribution of disasters caused by drought in Brazil. It can be seen that all regions are affected by this disaster typology throughout the year, from January to December. However, some regions are more affected in specific months, such as the Northeast, which is more affected in May.

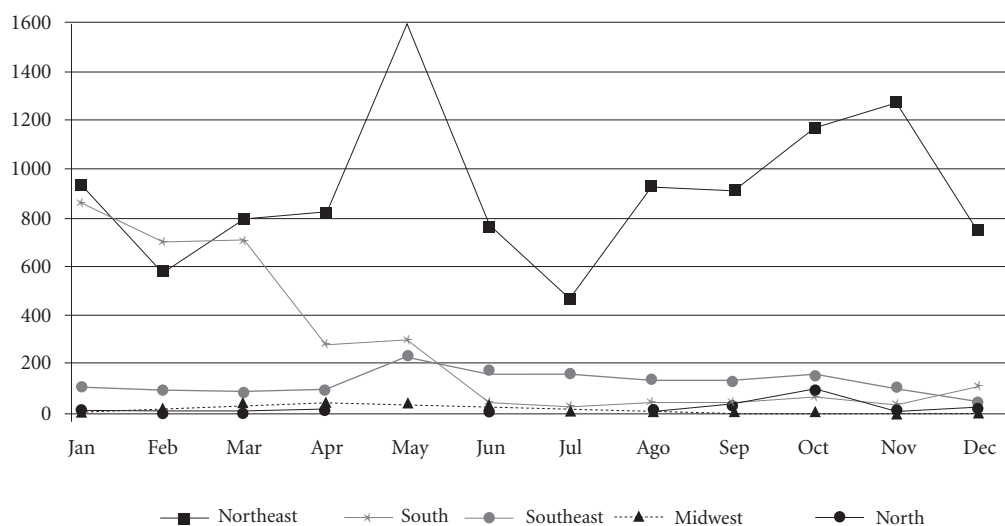
Main impacts of drought

Some projections of the impacts of climate change indicate that droughts will become more frequent and more intense in places that already have favorable conditions for them to develop, which may further aggravate the situation in affected areas and broaden the health problems that already exist^{3,5,10-12}.

The effects of drought on human health can greatly prejudice the performance capability of health services and infrastructure, or decrease the ability to provide health care, especially in times when such care is most needed^{13,14}.



Graphic 1. Percentage of decrees of states of emergency or public calamities recognized as such by the Federal Government in Brazil emergency decrees or public calamity state recognized by the Federal Government in Brazil, 2003 - 2014.



Graphic 2. Distribution of decrees of states of emergency or public calamities due to drought in Brazil by region from 2003 to 2014.

The implications of the effect of drought on human health are manifold. Some can be direct and short-term, like infectious gastrointestinal diseases. However, some impacts are indirect and long-term, often manifesting themselves months or years after the event, such as malnutrition and mental illness, which hampers preventative measures. Furthermore, the effects on health can be influenced by various pre-existing conditions such as nutrition and socioeconomic conditions, creating scenarios of individual and collective susceptibilities and environmental vulnerabilities^{5,8,11,15,16}.

The indirect effects of drought have an impact on other factors that condition or determine health, which results in changes in the morbidity and mortality profile of the people living in affected areas^{15,16}.

Thus, the occurrence and magnitude of harm to human health and the infrastructure of a particular location will depend on the vulnerabilities (susceptibilities) associated with the social, economic, political, environmental, climatic, geographical and health conditions in a specific area, and there is a direct relationship between the type of disaster and its effects.

Changes in the epidemiological profile of a locality and the occurrence of outbreaks and epidemics may constitute a public health emergency (PHE) and may overwhelm local health services, exceeding their ability to respond. The main recognized impairments are set out in Chart 1.

According to the document “Natural Disasters and Health in Brazil”, low levels of rainfall can affect the quantity and quality of water consumed by the population in the following ways: eutrophication and algal blooms in water sources; failure of the water distribution system and alternative sources of supply; intermittence in water supply; and depressurization in the water distribution network, which increases the possibility of contamination. Air pollution caused by dust and particles originating from fires, as well as changes in the cycles of vectors, hosts and reservoirs of diseases, are other forms of environmental exposure for humans arising from droughts. These aspects are conditioning and determinant factors in relation to health and they can cause problems such as outbreaks and epidemics, resulting in scenarios of collective and individual susceptibility and vulnerability¹⁷.

The following are all cited as having effects on health impacts on mental and behavioral health; and changes in the behavior of communicable and non-communicable diseases^{17,18}.

The safety and maintenance of health services, as well as the ability to act in a preventive and timely manner, are therefore paramount to reducing the risks to which people living in areas affected by drought may be exposed, especially in areas where there is the occurrence and recurrence of prolonged periods of drought^{5,8,10}.

To effectively diagnose the impacts of drought and the appropriate strategies to alleviate their effects it is necessary that health services are able to detect changes in the behavior of diseases and disorders in affected regions at the earliest opportunity, as well as providing proper diagnosis and treatment to people seeking health services. It is also essential that health education actions are developed to guide both health professionals and the public.

Given that local people are those who directly suffer the impacts of a disaster such as drought, it is essential that municipalities are prepared and able to adapt to face such an event, in order to maintain a level of organization and an appropriate structure for the continued functioning of the health sector in order to reduce the risks of disasters and to respond more efficiently to their effects.

These impacts also depend on the local resilience and how local people react to these threats or dangers, which obviously cannot be eliminated because it is impossible to control the rainfall. However, it is possible to prepare health services to act in a timely manner to reduce the risk to the health of people exposed to such situations.

In this context, the preparation of the Brazilian health sector response to public health emergencies, and specifically drought, represents a challenge for the SUS, given its national coverage which requires a coordinated approach by all the 26 State Departments of Health, the Federal District, 5,570 Municipal Health Departments, as well as the Ministry of Health.

Action by SUS in relation to public health emergencies caused by drought

The Secretariat of Health Surveillance (SVS) of the Ministry of Health, through Ordinance GM/MS No. 1378, of July 9, 2013, has the authority to coordinate the preparation and response of health monitoring in relation to public health emergencies of national and international importance, and to cooperate with States, Federal District and municipalities in response to these emergencies¹⁹.

Chart 1. Impairments to systems and services, and impacts on human health as a result of drought.

Impact of drought on systems, services and health		
System/Services	Characterization	Impacts on health
Water	The quantity and quality of water can be affected in many ways that can be detrimental to aquatic life and drinking water. There can also be an impact on food production, mainly on fishing and subsistence farming.	Diseases transmitted by water and food; Diseases transmitted by vectors; zoonoses
Food and nutrition	The quality and quantity of food may be affected due to the shortage and/ or contamination of water, the lack of sanitation, and increased population density because of population displacement.	Diseases transmitted by water and food; Malnutrition and dehydration; Diseases transmitted by vectors; Diseases transmitted by vectors and zoonoses.
Air quality	Low humidity, heat and dust, which are common during drought, represent a serious problem for people with respiratory diseases.	Respiratory diseases (allergic rhinitis and asthma); Acute respiratory infection (bronchitis, sinusitis and pneumonia); Fungal infectious diseases (mycoses); Allergic reactions.
Sanitation and hygiene	The availability of water for cleaning, sanitation and hygiene is directly linked to the reduction or control of various diseases. Because drought conditions generates water scarcity and/ or the need to save water, some sanitary and hygiene measures can be prevented from being performed.	Infectious diseases (dermatological, parasitic, respiratory).
Mental and behavioral health	The financial implications of drought conditions cause adverse effects such as psychosocial disorders in people who depend on rainfall for economic survival. One partner in a family may have to move to more remote areas in search of a job or a new source of income to meet the family's needs, often generating more anxiety, stress and depression.	Stress, anxiety and depression; Behavioral changes such as aggression and suicides.
Disruption of health services	The lack of water supply in health services can generate impacts such as the increased likelihood of contamination of instruments and equipment and the inability of health professionals to perform their work. Consequently, there is a possible risk of disruption to health care, which may further worsen the health conditions of the affected population. Power supplies can also be affected, impairing the use of medical equipment and the refrigeration of medicines and vaccines.	

Source: Adapted from OPAS⁵; CDC¹⁵; WHO³; Stanke et al.¹¹.

In 2014 the SVS published the Response Plan for Public Health Emergencies, with the following goals:

- Define the Secretariat's action strategy in responding to public health emergencies that exceed the capacity of action at the state and municipal levels;
- Establish a coordinated response by allowing the use of resources, as well as intra and inter-sectoral dialogue to ensure a timely, efficient and effective response;
- Adopt an Operations Command System and the Emergency Health Operations Center to manage and coordinate a response;
- Identify the roles and responsibilities of the different areas of the health sector in terms of interaction with the media during a public health emergency; promote compliance with the legal requirements and responsibilities of the Secretariat in responding to public health emergencies;
- Establish the use of common protocols and procedures for responding to public health emergencies²⁰.

Thus, specific contingency plans were developed for each type of public health emergency, one of which was the Contingency Plan for Public Health Emergencies in Relation to Drought. The purpose of this plan was in line with the Response Plan for Public Health Emergencies, i.e. aiming to define the responsibilities of the SVS in developing response actions to public health emergencies caused by drought²¹.

The Contingency Plan for Public Health Emergencies in Relation to Drought sets out the main problems related to the occurrence of droughts that can occur in the systems and services within a region, and which generate a negative impact on the conditioning and determining factors related to health, with resulting illness for the population. The Plan also lists the main actions to be carried out within the SUS, at the three levels of government, in order to deal with such situations²¹.

The strategy of the Contingency Plan for Public Health Emergencies in Relation to Drought is based on identified risk scenarios and on the response capacity of state and local entities. Based on these risk scenarios, the activities to be implemented are classified into four response levels (0, I, II and III). The response level is determined according to the conditions and assumptions that characterize the predicted risk scenario, either in accordance with the evolution of monitored information, or by the occurrence of the event, or by the size of the impact. Indicators are defined

for each response level, as well as the activities that should be performed²¹.

The organization of the actions by the SUS regarding public health emergencies due to drought is intended to reduce the exposure of the population and health professionals, and to prepare services to cope with its impact. Activities should be developed in a continuous, permanent, integrated and inter-sectoral way because they involve multiple actors and therefore such actions should be defined within the competence of each sector in order to ensure a timely and efficient response, as well as the safety and well-being of the population and the professionals involved in this process.

Considering that droughts can last for months or even years, the health sector should internalize a continuous and permanent work process, implementing policies, plans and strategies to improve the sensitivity of the system to identify potential changes in the behavior of diseases and disorders and to strengthen their its level of preparedness and response capacity.

In this context, the organization of the health sector should be based on its performance in risk management, incorporating factors such as risk reduction, emergency management, and recovery from the effects of disasters, as described below:

Risk reduction: actions that aim to prevent or minimize the impacts of public health emergencies. This involves activities to strengthen the performance capacity and organization of inter-sectoral and inter-institutional working processes;

Emergency management: actions to respond to emergencies by intensifying routine activities and alerting health services about the need to expand monitoring activities and health care in order to identify and adopt the necessary measures to control outbreaks, and to provide timely diagnosis and treatment;

Recovery: Stage in which they are implemented measures to begin the process of restoring the living conditions of the affected community. It consists of two parts: one that tends to restore the essential basic services (water supply, sewage, electricity, communication system), a short-term and transient, and, second, the permanent solutions are directed and long term²².

The health sector has responsibilities at all stages of the management of risk situations associated with droughts, including the characterization of operations and promoting health protection actions, both from a perspective of corrective management (existing risk) as well as from

a perspective of prospective/preventive management (future risk). The following are some of the most important responsibilities:

- Analysis of local and regional health situation, which should consider the scenario of the occurrence of drought, the survey and analysis of the epidemiological profile of the population, the survey and evaluation of available resources in the health sector, and the identification of needs;
- Liaison with the main actors (inter-sectoral and inter-institutional, local and regional) involved in drought situations;
- Preparation of a local contingency plan to provide a response to public health emergencies caused by drought;
- Development and training of health teams for both monitoring and assistance;
- Definition of health education strategy for both professionals and vulnerable people;
- Establishment and strengthening of a Health Committee on Disasters;
- Monitoring of waterborne, foodborne and non-communicable diseases in communities at risk;
- Promotion of actions linked with food and nutritional safety, contributing actions and goals related to poverty reduction, social inclusion, and ensuring the rights of human beings to adequate and healthy food;
- Intensification of monitoring actions in relation to health and primary care;
- Establishment of integration mechanisms involving all service coverage levels and the whole complexity of health care;
- Establishment and activation of healthcare flow, including primary care, hospitalization, laboratory and pharmaceutical;
- Establishment of plan for the deployment of supplies and services in cases of outbreaks of diseases and epidemics;
- Implementation of communication pathways between health professionals and managers;
- Implementation of communication pathways between managers, the media, non-governmental organizations and the general public;
- Continuous evaluation of response actions in order to determine future actions.

These activities are transversal and involve many sectors within the SUS with particular relevance for health monitoring; healthcare; laboratories; medicines, supplies and equipment; health communication; and health orientation and education.

Monitoring the quality of water for human consumption in drought situations

Monitoring of the quality of drinking water is a set of actions that are systematically adopted by public health authorities to ensure that the water consumed by the population meets the legislative requirements regarding the potability of water and does not represent health risks to humans²³.

The National Program for the Monitoring of the Quality of Water for Human Consumption (VIGIAGUA) aims to ensure that the population has access to water in sufficient quantity and of a quality compatible with the potability standards established in the current legislation, to reduce morbidity and mortality from diseases and the transmission of waterborne diseases, thereby safeguarding health²³.

The main instrument of VIGIAGUA is Ordinance GM/MS No. 2914/2011, which defines the standard for the quality of drinking water for human consumption. Such water should be treated in order to prevent human exposure to pathogens and dangerous substances that can occur in water and enable the spread of diseases and other health problems²⁴.

The main routine actions connected with monitoring the quality of water for human consumption are as follows: the systematic monitoring of the quality of water provided for the public; sanitary inspections of the different forms of water supply for human consumption; the assessment and management of health risks imposed by the conditions of the forms of water supply; the dissemination of information to the public about water quality and health risks; and the support of health and education-related actions, social mobilization etc.²³.

In cases of public health emergencies caused by drought, the monitoring of the quality of drinking water is hampered because it is difficult to find solutions that reconcile the need to save water with sanitary protection, and consequently, the protection of human health, always bearing in mind the structuring actions that need to be developed by the sanitation sector to ensure access to water of a quantity and quality acceptable for the entire population.

It is essential to preserve water in an adequate quantity and of adequate quality for human consumption and less essential uses of water need to be reduced. Some water demands are essential for the health of the population, such as water intake, which cannot be reduced. Other important uses of water are for personal hygiene, the preparation

and cooking of food, washing clothes, household washing, and the removal of excreta, which is relevant for maintaining personal hygiene and the healthiness of the environment, and which can be reduced in a measured way.

Faced with an emergency scenario caused by drought, the monitoring of the quality of drinking water for human consumption should be performed in conjunction with other areas of the health sector, based on risk management, in order to respond in a timely manner and avoid illness within the population as a result of drought.

Monitoring programs regarding the quality of water for human consumption should be developed according to different risk scenarios for each locality; however, some actions must be guaranteed during drought situations such as the following:

- Develop, in conjunction with those responsible for the water system, or via an alternative collective solution to provide a water supply, an action plan containing the definition of strategies and activities to minimize risk to health;
- Conduct sanitary inspections of the various forms of water supply, particularly of alternative solutions used for emergency supplies, such as wells, ponds, fountains and water trucks, and, where necessary, arrange for the temporary prohibition of such use until improvements are in relation to sanitary conditions;
- Identify other safe water when necessary, even if they are situated in other cities;
- Conduct monitoring of the quality of water for human consumption, prioritizing the most vulnerable locations;
- Provide sanitary barriers in conjunction with health monitoring and other partners to carry out the inspection of vehicles responsible for water supply, such as water trucks;
- Support health education actions along with other health professionals and those responsible for water supply using water trucks, particularly in relation to advising people about the proper handling and storage of water, the cleaning and disinfecting of water tanks, the treatment of water intended for human consumption in homes (filtration and the addition of two drops of 2.5% sodium hypochlorite to each liter of water or, in case of the unavailability of hypochlorite, filtration followed by boiling);
- Determine priority sources of water to supply water trucks, prioritizing the capture of water in water treatment plants using conventional forms of treatment and, where not possible, prioritize obtaining water from underground or

surface water sources. Perform minimum levels of water treatment through filtration and disinfecting before distribution to the population;

- Participate in anti-drought committees in places where they are established;
- Request that those responsible for water systems, or alternative collective solution to provide water supplies, systematically monitor the concentration of cyanobacteria in the catchment points of surface water and improve the operational control of water treatment plants, including more frequent washing of fast filters to avoid the accumulation of algae and cyanobacteria in the filter bed, which can cause the release of cyanotoxins into the treated water;
- Maintain links with emergency units (hospital and emergency care) to warn of the possible increase in the number of cases of waterborne diseases, especially acute cases of diarrhea, and a potential increase in the number of cases of psychosocial and behavioral disorders.

Role of the health sector in encouraging water conservation

Emergency situations such as droughts lead to discussions about universal access to safe water and sanitation, the use of new technologies to minimize waste, water treatment in emergencies, and water saving measures.

The health sector can also encourage the population and health professionals to perform some changes in attitudes in order to avoid waste and to conserve water within health units and households, such as the following:

- Turn off the tap when brushing teeth; lather up with the shower turned off;
- Watch for leaks; do not use drinking water to wash cars, sidewalks, property fronts and streets; do not use drinking water to fill swimming pools or for other activities not classified as for human consumption (drinking, personal hygiene and food preparation); wash fruits and vegetables in bowls with water and a brush, rinse in running water;
- Do not defrost food using tap water; gather dirty laundry together for washing;
- Pay attention to the use of toilets; do not discard paper, dental floss or any other objects in the toilet bowl;
- Use buckets instead of hoses for watering plants or washing animals.

Furthermore, the health sector can encourage the collection of rainwater and water from washing machines for general use, such as washing

sidewalks etc. Other actions can also be recommended, such as replacing conventional taps with modern self-closing taps and changing old-fashioned toilets for those with closed couple cisterns.

Final considerations

The responsibilities of the health sector in a public health emergency are inherent to what is within its competence to protect people's health and to ensure the provision of health services, while minimizing as much as possible the impacts of and exposure to risks.

In this respect, advance preparation is essential as well as knowledge about the actors involved in the preparation and response. The responsibilities and actions of the health sector regarding emergency public health situations caused by drought should be presented in a clear and systematic way to permit the actions to be developed to be discussed properly.

Strengthening the coverage capacity of the SUS in terms of public health emergencies caused by drought represents a challenge to the health sector. It is therefore essential to organize services through the establishment of local disaster health committees and to prepare contingency plans, considering that such organization can ensure

timely action and reduce the risk to the health of the population and health professionals.

Droughts are not events that occur suddenly and because of that fact state and municipal health departments should consider response actions in their planning, including the construction of scenarios based on the historical occurrences of droughts and, making inventories of existing resources, and identifying what is necessary for an adequate response.

The whole process of strengthening the coverage capacity of the SUS is intended to reduce the vulnerability of the population and the health services.

The organization and preparation of health services and health teams are critical to provide information and to evaluate lessons that have been learned, as well as to improve work processes, which should be developed continuously and permanently.

The monitoring of the quality of drinking water also faces many obstacles in order to achieve the goal of ensuring that water which is delivered in emergency situations is safe and healthy.

Because it is a transversal issue, the biggest challenge facing all the sectors involved in the issue of water supply is to find structural and lasting solutions, as well as emergency technologies to cope with situations of water scarcity.

Collaborations

AR Cabral and CV Bonfim worked in critical revision of the text. DB Rohlf participated of the approval of the version to be published. EL Silva and RMS Resende worked in literature review. FB Queiroz worked in conception and design of the article. JC Grigoletto worked editing the article. J Francischetti and MHB Daniel worked in analysis and interpretation of data. RC Andrade worked in critical revision of the text. TB Magalhães worked in analysis and interpretation of data.

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