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Environmental health surveillance and the performance of access to drinking water policies: a case study in Sobral - Ceará

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The authors have no conflicts of interest to declare.

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Abstract

Objective: Evaluate the performance of Environmental Health Surveillance in implementing policies for access to drinking water in Sobral-Ceará.

Method: Application of the evaluative model EGIPSS (*Évaluation Globale et Intégrée de la Performance des Systèmes de Sant*).

Originality/Relevance: Data treatment reduces the gap in discussions about environmental transformations and their repercussions concerning the health-disease process and the environment. As a relevance, it clarifies the importance of the theme of Environmental Health Surveillance along with its impacts and influences applied to the SUS (Brazilian Public Health Care System). In addition, there are their contributions to urban and regional planning, since the main results will bring subsidies to public managers in order to strengthen, for example, water treatment and distribution systems, strongly impacting the urban and regional environment under environmental and health aspects.

Results: The results showed that, from 2017 to 2021, the performance levels of the actions carried out by the Environmental Health Surveillance were good, regular and wrong. Water quality was one of the main tools carried out by the service. Through the opinion poll, the population was divided about the issues of water quality and quantity.

Social/Management Contributions: Environmental monitoring by the point of view of human health becomes fundamental because it favors a solid contribution to the construction of public policies and decision-making.

Keywords: water for human consumption, performance, environmental health, public health

Vigilância em saúde ambiental e o desempenho das políticas de acesso à água potável: um estudo de caso no município de Sobral – Ceará

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Objetivo: Avaliar o desempenho da Vigilância em Saúde Ambiental na execução das políticas de acesso à água potável no município de Sobral-Ceará.

Metodologia: Aplicação do modelo avaliativo denominado de EGIPSS (*Évaluation Globale et Intégrée de la Performance des Systèmes de Sant*).

Originalidade/Relevância: O tratamento dos dados diminui a lacuna ainda existente diante das discussões acerca das transformações ambientais e seus rebatimentos em relação ao processo saúde-doença e meio ambiente. Como relevância, oportunamente esclarece a importância da temática de Vigilância em Saúde Ambiental junto aos seus impactos e influências aplicadas ao SUS. Adicionalmente, observa-se suas contribuições junto ao planejamento urbano e regional, uma vez que os principais resultados trarão subsídios a gestores públicos de modo a fortalecer, por exemplo, os sistemas de tratamento e distribuição de água, impactando fortemente no meio urbano e regional sob aspectos ambientais e de saúde.

Resultados: Os resultados apontaram que, para o período de 2017 a 2021, os níveis de desempenho das ações realizadas pela Vigilância em Saúde Ambiental, se mostraram entre os níveis de bom, regular e ruim. A qualidade da água se constituiu como uma das principais ferramentas realizadas pelo serviço. Através da pesquisa de opinião, a população mostrou-se dividida em relação às questões de quantidade de qualidade de água.

Contribuições sociais para gestão: O monitoramento ambiental pelo ponto de visita da saúde humana torna-se fundamental, pois favorece uma forte contribuição junto a construção de políticas públicas e tomadas de decisão.

Palavras-chaves: água de consumo humano, desempenho, saúde ambiental, saúde pública

Vigilancia de la salud ambiental y el desempeño de las políticas de acceso al agua potable: un estudio de caso en el municipio de Sobral - Ceará

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Objetivo: Evaluar el desempeño de la Vigilancia en Salud Ambiental en la ejecución de las políticas de acceso al agua potable en el municipio de Sobral-Ceará.

Metodología: Aplicación del modelo evaluativo denominado EGIPSS (É Evaluation Globale et Intégrée de la Performance des Systèmes de Sant).

Originalidad/Relevancia: El tratamiento de los datos reduce la brecha que aún existe frente a las discusiones sobre las transformaciones ambientales y sus repercusiones en relación con el proceso salud-enfermedad y el medio ambiente. Como cuestión de relevancia, aclara oportunamente la importancia del tema Vigilancia en Salud Ambiental junto con sus impactos e influencias aplicadas al SUS. Adicionalmente, se observan sus aportes a la planificación urbana y regional, cuyos principales resultados traerán mayor claridad a los gestores públicos para fortalecer, por ejemplo, los sistemas de tratamiento y distribución de agua, impactando fuertemente en el medio ambiente urbano y regional. aspectos.

Resultados: Los resultados mostraron que, para el período de 2017 a 2021, los niveles de desempeño de las acciones realizadas por la Vigilancia de Salud Ambiental se ubicaron entre los niveles de bueno, regular y malo. La calidad del agua fue una de las principales herramientas llevadas a cabo por el servicio. A través de la encuesta de opinión, se dividió a la población con relación a cuestiones de cantidad y calidad del agua.

Contribuciones sociales a la gestión: El monitoreo ambiental desde el punto de vista de la salud humana se vuelve fundamental, pues favorece una fuerte contribución a la construcción de políticas públicas y la toma de decisiones.

Palabras clave: agua para consumo humano, actuación, salud ambiental, salud pública

Introduction

In 2010, the United Nations (UN) recognized the right to clean and safe water and access to sanitation as essential human rights to fully enjoy life and all other rights, leading States to reflect and put into practice actions that can effectively bring this condition as an

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effective right, imposing great challenges on it (Camargo, 2022; Lima et al., 2022). Still at an institutional level, among the Sustainable Development Goals (SDGs), in the SDG 6, the main aspects linked to human supply and environmental sanitation are presented, where the need to favor universal and equitable access to drinking water and safe for everyone.

In the context of guaranteeing a set of fundamental rights, present in the Federal Constitution of Brazil of 1988, it can be identified, from there, that a set of normative instruments, investments and public policies, aimed at ensuring population access to basic services in Sanitation, especially water for human consumption, has begun to be implemented in recent decades in the country. Regarding such aspects, these responsibilities are currently centralized in the specific field of environmental health, which, in turn, is still largely unknown by society in general. Furthermore, in the Brazilian normative apparatus, Environmental Health Surveillance has stood out, which results in the inspection of a set of actions and services provided by public and private bodies and entities, aiming at knowledge for detection/prevention of environmental determinants that interfere in human health (Brazil, 2007).

In Ceará, the Environmental Health Surveillance nucleus has existed since 2007 and is part of the central organization chart of the State Health Department. Its main objective is to ensure that actions are structured in the different municipalities, to respond to the surveillance systems proposed by the Federal Government. Even with more than ten years of implementation, most municipalities have their structure in shared actions through other Surveillances (for example, Sanitary or Occupational Health), and the recognition and implementation of Environmental Health Surveillance as an independently structured. The municipality of Sobral differentiates itself by the premise of being the only one in the interior to have, since 2010, its actions independent and disintegrated from other surveillance.

The data reveals that regarding access to drinking water for people in Sobral, 100% of the urban and rural population is effectively served by the supply network (SNIS, 2020). However, other public results indicate that the municipality has, during the last 5 years (2017-

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2021), ranked 3rd, 4th or 5th among the highest rates of hospital admissions and deaths caused by waterborne diseases, taking into account all other surrounding municipalities (Datasus, 2019). In this sense, it is essential to understand the internal and external actions of Environmental Health Surveillance in monitoring the evolution of possible interferences in human health caused by waters outside potability standards.

According to this, it is possible to observe that the theme of this research contributes strongly to the guidelines for urban and regional planning in the interior of Ceará, one that provides results that can constitute parameters and subsidies for public managers in the decision-making process, especially when projects are put into practice that address the quality of drinking water as an agenda, technical improvement of water treatment plants and even when prioritizing the regulation of data in health systems that integrate health assessment from the point of view of conditions environmental. Additionally, it is reiterated that addressing this issue within the planning of health services also constitutes a positive gain in organizational policies, as it will expand the "range" of attention to future diagnoses of illnesses that are genuinely environmental in nature.

In this way, the present work aims to evaluate the performance of Environmental Health Surveillance in implementing policies on access to drinking water in Sobral-Ceará and verify, together with consumers, the regularity and quality of the water offered in Sobral-Ceará, in order to be able to relate persistent local challenges.

To this end, a methodology for evaluating the performance of Environmental Health Surveillance in Sobral is proposed, through the application of an evaluation model called EGIPSS (*Évaluation Globale et Intégrée de la Performance des Systèmes de Sant*) where four fundamental functions are defined, which allow proposing, quantifying and qualifying the Environmental Health Surveillance Performance Index (ID): Adaptation Function; Production Function; Goal achievement function and Value maintenance function. Relative to the second

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objective, questionnaires were applied, in a random and stratified manner, to consumers of municipal water supply systems, in rural and urban areas.

It is understood that the literature has advanced from the perspective of evaluating programs in this category in the State of Ceará. Part of the studies focus on addressing the quality of water for human consumption in terms of microbiological and physical-chemical aspects (Bonfim, 2020; Silva et al., 2020; Formiga et al., 2020; Gomes (2019); Rodrigues & Diniz, 2019; Oliveira et al., 2019; Oliveira et al., 2012) and correlating water quality to specific diseases (Barbosa et al., 2019; Macedo et al., 2019; Nunes et al., 2019; Costa, 2018; Pereira et al., 2019); other literature explores environmental constraints in accordance with legal and historical aspects (Abreu, 2021; Filho & Araújo, 2020; Vasconcelos & Mota, 2020; Cavalcante et al., 2019; Gomes & Paula, 2019; Gomes & Pessoa, 2019; Silva & Albuquerque, 2018). However, approaches that allow local knowledge regarding specific policies involving the territorial, economic and social reality of municipalities, in the face of this service, constitute a gap for economic, socio-environmental and public policy studies.

Environmental Health and Environmental Health Surveillance: theoretical and institutional aspects

Environmental health comprises the area of public health that disciplines scientific knowledge from the perspective of formulating public policies and the corresponding interventions related to the interaction between human health and the natural and anthropic environmental factors that determine, condition and influence it, with a view to improve the quality of life of human beings from the point of view of sustainability (ONU, 2016). And the literature recognizes that environmental health science is crucial to taking action to protect public health (Sutton et al., 2021).

Traditionally, environmental health evaluates and controls physical, chemical and biological factors external to the person and with a high potential to impact health through a set of direct and indirect mechanisms. Over time, Science and its results were important for a better

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understanding of the toxic or infectious potential of some areas inserted in the environment and, when not managed and controlled, they can have non-negligible impacts on populations. In view of this, expanding horizons and scientific research within this topic is absolutely necessary and the results identified enhance the decisions that will be taken as a way of transforming the scenarios (Morris, 2010).

According to the Brazilian Ministry of Health (MS), environmental health occurs when aspects of human health and disease are determined by environmental reasons. The United Nations states that the human species is subject to a series of risks arising from situations that go beyond psychological, accidental, biological, physical and chemical determinants. This is because, given the modernization process and its consequences, including social inequalities, pollution, environmental degradation; the growing concentration of economic-political power; accelerated industrialization; the use of new technological methods in agriculture, health risks proliferate and diversify (Fenner & Machado & Gomes, 2017).

The National Environmental Health Association (NEHA) highlights environmental health as the science and practice of preventing harm and disease in humans and promoting well-being, through the identification and evaluation of dangerous sources and agents, by establishing limits on harmful agents physical, chemical and biological, in air, water, soil, food, and other media and environments, which may adversely affect human health (Olivar, 2018).

When environmental health takes into account the human health dimension integrated with the environment, this condition must first understand that this environment is part of a complex system of relationships. On the other hand, the breadth of these issues is present when taking into account the dimension of global health, considering that it has encompassed different international, cultural, economic, political and social regimes (Fenner & Machado & Gomes, 2017; Tambellini & Câmara, 1998; Krasner, 1982). It is clear that the concept of health is broad and integrated, which involves living conditions, access to work, school, housing and

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food. It can be noted that this set is part of environmental factors, thus being a right for everyone, a social achievement and depends on multi-professional action (Silva, 2014).

Therefore, the challenges applied to health and environmental management must have multidimensional characteristics, remaining at the discretion of each country. Such challenges involve the understanding that surveillance mechanisms over the quality conditions of natural resources and their impact on the well-being of populations are considered a powerful tool, especially in government decision-making with the formulation of public policies (Davis & Sharp, 2020).

Particularly, water surveillance refers to a dynamic and adaptive process, and must have the ability to combine the relationship between availability, specific needs of families, communities and other interested parties, evaluating in detail the aspects arising from quality across space and time. The adoption of efficient management must also include social, technical, legal understandings, institutional configurations and user habits. At the end of the journey, an equitable operation will occur resulting in the complete reach of existing systems (Nyamwanza & Kujinga, 2017; Chartzoulakis & Bertaki, 2015).

Regarding the need to monitor water quality by public regulatory bodies, it is recognized that local water suppliers are obliged to monitor the quality offered in their distribution systems. To do this, they must develop a program with good performance, whose objective is to provide information about the degree of safety for consumption, warning about potential risks to human health, if they are not within the expected reality (Rahman et al., 2015; Who, 2019).

At an institutional level, in 2015 the document entitled "Transforming Our World: The 2030 Agenda for Sustainable Development" (Agenda 2030) was signed, committing to achieving, by 2030, the 17 Sustainable Development Goals (SDGs) and the 169 Goals established in document 4. The Goal 6 (SDG 6) "Drinking Water and Sanitation", aims to "Ensure the availability and sustainable management of water and sanitation for all".

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Taking SDG 6 as a specific example, Gandelman et al. (2012) highlight that the universalization of all sanitation services in Brazil is one of the greatest difficulties today, and inclusion, from an interdisciplinary and integrated perspective, makes total difference, contributing significantly to the decision-making processes that involve managers and civil society.

In Brazil, based on the conclusions of the first health studies public, the need to strengthen the focus on the environment was perceived. The structuring of Environmental Health Surveillance in the country is linked to the SUS attributions established in the Constitution of 1988, with Law No. 8,080 (September 19, 1990) and with the National Plan for Health and Environment in Sustainable Development.

In 2000, it began to be implemented through Normative Instruction No. 01 of the Health Surveillance Secretariat (SVS), of the Ministry of Health (March 7, 2005) with the official institutionalization of the General Coordination of Environmental Health Surveillance (CGVAM). A technical structure was established based fundamentally on the following areas of activity: (I) Surveillance of Water Quality for Human Consumption (VIGIÁGUA); (II) Health Surveillance of Populations Exposed to Chemical Contaminants (VIGIPEQ), focused on priority chemical substances (pesticides, benzene, lead, asbestos and mercury), currently also involving the activities of VIGISOLO (contaminated areas); (III) Surveillance of populations exposed to atmospheric pollution (VIGIAR); and (IV) Environmental Health Surveillance of Risks Associated with Disasters (VIGIDESASTRES), encompassing VIGIFIS (related to physical factors) and also VIGIQUIM (related to monitoring accidents involving dangerous products) (Rohlfs et al., 2011).

According to the National Health Foundation (Brazil, 2002), other objectives of Environmental Health Surveillance can be cited: (I) produce, integrate, process and interpret information to be made available to the SUS, which serve as instruments for planning and executing actions related to health promotion, prevention and control of diseases related to the environment; (II) establish parameters, duties, procedures and actions related to environmental

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surveillance at different levels of competence; (III) identify risks, disseminate information regarding conditioning environmental factors, determinants of diseases and other health problems; (IV) promote health protection actions related to the control and recovery of the environment; (V) know and stimulate the interaction between environment, health and development in order to strengthen popular participation in promoting health and quality of life.

It is important to highlight that each Brazilian state and municipality has complete autonomy to add policies, activities and actions that can achieve performance that has public health as its horizon and, consequently, as an additional guarantee of the establishment of environmental quality.

In relation to the eight goals of SDG 6, Goal 6.1 states that it is possible "by 2030, to achieve universal and equitable access to safe and affordable drinking water for all" (Bronzatto et al., 2018), thus being directly related to actions of VIGIÁGUA. Achieving this goal requires an improvement in monitoring measures to ensure safety over short time scales, especially in vulnerable areas, where access to safe drinking water can vary with multiple time-dependent factors, including income, season and availability, as well as being shaped through social relationships (Adams et al., 2020; Price et al., 2019).

The reduction of morbidity and mortality due to waterborne diseases and injuries, favoring the search for improvements in the sanitary conditions of the various forms of water supply for human consumption, constant intensification of partnerships with other institutions that can assist in the quality process, creating, when appropriate, information systems that facilitate data organization. These points are some of the main secondary objectives of the VIGIÁGUA Program in Brazil.

In short, the interrelationships combined with the complexity and diverse aspects of health problems in urban and rural areas require innovative and robust strategies so that evident problems can be identified more quickly and thus can contribute to reducing exposure to all the risk factors typical of each space, especially among those most vulnerable populations.

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The combination of high social, economic and environmental risks experienced by these groups presupposes a more appropriate, rapid approach with a strong impact on equality, where everyone can benefit from harm reduction practices that may be implemented by managers (Gouveia, 1999).

The EGIPSS method (*Évaluation Globale et Intégrée de la Performance des Systèmes de Sant*) as an analytical performance model: practical applications

In recent years, performance assessment has assumed a prominent role in the strategic agenda of institutions around the world. The growing concern in measuring performance is related to knowing emerging factors in contemporary societies. Within the themes to be known, it can be highlighted that it is initially important to relate a topic that is of greatest interest to the population. Subsequently, questions about the variability of costs and quality of services offered must be integrated. Therefore, when developing performance assessment systems, these issues must be considered to meet both the needs for future accountability and consequent "accountability", substantially resulting in continuous quality improvement (Costa, 2015; Champagne et al., 2011).

It is noteworthy that municipal administrations are fundamentally responsible for the preservation, maintenance and promotion of the main necessary social themes and, above all, public health. To reduce avoidable risk factors, integrated strategies with a proactive approach to emerging issues are suggested, such as key global trends, new technologies and emerging health threats (Donzelli & Linzalone, 2023).

In view of this, the EGIPPS model appears as a systematic model proposed by the Montreal group and was built from a multidimensional perspective, which will allow the interaction and judgment of the main qualities and specificities of a given system (Champanne et al., 2011).

The method associates and integrates concepts related to the performance of organizations, grouping them into specific dimensions and functions within a single model.

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Representation is fundamentally characterized by the following functions: Adaptation (encompasses a set of technologies, policies or social actions linked to the development of activities); Goal Achievement (brings together the main resources to achieve the service's objectives); Maintenance of Values (aggregates the satisfaction levels of employees directly linked to the service and other motivations) and Production (systematizes the processes directly related to the service routine) (Araújo, 2014).

It is important to highlight that the application of the EGIPSS model to performance assessments in public or private organizations linked to public health is recent, which positively characterizes the development of studies and research using it as a methodological resource. Providing more and more results to be adopted as subsidies and decision-making with public managers, it becomes an essential tool for this purpose. The unification of themes, such as environmental, social, human health and others, becomes an interesting field of investigation, however, it is still very restricted.

Given this situation, in Brazil some applications are mainly aimed at identifying the level/degree of performance of assistance services in public and collective health or for analyzing the control of certain diseases.

To evaluate the performance of Epidemiological Surveillance actions in the state of Pernambuco, for example, the application of the EGIPSS method was essential. It listed the potential risks of communicable diseases and it was possible to verify that there is a worrying scenario in the State and that there is a significant risk of emergencies in this category arising. It was presented in the study that some internal work processes would need to be improved potentially and more energetically so that the quality of the monitoring service could be increased, avoiding a major health problem (Lima, 2014).

Adopting the EGIPSS model and aiming to identify the level of performance, as well as the epidemiological situation of a health region, also in the Pernambuco, it was revealed that policies and technologies aimed at this area need to better establish a strong and more

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organized integration of actions with the surrounding municipalities, and some aspects related to organizational management, especially the work environment among employees, are weakened, making the level classified as regular (Paiva, 2013).

In the case of a more specific study, Jordão (2014) identified that the overall performance of the actions of a municipality located in the interior of the State of Pernambuco, with regard to combating and controlling schistosomiasis, was at a regular level of quality and that several failures identified, such as: outdated statistical data, insufficient coverage rate, negotiations between public bodies and communities that are still at an insufficient level.

Demonstrating the identification of the emergency care system in the state of Goiás, Brazil and using the EGIPSS model, three health regions were chosen to be studied along with aspects relating to fixed and mobile pre-hospital care and hospital care. Were selected 85 indicators and their performance was measured based on comparison with the state average. As results achieved, the interrelationships in relation to the indicators were analyzed through the preparation of technical sheets as a way of expanding and supporting decision making. Of the three studied regions, Entorno Sul was the one that presented the weakest overall performance; however, important differences can be observed regarding the problematic dimensions/subdimensions across regions. The research draws clear attention to the fact that having full access to health services is a human right acquired in the Federal Constitution (Champagne et al., 2011).

In the State of Mato Grosso do Sul, the performance of 15 regional hospitals was calculated by determining the EGIPSS model. Were chosen 185 indicators from lists related to the various performance assessment systems used internationally. Applying questionnaires to professionals who work in these hospitals and to the population using the service, a normative analysis of the set of indicators was carried out, which resulted in the worst scenario and performance in the following reality: in the role adaptation, with the availability of resources, community mobilization and integration systemic; in the goal achievement function, together

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with general mortality; in function maintenance of values highlighted a work environment, job satisfaction, turnover of professionals with significant shortages and in the production function, productivity and insufficient quality (Ste-Marie et al., 2012).

That said, Sutton et al. (2021) argue that evaluation methods related to service performance, similar to those highlighted in this section, really need to be robust and capable of synthesizing what is known about the environmental drivers of health and that they are crucial to making science actionable and evident in the decision-making process. Lima et al. (2022) add that in addition to the results achieved with the application of these methods, the inclusion of social participation in the formulation of resulting public policies is extremely valuable, generating new values and behaviors.

Methodology

The study area is Sobral, located in the Northwest region of the state of Ceará, approximately 240 km from the state capital. It has an urban structure made up of 16 districts, with the urban headquarters divided into 37 neighborhoods, occupying an area of 2,068.474 km^2 and with an estimated population of 210,711 (Gomes, 2017). The justification for choosing Sobral lies in the fact that it is one of the few municipalities in Ceará with a structured Environmental Health Surveillance agency. Primary source data was used, obtained through the application of semi-structured questionnaires with general management, the technical and administrative team of environmental health surveillance and consumers.

The performance of policies and indicators produced by Environmental Health Surveillance were analyzed by applying the EGIPSS where they are outlined by four fundamental functions (Adaptation Function; Production Function; Goal Achievement Function and Value Maintenance Function) (Table 1), which, together, allow justifying and quantifying the Performance Index classification of Environmental Health Surveillance (ID), through the preparation of the analysis and judgment matrix. The ID of each function is calculated by expression (1), adapted from Araújo (2014):

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$$ID = \frac{1}{N} \sum_{i=1}^{n} \left(\frac{P}{P\,max} \right) \tag{1}$$

Where: ID = Function Performance Index (adaptation, production, achievement of goals and maintenance of value); N = number of existing criteria for the indicator; I = i- th criterion (i =1, ..., n); P = score obtained for the variable; P $_{max}$ = maximum score for the variable.

Table 1

Analysis and judgment matrix for the functions of adaptation, production, achieving goals and maintaining values (2022)

Adaptation Function	
Indicators	**Variables**
People management	Adequacy of the number of technical personnel to the demands of V.S.A activity and unit management.
Equipment and materials management	Adequate availability of equipment and materials (vehicles, computers, printers, telephones and extensions, field monitoring equipment).
Financial management	Adequate reception of public financial resources transferred by higher levels to be used in the development of Surveillance actions in the last 5 years of management.
Institutional partnership	Number of actions and partnerships carried out: with NGOs; integrated with other government sectors; signed with teaching/research/extension institutions.
Technical and community mobilization	Number of field practices for monitoring Treatment Stations (ETA) with a focus on water quality control; holding educational lectures; responding to requests from groups, associations and events.
Permanent Education	Carrying out continuing education activities (PE); number of students selected for curricular and mandatory supervised internship.
Production Function	
Notification, investigation and data analysis	Percentage of water samples analyzed with marker for the parameter: apparent color, turbidity, fluoride, residual chlorine, total *coliforms*, *Escherichia coli.*

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	Percentage of samples in disagreement with sanitary quality legislation for physical-chemical and microbiological samples analyzed in urban headquarters and rural communities.
	Number of SAA systems; SAC and SAI registered with V.S.A in the last 5 years; number of information systems used directly in V.S.A to process, store and discuss data on water for human consumption.
	Number of meetings with technical managers to address water quality in monitored treatment plants in the urban headquarters and rural communities of Sobral-Ceará.
	Number of total hospitalizations due to waterborne diseases throughout the territory of the municipality of Sobral-Ceará.
Evaluation and dissemination of information	Collections of justifications from treatment operators in relation to problems found; published scientific articles; participation in scientific events; number of technical visits carried out by representatives of civil society to the physical facilities and activities carried out at V.S.A.
Prevention and control measures	Number of educational communication materials distributed to the population; existence of communication channels with the community; participation in environmental and health education campaigns carried out by the Municipal Health Department.
Goal Achievement Function	
Notification, investigation and data processing	Percentage of achievement of targets (X) established by the Ministry of Health and State and Municipal Health Departments established for analysis of water samples; existence of specific analysis and inspection documents/reports; awarding of awards or bonuses for achievements of goals achieved in the last 5 years.
Value Maintenance Function	
Valuing the hierarchical structure	Existence of standards and rules that can organize the administrative management of Surveillance actions; existence of a professional development policy; continuity of actions by municipal management.
Interpersonal relationships	Personal satisfaction with the work performed; collaboration and responsibility in the division of tasks; relationship with peers; relationship with hierarchical superior; autonomy and support to carry out activities; professional motivation.

Source: Elaborated by the authors.

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In the second stage, the indicators were aggregated to obtain the Global Performance Index (GDI), calculated by the weighted average of the performance indices for each function, taking as weight the number of variables for each function, following adaptation proposed by Ferreira (2014). The indexes were calculated aiming for a five-year evaluation (2017-2021) and were adjusted to a scale of values between zero and one, where zero represents the worst performance and 01 the best performance. For comparison and analysis purposes, the following classification criteria were defined: excellent for values between 0.81 and 1.0; good for values between 0.61 and 0.8; regular for 0.41 and 0.6; bad for zero and 0.4.

A questionnaire was applied to general management and three questionnaires to the technical and administrative health surveillance team, whose answers correspond to the scenario for the period 2017-2021. In addition to these, questionnaires were applied to consumers selected in a random and stratified manner from the seven largest supply systems of SAAE and CAGECE with greater coverage in terms of number of active residential economies with access to piped drinking water (SEDE I, SEDE II, Macapá, Aracatiaçu, Beira Rio, Taperuaba and Jaibaras). The definition of the sample size for a finite population, according to Fonseca and Martins (1996), totaling 196 consumers. In the end, it resulted in 210 responses, that is, 14 additional contributions:

$$n = \frac{(Z^2 . \hat{p}.\hat{q}.N)}{[d^2.(N-1)+Z^2.\hat{p}.\hat{q}]} \qquad (2)$$

Where: n = initial sample size; Z = abscissa of the standard normal distribution; $\hat{p}$= proportion adopted; $\hat{q}$= complement of $\hat{p}$; d = estimation error; N = population size. In the absence of data on p and q estimates, the value of 50% is assumed, as this provides the largest sample size. The maximum margin of error allowed was 7% (d=0.07). In this distribution, the urban headquarters represented around 32.3% of the participants (total of 68) and were

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distributed across the water systems: URBAN HEADQUARTERS I- Alto da Brasília, Centro, Pedrinhas, Padre Ibiapina, Vila União, Cidade Dr. José Euclides, Sumaré, Junco, Jerônimo de Medeiros Prado, Alto do Cristo, Domingos Olímpio, Campo dos Velhos, Derby, Pedro Mendes Carneiro (with 57.3% of the total) and SEDE URBANA II - COHAB I, COHAB II, Sinhá Sabóia and Industrial District (with 42.7%). In the case of rural communities, the participation percentage was 67.7% (n=142) and made up of the Macapá systems (19.8%-n=28); Beira Rio (20.8%-n=29); Jaibaras (19.8%-n=28); Aracatiaçu (19.8%-n=28); Taperuaba (19.8%-n=29).

It is noteworthy that the majority of interviewees have completed secondary education (24.7%), in relation to the type of housing, 75.2% have their own home and the basic family income is around an approximate average of BRL 2,200.00 for 49% of the public participating in the research. The questionnaire consisted of 28 questions, which were divided into two blocks: general data and the relationship between public health and drinking water consumption.

Results and discussion

Environmental Health Surveillance Performance Analysis

Analyzing the performance of an organization integrally linked to public health services is only possible through a multidimensional construction that should allow different interested parties to debate and make a judgment about the essential and specific qualities of its service, depending on their beliefs, knowledge, responsibilities, interests and projects (Conndriopoulos, 2003).

The objective of the adaptation function was to gather indicators responsible for driving actions that will promote the execution of the fundamental objectives of Environmental Health Surveillance, presented in Table 1. The low performance in the people management indicator is due to the insufficiency of the technical team, which even 2021 had only three professionals (two with higher education and one with a technical level); such evidence is related to the performance of basic functions of health surveillance, such as inspections and collection of material for analysis.

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In the indicator management of equipment and materials, necessary for the full development of Environmental Health Surveillance actions, the number of equipment proved to be stable and at a minimum number (mostly 01 copy) over the years, denoting a lack of investment and exposing the sector to stop activities in the event of maintenance or breakdown of some basic equipment. A serious situation concerns the organization of the vehicle fleet in a shared manner by the Municipal Health Department, on a prior scheduling basis (48 hours), which, at times, makes it impossible to develop urgent actions. Another recurring problem is the unsuitability of the vehicle for inspection actions, where, sometimes, small vehicles are made available that do not accommodate equipment and collection boxes.

The reduced availability of adequate financial resources was responsible for the low value of the Financial Management indicator. Approximately BRL14,716,027.40 made available for Health Surveillance in Sobral, between 2017 and 2021 but only BRL400,000.00 was allocated to Environmental Health Surveillance. It is important to highlight that the main action of monitoring the collection and analysis of water for human consumption is subsidized by the federal and state governments, and it is not included in these resources.

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Table 1

Analysis and judgment matrix for the adaptation function (2017/2021)

INDICATORS	2017	2018	2019	2020	2021
People management	0.0	0.0	0.0	0.0	0.0
Equipment and Materials Management	0.57	0.57	0.57	0.57	0.57
Financial management	0.33	0.33	0.33	0.33	0.33
Institutional Partnership	0.50	0.50	0.50	0.33	0.17
Technical and Community Mobilization	0.58	0.75	0.67	0.75	0.83
Permanent Education	1.00	1.00	1.00	0.25	0.25
Innovative Strategies	0.00	0.00	0.00	0.00	0.00
ID – Adaptation Function	0.42	0.45	0.43	0.31	0.30

Source: Elaborated by the authors.

The institutional partnership indicator showed regular values until 2019, falling in subsequent years. The main actions were developed within the scope of SISAR (Integrated Rural Sanitation System), HEMOCE (Hemotology and Hemotherapy Center of Ceará) and the Federal Institute of Education, Science and Technology of Ceará–Sobral Campus, the latter with projects that promoted research in new methodologies that aimed to improve the methodological aspects of improving and accessing water in rural communities. With the Covid-19 pandemic, the continuity of partnerships has been paralyzed in recent years.

The technical and community mobilization indicator presented values that ranged between regular and good. In total, between 2017 and 2021 there were 104 inspections, which took place both at the urban headquarters and at stations located in the communities. The environmental inspections carried out by Environmental Health Surveillance, carried out in response to private requests or in an integrated manner with the State Department of Health, Public Ministry or specific private institution, resulted in 83 practices in this category, with a high concentration for 2020, corresponding to 96% of the actions mentioned, mainly for actions to combat the new coronavirus.

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The best performance in the dimension is found in the permanent education indicator, an excellent rating until 2019, with actions to promote educational practices that seek constant improvement in ways of working, based mainly on the demand of the populations served, adjusting services offered, with the aim of guaranteeing quality assistance. The incipient performance in 2020 to 2021 is associated with the reduction in activities and integration with the community due to the Covid-19 pandemic.

In the indicator of innovative strategies incorporated into the service, no actions were identified over the years researched. The ID of the adaptation function appears regular until 2019 and low for the last two years researched, mainly due to the damage to some indicators, associated with restrictions imposed by the pandemic.

The production function evaluates actions to monitor the quality of water distribution services to consumers, both in technical aspects (physical, chemical and biological properties of water) and in managerial aspects (dissemination of information and prevention and control).

In Table 2, it is possible to check all the even numbers resulting from each one, divided over the monitored period.

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Table 2

Analysis and judgment model for the production function (2017/2021)

INDICATORS	2017	2018	2019	2020	2021
Reporting, Investigation and Data Analysis	0.92	0.96	0.97	0.97	0.97
Assessment and Dissemination of Information	0.75	0.87	0.50	0.25	0.63
Prevention and Control Measures	0.67	0.67	0.33	0.33	0.50
ID – Production Function	0.78	0.83	0.60	0.51	0.70

Source: Elaborated by the authors.

The analyzes of samples collected in the municipalities of Ceará are carried out at the Central Public Health Laboratory – LACEN and funded through a partnership between the Ministry of Health and State governments, preventing conflicts of interest and political interference that could favor the monitored companies. Sobral, between 2017 and 2020, should monitor at least 240 water samples/year for physical-chemical parameters and 120 microbiological parameters/year (in 2021, those of a physical-chemical and microbiological nature were adjusted, jumping from 240 to 252 and 120 to 180, respectively). In the reporting, investigation and data analysis indicator, the results were classified as excellent in all years. In the urban headquarters of Sobral, Environmental Health Surveillance established, during the period, 18 collection points, distributed across all regions of the municipality for continuous monitoring. Monitoring actions made it possible to identify and seek solutions to numerous problems such as: instant interruptions in the distribution network for operational repairs; temporary increases in solid and suspended materials present in pipes; negative pressures on distribution networks, distribution shutdowns at some collection and sampling points. Regarding problems found in water quality, the percentage of samples identified in disagreement with parameters established by current legislation remained at 20.45% for urban headquarters and 30.5% for rural communities.

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According to the management of the unit, the activities of registering new supply

systems (which jumped from 49 to 79 in 2017 to 2021) and feeding information into VIGIÁGUA

(Water Surveillance for human consumption - a system created by the Federal Government and

which allows reporting the results of water analyzes and registering new water systems) were

carried out properly. However, the Covid-19 pandemic contributed to the significant reduction in

technical meetings between Environmental Health Surveillance and water treatment and

distribution companies, as if 98 meetings were held in 2017, this number drops to two in 2021.

In relation to the Information Assessment and Dissemination indicator, the values can be

classified as "good" or "excellent" in 2017, 2018 and 2021. A significant drop in performance

was observed in 2019 (regular) and 2020 (poor). In quantitative terms, 215 documents

requesting necessary adjustments were sent to water distributors. Furthermore, seven

publications were produced, including scientific articles and participation in events of national

and international relevance in the period under analysis.

The prevention and control measures indicator refers to the production of educational

material and participation in campaigns in partnerships with other bodies related to public

health. This indicator achieved "good" performance for 2017 and 2018, with lower performance

in the following years. Although the pandemic may be partly responsible for the drop in

performance, there was a significant disarticulation of actions in 2019 (before the pandemic),

the information collected in this research did not allow us to clearly identify the factors

determining this drop in performance.

The target achievement function represents a panel of the main demands carried out

during a given period and are routinely subject to demands from managers of the Municipal

Health Department. The analysis of target achievement allows the identification of bottlenecks in

the workflow of the unit, which will promote changes in the technical team's operating strategies

and subsidize demand for human and financial resources. It must be considered, however, that

the evaluation of goal achievement has a multidimensional aspect, including several analysis

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elements such as: quality, effectiveness, efficiency, equity, productivity, among others (Bezerra et al., 2020).

Table 3 presents the performance index for the goal achievement function. As this index has only one indicator (Notification, Investigation and Data Processing), only the value of the performance index for the respective function will be presented. In relation to the quantitative goals of sample analysis, a high conformity of surveillance actions was identified over the years researched, with a sample quantity exceeding 90% in almost all parameters (apparent color, turbidity, fluoride, CRL, CT and EC), with the exception of the turbidity parameter, in 2017, whose percentage of verified samples was 22.6%, in the urban headquarters and 30.9% in rural communities.

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Table 3

Analysis and judgment matrix for the goal achievement function and percentage of goal achievement in the "Notification, Investigation and Data Processing" indicator – by investigated parameter (2017/2021)

PARAMETER	2017		2018		2019		2020		2021	
	SU	CM	SU	CM	SU	CM	SU	CM	SU	CM
CA	95.2%	100%	95.2%	100%	100%	98.9%	100%	92.4%	100%	98.2%
TURBIDITY	22.6%	30.9%	96.4%	100%	100%	99.5%	100%	95.0%	100%	98.2%
FLUORIDE	83.3%	100%	59.7%	90.2%	79.1%	86.8%	95.8%	99.3%	100%	84.7%
CRL	92.2%	92.7%	96.4%	94.8%	100%	91.4%	100%	87.8%	100%	98.0%
CT	93.3%	100%	96.6%	100%	100%	98%	100%	100%	100%	97.3%
EC	93.3%	100%	96.6%	100%	100%	98%	100%	100%	100%	97.3%
ID – Goal Achievement Function	0.91		0.91		0.93		0.93		0.93	

Subtitle: SU – Urban Headquarters; CM – Rural Communities; CA – Apparent Color; CRL- Free Residual Chlorine; CT- Total Coliforms; EC- Escherichia Coli.

Source: Elaborated by the authors.

Lira & Gonçalves (2022) also proposed to quantitatively evaluate water samples to identify compatibility for human consumption in a city in the interior of Maranhão. An evaluation percentage of more than 80% of analysis was found for all samples studied, and performance of Vigiágua in the municipality is very positive, with the full inclusion of groundwater monitoring. The Municipal Health Department, also in Sobral-CE, is responsible for checking this monitoring.

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The parameters analyzed by the Environmental Health Surveillance under analysis stand out as being the main "reflectors" that accuse or alert inappropriate conditions of water quality for human consumption, a fact, conditioned by economic issues; however, Qin et al. (2023) warn that it is strictly important to expand monitoring activities, including, above all, other chemical elements, such as heavy metals. In the same study, the authors warn that in China some water samples have limits above the legal ranges and already represent risks for children and population groups with some health comorbidity.

Another role of Environmental Health Surveillance concerns requesting distribution companies to diagnose their own internal analyses. These documents are called Control Reports, which contain, in addition to the results of the analyzed parameters, the recurring problems identified by the operators.

Additionally, we sought to identify some internal awards, in order to offer greater visibility to these results and encourage employees, but in none of the years analyzed were awards given for achieving goals.

The function of maintaining institutional values provides a direct influence on performance, as it reflects organizational behavior from a perspective formed by two components: the human structures of the organization, together with the individual characteristics that form each one. Furthermore, these dimensions, observed in an aligned manner, can significantly explain variables linked to the acquisition and development of organizational knowledge (intellectual capital) and, consequently, an improvement in performance in the quest to meet goals (Yang & Peterson & Cai, 2003). In this sense, the questionnaire addressed issues related to the indicator valuing the hierarchical structure and interpersonal relationships. The General Management, Technical and Administrative Team were those who contributed to collecting the data. In Table 4, the results for the indicator are identified.

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Table 4

Analysis and judgment matrix for the value maintenance function (2017/2021)

INDICATORS	2017	2018	2019	2020	2021
Valuing the Hierarchical Structure	0.50	0.83	0.83	0.83	0.83
Interpersonal Relations	0.87	0.87	0.87	0.87	0.87
ID – Value Maintenance Function	0.68	0.85	0.85	0.85	0.85

Source: Elaborated by the authors.

With the exception of 2017, with a regular value (0.5) in one indicator, the other years showed excellent performance in both function indicators. According to those interviewed, this performance standard represents the result of some actions that are part of the group's work culture, such as: entry and exit times; compliance with weekly workload; record of all incidents that occur during field activities; record with photos of inspection and inspection moments; do not return to the service headquarters without having collected it; whenever there is a request for a technical visit, this must be scheduled and proven by sending a letter from the requesting institution. In order to technical data to be released, there must be a release coming especially from the research and ethics nucleus of the Visconde de Saboia Family Health Education School, and among other standards that are important for the development of activities.

The variable existence of a professional development policy presented responses indicating the lack of a program or specific actions to encourage professional development. In the indicator of interpersonal relationships, all interviewees highlighted their personal satisfaction with the work carried out (item presented an "excellent" rating), while in collaboration and responsibility in the division of tasks, relationships with peers and immediate supervisor, a "good" rating was given. A relevant point mentioned was the autonomy and support for carrying out internal activities, with an "excellent" concept.

Finally, professional motivation is a fundamental element for human beings. Regardless of the reasons, motivation represents a subjective element and may be related to factors

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external or internal to the organization. In this sense, the interviewees gave a "good" rating on the work motivation scale, however, not mentioning the factors that influenced this assessment.

With the perspective of also investigating the performance of the Vigiágua Program in municipalities belonging to the Saupé Industrial and Port Complex, in Pernambuco, it was highlighted that of the four municipalities analyzed, all positively achieved all the goals established by the systematics of the program, so analogous to what was found in the reality of Sobral-CE; that all technicians involved would need to have access to technical training, so that they could better improve fieldwork techniques; only a single municipality was failing to meet the analysis targets for the Free Residual Chlorine and Turbidity parameters. Unlike the reality found in Sobral-CE, municipalities would need to hire a larger quantity so that the scope of activities of Vigiágua would be more effective (Ferreira, 2014).

Global Performance Indices - IDG

The multidimensional character of the EGIPSS model allowed the understanding of the elements for the evaluation of Environmental Health Surveillance with regard to inspection and monitoring actions for drinking water supply services in Sobral.

The results of the Global Performance Index, presented in Table 5, indicate that despite the existence of standards of excellence in some dimensions (Achievement of Goals and Maintenance of Values), the global index remained, in most years analyzed, in a "regular" concept", with a tendency for indicators to worsen in the last two years, possibly due to the Covid-19 pandemic, which disrupted institutional partnerships, continuing education actions and changed the team's work and interaction regime.

It is important to highlight the greater weight for the Adaptation Function Performance Index, which in addition to expressing the lowest values of the dimensions analyzed, presents the greatest relative weight due to the greater number of indicators. It is worth highlighting the zero score in the people management indicator and insufficient financial resources, finding explanations in a context of budget restrictions in public management.

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Table 5

Global Performance Index and job performance indexes (2017/2021)

Function	Weight (number of indicators)	2017	2018	2019	2020	2021
Adaptation	7	0.42	0.45	0.43	0.31	0.3
Production	3	0.78	0.83	0.6	0.51	0.7
Goal Achievement	1	0.91	0.91	0.93	0.93	0.93
Maintenance of Values	2	0.68	0.85	0.85	0.85	0.85
Global Performance Index	–	0.58	0.63	0.57	0.49	0.53

Source: Elaborated by the authors.

Despite the high values for the Performance Index of the Goal Achievement Function, critical consideration is necessary, as the respective function only measures the percentage of achievement of goals and not the relevance of the goals themselves, that is, it does not assess whether the goals correspond to the actions necessary to ensure adequate monitoring. In this sense, the high percentage of goal achievement may only signal the existence of less ambitious goals.

Considerations on consumer evaluation of the water distribution service in Sobral–CE

Identifying the opinions and general views of drinking water consumers distributed in urban and rural centers is an extremely important activity for decision makers, as in addition to making it possible to gather information on the process of regularity between quality and quantity of this essential resource. It also promotes the knowledge of consumer behavior, their profile, needs, priority of choices, and what they recognize as added value (Ikeda & Oliveira, 2005; Rocha & Platt, 2012). Furthermore, this type of interaction with users of public services can constitute one of the steps towards the full action/integration of the population in the constitution of environmental governance related to the aspect of access to quality water,

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through social participation, as Lima et al. (2022, p. 5) highlights "one of the aspects to be given greater attention in the search for solutions to the inefficiency of public policies is the valorization and guarantee of spaces for opinions and social demands".

The sample consisted of 68 questionnaires applied in the urban headquarters and 142 questionnaires in rural communities. The subjects were asked about the main source of water in their home. It is noted that the majority (66.1%) stated that they have the SAAE (Autonomous Water and Sewage System), which is the municipal authority for water distribution; 29% are supplied by CAGECE (Ceará Water and Sewage Company); 5% is supplied by water trucks, collection from artesian wells or collection from rivers or lakes. Thusly, it was possible to identify that 95% of consumers are connected to the regular treated water supply system.

Table 6 presents some selected data on the perceived characteristics of water by consumers in Sobral. A characteristic that stands out in the analysis is the high percentage of consumers who perceive water as having an unpleasant color, flavor or smell (74%), which explains why 67.7% of consumers do not trust the water distributor's treatment and 66.6% of consumers prefer to drink mineral water.

According to an explanation from Environmental Health Surveillance, the taste and smell are directly favored by the excessive presence of chlorine in some monitoring points (this increase is motivated by the reason that, even if there is a dispersion process in the atmosphere, there will be sufficient quantity when the water reaches homes and is capable of inhibiting growth). The color can be explained, according to specific records, based on the justifications presented by the distribution companies, due to the scheduled interruption of supply, motivated by the carrying out of maneuvers in the system (to check for leaks, irregular reception) and when normalized, flow occurs through the solid waste pipeline (earth). Another reason given is related to the type of water treatment technology in rural communities, which is not sufficient to completely remove impurities and solid material from the water.

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Table 6

Characteristics of water supply to consumers in Sobral/CE (2021)

Question	Options	Percentage (%)
In your home, what is the main source of drinking water?	Filtered water	18
	Mineral water	66.6
	Tap water	14.2
	Other	1.2
TOTAL:	**210**	**100**
If it is a TAP, does it undergo treatment?	Filtration	66.6
	Boil	3.3
	None	30.1
TOTAL:	**210**	**100**
If it is not TAP, what are the reasons not to drink it directly?	Features color	30.5
	Feel the taste	36.6
	Smell	7.2
	Shows color and feels flavor	4.4
	Shows color and smells	1.1
	Feel the taste and smell	20.2
TOTAL:	**210**	**100**
Do you trust the Company's treatment?	Yes	32.3
	No	67.7
TOTAL:	**210**	**100**

Source: Elaborated by the authors.

An important indicator, however, which cannot be further investigated within the scope of this research, concerns the percentage of people who experienced vomiting, diarrhea and gastrointestinal discomfort in the last 10 days; according to the consumers interviewed, 41.4% indicated one of the episodes in the family. It cannot be said that all the symptoms perceived by this public are reflections of water quality, however, it must be remembered that around 20.45% of urban water samples and 30.5% of samples collected in rural communities were in disagreement with quality parameters required by current legislation. Such evidence indicates public health problems that urgently require identification of the causes and priority actions to be taken.

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This theme triggers an alert that has already been defended by Khan et al. (2007). The researchers, in a study based on the survey of environmental health indicators in New Zealand, classified that public managers in environmental health must be very careful with the organization and representativeness of health data recorded in the care system, that is, disease rates transmitted by water do not reflect the real rate in communities and there is underreporting recorded in information systems and consequently, gastrointestinal illnesses, for example, are not fully identified and this will reflect on future decision-making that will no longer be assertive and efficient.

Within the perspective of the perception of the community that uses the public drinking water supply system, it is important to point out that in addition to the regular supply of water, which is a responsibility of the public authorities, Kowalski & Grott (2014) advise that the introduction of specific activities Environmental education as a preventive measure is also fundamental for the maintenance and consequent preservation, even of water resources that are part of the environmental system that gives the origin of this consumed drinking water. Thus, strengthening the prevention model will provide future gains in environmental and human health.

Final considerations

The evaluation of the Function Performance Indexes and Global Performance Index using the EGIPSS methodology made it possible to identify good or regular performance for the majority of functions. Performance was better (excellent or good) for those functions more closely related to the legal obligations of the Environmental Health Surveillance service, notably in monitoring the quality of the water offered. It was proven, using the method, that Sobral-CE has tools that provide support to understand how drinking water is being distributed both in the urban headquarters and in rural communities and in this way can use this information in favor of improvements in the population health care system. Data ranging from the formation of the

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technical team to how this technical team carries out its daily work activities were also important for this outline of the scenarios found.

Although the indicators presented reveal that the water quality monitoring, collection and analysis service has developed adequately, some elements deserve reflection. The first concerns the destination of the information generated by Environmental Health Surveillance and the responses from the Municipal Health Department, in order to investigate the high percentage of reported cases of diseases with possible causes of waterborne transmission. The second question concerns the legislation itself through Ordinance GM/MS No. 888 (May 4, 2021) which defines the quantity of samples collected, in terms of their adequacy and efficiency in capturing water quality in different supply systems, notably in the Northeast, with a marked disparity in the supply and quality of water from natural sources throughout the year.

Another important question concerns the absence of police power for Environmental Health Surveillance, thus, in case of finding irregularities in the supply, the respective body only had the option of forwarding requests for corrective actions from the distribution companies, not having no coercive power to guarantee greater effectiveness of supervision.

It was observed that all the indicators analyzed and especially those results that were concentrated in the period of 2020 and 2021 (the peak of the Covid-19) did not suffer significant impacts on the monitoring results, mainly on the quality content of drinking water. distributed to the population, a fact justified by the rapid preparation and commitment of the public health management of the municipality, which organized itself so promptly and internally followed all internal and external security protocols.

Here it is recognized that studies and challenges applied to health and environmental management, in addition to their multidisciplinary character, gain importance from their regional and territorial perspective, since socio-environmental vulnerability often permeates natural systems shared by different municipalities. Furthermore, given the levels of municipal integration, with emphasis on regions of broad regional influence, where a set of medium-sized

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cities, new metropolitan regions and regional development hubs stand out, public policies on a regional basis are increasingly demanded.

On this basis, we can see gaps in the literature that have not yet been addressed by this work, while it is considered necessary, from an urban-regional perspective, to make advances with regard to: at the intra-municipal level , diagnoses that integrate multiple sectors (secretariats, coordinators, etc.) environmental and management activities, in general; due to the broad transformations underway in rural spaces, diagnoses that advance the understanding of urban-rural relations; propositions of regional indicator matrices that allow integrated development actions at the regional or territorial level; economic-financial studies to support intermunicipal articulations, which allow maximizing regional development opportunities; advance studies on the integrated management of water resources, considering the contribution of environmental health surveillance. Moreover, the post-Covid-19 pandemic scenario, which demands great scientific efforts in monitoring new variants, treatments and challenges that are still unknown, imposes new confrontations, under a panorama of dissemination of science denial information. Therefore, especially in the context of public health, environmental health surveillance studies are gaining importance and will require that the aspects/gaps mentioned here be increasingly recognized.

It is considered that this work will clearly contribute to the field of urban and regional planning, especially in the field of investigations into the relationships established between regional components and the environment, based on the understanding of public action on the links between human beings and systems natural resources, with a view to well-being, quality of life and sustainability, considering localized experiences, in municipal areas. Additionally, the importance of new financial investments in drinking water supply treatment systems is highlighted as a measure to enhance damage reduction in public health.

In addition to the perspective of planning (urban and regional), it is recognized that these mechanisms for monitoring institutional performance, in the provision of essential public

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services, have established themselves as a powerful tool for materializing the constitutive

characteristics of Sustainable Development, through its objectives (SDG). Highlights here

include: access to a healthy life and well-being of populations, reducing maternal and child

mortality and waterborne diseases (SDG 3); universal access to safe, drinking water, and

adequate sanitation and hygiene, with the preservation of water bodies (SDG 6); ensure

inclusive, safe, resilient and sustainable cities and human settlements, in order to protect and

safeguard cultural and natural heritage (SDG 11). This set of elements depends not only on the

universalization of water supply and sanitation services, but on the quality and safety of their

execution.

In order to provide continuity to the theme of this study, the need for a future research

agenda is highlighted, with the fundamental premise of adding debate and discussions on

environmental health surveillance, taking into account the scope of the entire State of Ceará,

paying attention for local and regional specificities, thus bringing together broad data to be used

in a more assertive way by decision makers.

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