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EVALUATION OF THE VIGIAGUA: QUALITY OF DATA ON SUPPLY METHODS

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EVALUACIÓN DE VIGIAGUA: CALIDAD DE LOS DATOS SOBRE MÉTODOS DE SUMINISTRO

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ABSTRACT
Objective: To evaluate the Water Quality Surveillance System for Human Consumption in Ceará between 2020 and 2023. **Methods:** This is an evaluative study with a quantitative approach, based on secondary data from SISAGUA. Thirty-five variables were analyzed, following the methodology of the Centers for Disease Control and Prevention (USA) according to the guidelines for evaluating public health surveillance systems. The attributes analyzed were acceptability, completeness, and timeliness, aiming to strengthen water quality surveillance. **Results:** During the period, 36,596 data related to supply methods were recorded. SISAGUA presented 100% completeness in 14 variables, while three were regular, six poor, and 10 very poor. The system had excellent acceptability (average of 89.13%), high performance in timeliness of records, and good completeness in monitoring water quality. **Final considerations:** However, despite meeting the target of analyzed samples, there is still a significant percentage of unsatisfactory results.
Keywords: *Drinking Water; Public Health Surveillance; Environmental Health, Information Quality.*

RESUMO
Objetivo: Avaliar o Sistema de Vigilância da Qualidade da Água para Consumo Humano no Ceará entre 2020 e 2023. **Métodos:** Trata-se de um estudo avaliativo com abordagem quantitativa, baseado em dados secundários do Sisagua. Foram analisadas 35 variáveis, segundo a metodologia do *Centers for Disease Control and Prevention,* conforme as diretrizes para avaliação de sistemas de vigilância em saúde pública, sendo analisados os atributos aceitabilidade, completitude e oportunidade. **Resultados**: No período, foram registrados 36.596 dados relacionados às formas de abastecimento. O Sisagua apresentou 100,0% de completitude em 14 variáveis, enquanto 3 variáveis apresentaram resultados regulares, 6 ruins e 10 muito ruins. O sistema teve excelente aceitabilidade com mediana de 89,13%, alto desempenho na oportunidade dos registros e boa completitude no monitoramento da qualidade da água. **Considerações finais:** Apesar do cumprimento da meta de amostras analisadas, ainda há um percentual significativo de resultados insatisfatórios.
Descritores: *Água Potável; Vigilância em Saúde Pública; Saúde Ambiental; Qualidade dos Dados.*

RESUMEN
Objetivo: Evaluar el Sistema de Vigilancia de la Calidad del Agua para Consumo Humano en Ceará, 2020 y 2023. **Métodos:** Se trata de un estudio evaluativo con enfoque cuantitativo, basado en datos secundarios del Sisagua. Se analizaron 35 variables, siguiendo la metodología de los Centros para el Control y la Prevención de Enfermedades (EE.UU.) según las directrices para la evaluación de los sistemas de vigilancia de salud pública. Los atributos analizados fueron aceptabilidad, exhaustividad y oportunidad. **Resultados**: Durante el período se registraron 36.596 datos relacionados con los métodos de suministro. Sisagua presentó 100,0% de completitud en 14 variables, siendo tres regulares, seis malas y 10 muy malas. El sistema tuvo una excelente aceptabilidad (promedio de 89,13%) y un alto desempeño en términos de oportunidades de registro. y una buena exhaustividad en el monitoreo de la calidad del agua. **Consideraciones finales:** Apesar de cumplir el objetivo de muestras analizadas, todavía existe un porcentaje importante de resultados insatisfactorios.
Descriptores: *Agua potable; Vigilancia de la Salud Pública; Salud Ambiental, Calidad de la Información.*

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INTRODUCTION

Access to safe drinking water is a fundamental human right, and ensuring the safety and quality of water for human consumption is part of the Sustainable Development Goal (SDG) of the 2030 Agenda, proposed by the United Nations in 2015, which Brazil has signed. This goal aims to guarantee the right to access water that meets acceptable quality standards, which is crucial for public health monitoring and guiding disease prevention strategies within the population[1].

In 2010, the United Nations declared access to clean, safe water and basic sanitation as a fundamental human right essential for living with dignity. The water used by humans for drinking, food preparation, and personal hygiene must not contain pathogenic (disease-causing) microorganisms (disease-causing agents) or elevated levels of substances that pose a health risk [2].

Some waterborne diseases have led to a series of epidemiological and social problems that may be associated with poor hygiene and sanitation conditions. In this context, it is possible to observe the reflection of the failure to implement public policies, limited knowledge, and regulatory oversight regarding the improper disposal of contaminating substances and solid waste in the environment, which is common in developing countries such as Brazil [3].

The National Health Surveillance Policy is a public state policy and a key part of the Unified Health System (SUS). It is defined by its universality, cross-sectoral approach, and its role in guiding the care model across different regions. Its management is solely the responsibility of public authorities, and its main goal is to strengthen the prevention, detection, and control of health risks and conditions affecting the population, ensuring timely and effective responses to health threats [4].

Environmental Health Surveillance must focus on environmental risk factors that may affect population health. This involves anticipating and predicting the disease process through inspection, control, monitoring, intervention, and risk communication, particularly concerning drinking water, air, soil, environmental contaminants and chemical substances, natural disasters, accidents involving hazardous products, physical factors, and the work environment [5].

Moreover, surveillance of these risk factors is conducted through national programs, structured and organized at national, state, and municipal levels, including the Water Quality Surveillance Program for Human Consumption, known as Vigiagua, which aims to implement actions that ensure the population's access to water in adequate quantity and quality, following the drinking water standards established by current legislation. The aim is to reduce morbidity and mortality from water-borne diseases and illnesses, reinforcing the goal of improving the sanitary conditions of the various forms of water supply and, most importantly, assessing and managing health risks related to water supply. The implementation of the Vigiagua Program in a municipality is recognized if the three core actions-system registration, operational control, and health surveillance-have been conducted during the designated reference years [6].

Therefore, this study aims to evaluate the performance of the Vigiagua Program in Ceará regarding data quality between 2020 and 2023, investigating the effectiveness of monitoring actions, the challenges faced, and opportunities for improvement. The analysis of this period is particularly relevant, considering the impacts of the Covid-19 pandemic, which required adjustments in environmental health surveillance strategies and water management.

METHODS

This is an evaluative study, with a quantitative approach and based on secondary data in the public domain, related to the information from the Water Quality Surveillance Information System for Human Consumption (Sistema de Informação de Vigilância da Qualidade da Água para o Consumo Humano – Sisagua).

The study was conducted in the state of Ceará and covered the period from 2020 to 2023. According to IBGE (2022), the population of Ceará is approximately 8,794,957 inhabitants 7.

The system was evaluated using the methodology proposed by the Centers for Disease Control and Prevention of the United States, as outlined in Updated Guidelines for Evaluating Public Health Surveillance Systems, focusing on the attributes of acceptability, completeness, and timeliness. In this study, 35 variables were assessed based on the completeness attribute (Frame 1).

Frame 1 – Variables assessed for the completeness attribute of the forms of supply, Ceará, 2020-2023.

VARIABLES			
➔ **Geographical region**	➔ Type of Supply Method	➔ **Number of residential savings (permanent households)**	➔ Population served by SAA (Water Supply System) /SAC (Collective Alternative Solutions)
➔ **UF (Federal Unit)**	➔ Code ➔ And name of the supply method	➔ **Filtration, Disinfection, Cistern, Rainwater harvesting**	➔ Number of residential savings for occasional use
➔ **Regional Health Center**	➔ Year of reference	➔ **Type and CNPJ of the institution**	➔ Water supply by water truck ➔ Public fountain ➔ Natural spring ➔ Water piped via SAA
➔ **Municipality**	➔ Registration and filing dates	➔ **Presence of a water tank**	➔ Acronym of the institution
➔ **IBGE code**	➔ Surface and groundwater abstraction	➔ **Lack of water storage**	➔ Name and CNPJ of regional/local office

	➔ Population-to-household ratio		➔ Other supply methods

Source: Own Authorship.

Completeness was calculated based on the proportion of fields filled in relation to the total number of records in each year. Subsequently, the average of these results was measured to represent the analyzed period, considering only the mandatory variables related to the registered water supply methods. To measure the degree of completeness, according to Romero e Cunha, 20148, as excellent (≥95%), good (90% to 94%), fair (70% to 89%, poor (50% to 69%) e very poor (≤49%), The result was determined based on the average of the results to represent the period analyzed. final incompleteness corresponded to subtracting 100% from the value found in the average percentage of final completeness.

Acceptability was assessed by the proportion of municipalities that carry out actions for the surveillance of the quality of water intended for human consumption. This indicator considers the program implemented in the municipality as a criterion, covering three stages of monitoring: Registration, which involves registering the forms of water supply for human consumption; Control, which refers to water quality monitoring data by service providers; and finally, Surveillance, carried out through water quality monitoring by the health sector. For the assessment of acceptability, the classification parameter used was adapted from the criterion established by Mata, 20221, which categorizes performance as excellent for ≥80% of municipalities carrying out actions to monitor the quality of water for human consumption; fair, between ≥50 and <80%; or poor, when <50%. The result was determined based on the median of the annual values obtained.

The timeliness assessment was conducted considering the median number of days elapsed until the recording of drinking water quality monitoring data, routinely conducted by the health sector. This analysis includes the results of low-complexity tests for the following basic parameters: heterotrophic bacteria combined residual chlorine, free residual chlorine, total coliforms, color, chlorine dioxide, Escherichia coli, fluoride, pH, and turbidity.

The data was organized into three categories: timeliness from collection to report, calculated by the difference, in days, between the date the report was issued and the date the sample was collected; timeliness from report to record, determined by the difference, in days, between the date the data was recorded in Sisagua and the date the sample was reported; and timeliness from collection to record, obtained by the difference between the date the data was recorded in Sisagua and the date the sample was collected. As an evaluation parameter, the system was considered timely when it met the following criteria: median of ≤7 days for the category 'timeliness from collection to report', median of ≤14 days for 'timeliness from report to registration', and median of ≤30 days for 'timeliness from collection to registration'. The final classification of the system was based on the category 'timeliness from collection to recording', as this group covers the entire process flow, from the collection of the sample to the final recording of the results in the system.

Secondary data produced by the Water Quality Information System for Human Consumption from 2020 to 2023 were used, available in the database of the Brazilian Open Data Portal (Portal Brasileiro de Dados Abertos). Thus, the study was exempted from submission to the Research Ethics Committee (Comitê de Ética em Pesquisa – CEP), as the databases are publicly accessible and contain aggregated information, in accordance with Resolution No. 510 of April 7, 2016, from the National Health Council (Conselho Nacional de Saúde – CNS), which exempts evaluation by the Research Ethics Committee 9. The public domain software Microsoft Office Excel version 2019 and Epi Info 7.2.3.1 were used to analyze the data. The information was analyzed in accordance with the Annex of the GM/MS Consolidation Ordinance No. 5, dated September 28, 2017, as amended by GM/MS Ordinance No. 888 of May 4, 2021, and GM/MS Ordinance No. 2,472 of September 28, 2021.

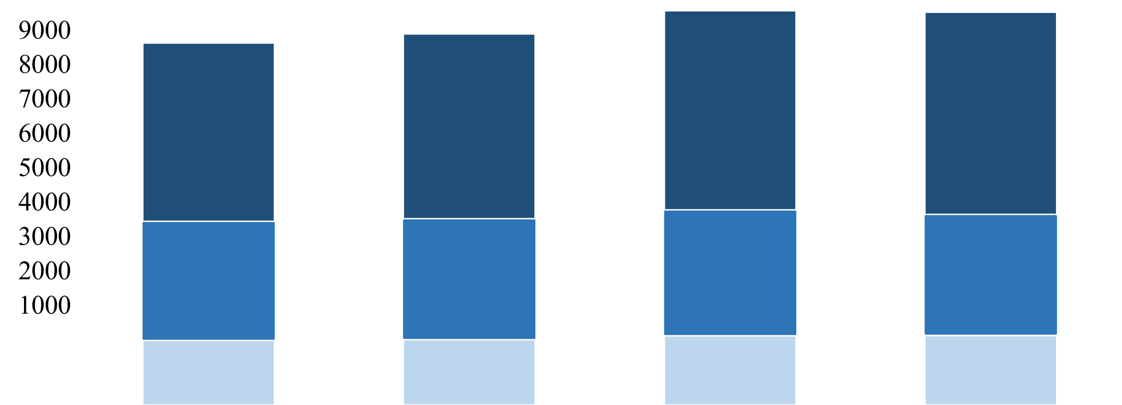
RESULTS

In the period between 2020 and 2023, 36,596 records were identified referring to data on the forms of supply in Ceará, of which 6,579 records were for Water Supply Systems (SAA), 11,462 for Collective Alternative Solutions (SAC) and 18,555 records for Individual Alternative Solutions (SAI), in the database obtained each record under analysis corresponds to a line and its respective data which are presented in 35 variables (Graph 1).

The assessment of data quality in relation to the completeness attribute shows that 14 variables were classified as excellent, as they had 100.0% completeness for the forms of supply.

These variables are mandatory fields containing essential information about the registration of the forms of supply, and are categorized according to: Geographical Region; State (UF); Regional Health Center; Municipality, IBGE Code; Type of Supply Method, Form of Supply Code, Name of the Supply Method, Year of Reference, Date of Registration, Date of Completion, Surface Capture, Groundwater capture, Population-to-household ratio. Sisagua achieved 100.0% completeness in 14 variables, while 3 had fair results, 6 were classified as poor and 10 as very poor.

Graph 1 – Number of records by form of supply, Ceará, 2020-2023.



	2020	2021	2022	2023
SAI	4325	4486	4835	4909
SAC	2801	2848	2966	2847
SAA	1584	1599	1694	1702

Source: SISAGUA, 2024. Data extracted on September 15, 2024.

Table 1 – Completeness of water supply records, Water Quality Surveillance Information System for Human Consumption (SISAGUA), 2020-2023.

Percentage Completeness per year					**% Medium from Completeness Initial**	**Quality**
Mandatory Filling Variables	2020	2021	2022	2023		
Geographic Region	100	100	100	100	100	Excellent
UF	100	100	100	100	100	Excellent
Regional Health Center	100	100	100	100	100	Excellent
Municipality	100	100	100	100	100	Excellent
IBGE Code	100	100	100	100	100	Excellent
Type of Supply Method	100	100	100	100	100	Excellent
Form of Supply Code	100	100	100	100	100	Excellent
Name of the Supply Method	100	100	100	100	100	Excellent
Year of Reference	100	100	100	100	100	Excellent
Date of Registration	100	100	100	100	100	Excellent
Date of Completion	100	100	100	100	100	Excellent
Surface Capture	100	100	100	100	100	Excellent
Groundwater Capture	100	100	100	100	100	Excellent
Population-to-household ratio	100	100	100	100	100	Excellent
Number of residential savings (permanent households)	96	98	99	100	98	Excellent
Mandatory Filling Variables for at least one of the forms of supply						
Filtration	98	99	99	99	99	Excellent
Disinfection	84	87	88	89	87	Fair
Pop receives water from SAA/SAC	50	50	51	52	51	Poor
Canalization	32	32	31	30	31	Very poor
Non-Mandatory Filling Variables						
Cistern	82	82	82	82	82	Fair
Rainwater harvesting	82	82	82	82	82	Fair
Type of Institution	50	50	49	48	49	Poor
Name of the Institution	50	50	49	48	49	Poor
CNPJ of the Institution	50	50	49	48	49	Poor
Water tank	50	50	51	52	51	Poor
No reservoir	50	50	51	52	51	Poor
Number of residential savings (occasional use)	47	47	46	42	46	Very poor
Water truck	32	32	31	30	31	Very poor
Public fountain	32	32	31	30	31	Very poor
Natural spring	32	32	31	30	31	Very poor
Pop receives water from SAA	32	32	31	30	31	Very poor
Acronym of the institution	33	33	33	33	33	Very poor
Name of regional/local office	33	33	33	33	33	Very poor
CNPJ of regional/local office	33	33	33	33	33	Very poor
Other types of supply	15	16	14	14	14	Very poor

Source: SISAGUA, 2024. Data extracted on September 15, 2024.

For the "Timeliness" attribute, three datasets were analyzed. In the first, "Timeliness from collection to report", the median in Ceará was 7 days, which was considered timely. In the second, "Timeliness from report to registration", the median was 10 days, maintaining the classification. Lastly, in the "Timeliness of collection to registration" grouping, the state was also classified as timely, with a median of 18 days.

Table 2 – Timeliness of data from surveillance monitoring of basic parameters in SISAGUA, Ceará, 2020-2023.

	Timeliness from collection to registration			Timeliness of the report to registration			Timeliness from collection to registration		
Year	Medium	Median	Standard deviation	Medium	Median	Standard deviation	Medium	Median	Standard deviation
2020	5,43	5	10,39	17,03	8	27,55	22,47	14	29,34
2021	5,9	6	5,34	14,38	8	29,66	20,28	15	29,65
2022	7,73	7	7,71	16,34	11	20,99	24,08	20	21,91
2023	7,91	7	8,95	32,58	15	46,11	40,49	23	45,90

Source: SISAGUA, 2024. Data extracted on September 15, 2024.

Between 2020 and 2023, 188,838 analyses were carried out for residual disinfectant chlorine in Water Supply Systems and Collective Alternative Solutions. Among these, 185,922 analyses were performed in Supply Systems (SAA) and 2,916 in Collective Alternative Solutions (SAC). The state of Ceará reached the target in all the years analyzed, with 2022 standing out, reaching 93.0% of analyses performed. The lowest percentage was recorded in 2020, at 82.2%.

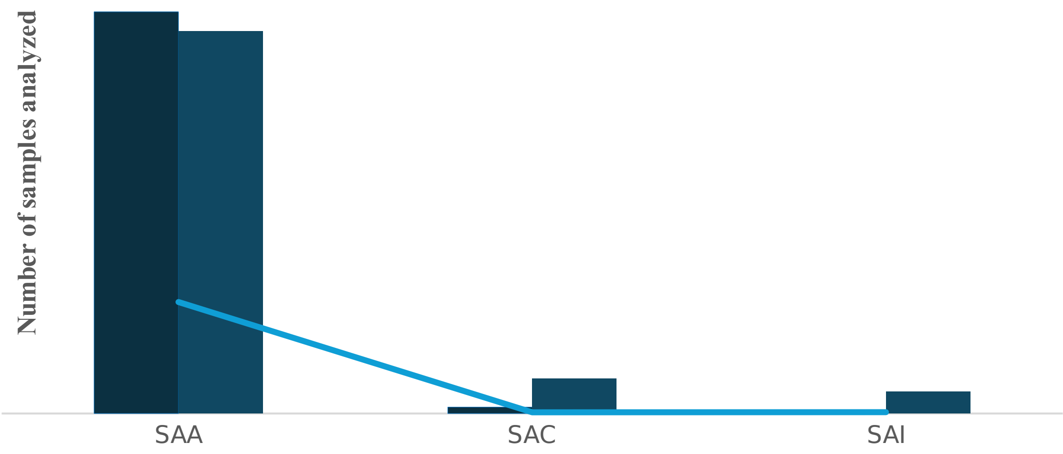
Regarding the turbidity parameter, a total of 203,330 samples were analyzed, distributed across the different types of water supply: 176,949 samples in Water Supply Systems (SAA), 16,247 in Collective Alternative Solutions (SAC), and 10,134 in Individual Alternative Solutions (SAI).

The year with the best performance was 2021, with 94.76% of samples analyzed, while 2020, the pandemic year, recorded the lowest percentage at 91.9%. Regarding the fluoride parameter, 52,708 samples were analyzed during the period, with the vast majority conducted in Water Supply Systems, totaling 51,583 analyses, followed by 541 in Collective Alternative Solutions (SAC) and 584 in Individual Alternative Solutions (SAI). The year with the highest percentage of samples collected was 2021, with 94.38%, while 2022 recorded the lowest percentage, with 88.93%. In Ceará, 80.2% of the population is served by water supply systems (SAA), totaling 9,187,103 people. Comparing the years analyzed, in 2020, 7,971,179 people were served by Water Supply Systems (SAA), of whom 4,975,227 received fluoridated water, which represents 54.15%. In 2023, the population served was 6,504,062, with 4,133,932 having access to fluoridated water, equivalent to 47%. In 2023, the population served was 6,504,062, with 4,133,932 having access to fluoridated water, equivalent to 47%.

In 2020, 58,014 samples were analyzed for total coliforms across the different types of water supply: 50,891 samples for Water Supply Systems (SAA), 4,420 for

Collective Alternative Solutions (SAC), and 2,701 for Individual Alternative Solutions (SAI). Of these, 27.9% (16,200/58,014) showed the presence of total coliforms, 22.2% in Water Supply Systems, 66.7% in Collective Alternative Solutions, and 72% in Individual Alternative Solutions.

Graph 2 – Number of physicochemical analyses carried out by form of supply, 2020-2023, Ceará.



Source: SISAGUA, 2024. Data extracted on September 15, 2024.

Regarding *E. coli*, 36.5% (5,920/16,200) of the samples with total coliforms had the bacteria. When stratified by type of water supply, 32.8% (3,716/11,305) of samples from Water Supply Systems (SAA) contained *E. coli*. In Collective Alternative Solutions (SAC), 37.9% (1,120/2,950) of the samples had the bacteria, while in Individual Alternative Solutions (SAI), 55.7% (1,084/1,945) of the samples indicated the presence of *E. coli*, the year with the lowest number of samples.

The year 2022 recorded the highest number of samples for total coliform analysis, totaling 61,113. Of these, 54,340 originated from Water Supply Systems (SAA), 4,131 from Collective Alternative Solutions (SAC), and 2,638 from Individual Alternative Solutions (SAI). The presence of total coliforms was identified in 28.7% (17,555/61,113) of the samples, 23.2% in the supply systems, 70.4% in the collective solutions, and 76.6% in the individual solutions. Among the samples with total coliforms, 31.3% (5,501/17,555) had *E. coli*. When analyzing the type of supply, it was observed that in the Water Supply Systems (SAA), 26.2% (3,319/12,622) of the samples contained the bacteria. In Collective Alternative Solutions (SAC), *E. coli* was detected in 39.5% (1,152/2,911) of the samples, while in Individual Alternative Solutions (SAI); this percentage was 50.9% (1,030/2,022), which corresponded to the year with the lowest number of samples collected.

DISCUSSION

Regarding the reality of the Vigiagua Program in the state of Ceará in terms of data quality, between 2020 and 2023, this study investigated the quality of the data related to the registration, control, and monitoring actions of Water Supply Systems (SAA), Collective Alternative Solutions (SAC), and Individual Alternative Solutions (SAI), highlighting the key element: the completeness of the information and the opportunities for improvement. The analysis of this period provided three distinct scenarios: the completeness of records regarding water supply systems, the timeliness of surveillance data on basic parameters, and the number of physicochemical and total coliform analyses conducted according to the type of water supply.

Given the information obtained from the supply systems in Ceará, using Sisagua as a data collection tool, considering the Program's instruments and the impact of surveillance actions in the territory to determine effective and safe strategies, there are still limitations in financial resources for investments in this area. These limitations compromise the effectiveness of actions, hindering the expansion and strengthening of surveillance policies.

Thus, the assessment of data quality concerning the completeness attribute, in which 14 variables were classified as excellent, had 100.0% completeness, corroborating the studies by Mata et *al*, 2022[10] in which Sisagua obtained an excellent classification for 25 of the 35 variables surveyed, similar to the results found in our study.

In a second scenario, where rigorously monitoring the quality of the water that reaches household taps becomes a vital action, the “Timeliness” attribute was verified, in which three sets of data were analyzed, the state of Ceará was classified as timely, with a median of 18 days corroborating the findings of Araújo *et al*., 2022 [11] and Júnior *et al*., 2019 [12] in the analysis of supply coverage and the quality of the data of the forms of supply, with relevant results obtained from public data of the analyzed platforms.

The third scenario is characterized by the quality and quantity of physicochemical analyses performed by form of supply (chlorine, turbidity, and fluoride) between 2020 and 2023, with 188,838 analyses performed for disinfectant residual chlorine in Water Supply Systems and Alternative Collective Solutions. The state of Ceará reached the target in all the analyzed years, with 2022 standing out with 93.0% and 2020 with the lowest percentage, 82.2%. Regarding the turbidity parameter, the year with the best performance was 2021, with 94.76%, while 2020, the pandemic year, showed the lowest value with 91.9%. Regarding the fluoride parameter, 52,708 samples were analyzed, the majority of which (51,583) corresponded to Water Supply Systems (SAA). he year with the best percentage of samples analyzed was 2021, with 94.38%, while 2022 showed the lowest percentage, with 88.93%, that is, in the 2020 interval, the analyses for disinfectant residual chlorine and turbidity did not perform satisfactorily.

Maintaining adequate levels of free residual chlorine is essential for effective water disinfection[13,14]. The study by Gomes, 2018 [15], which analyzed residual chlorine results, found that although the concentrations of residual chlorine in some water samples were within the limits established by legislation, the presence of total coliforms was still detected. It is well established that chlorine and chlorinated compounds are strong oxidizers and, when applied to water, can react with a variety of organic and inorganic compounds to form other compounds. Therefore, depending on the chemical characteristics of the water, the presence of certain impurities consumes part of the added chlorine. Hence, monitoring the surveillance of basic parameters and the number of physicochemical analyses conducted by supply systems is relevant for assessing the quality of water in supply systems.

Another relevant aspect is the occurrence of dental caries and fluorosis due to exposure to fluoride in the water, which is only assessed over time. Thus, Brazilian experts recommend that fluoridation monitoring be conducted by independent entities with no direct affiliation to water treatment operations. This principle, known as *heterocontrole* (a Portuguese term referring to independent external monitoring), involves the direct analysis of samples collected from the distribution network to ensure the quality and compliance of fluoridation levels [16].

In 2020, 58,014 samples were analyzed for total coliforms across the various water supply types. Regarding total coliform analyses by supply type, 32.8% of samples from Water Supply Systems (SAA), 37.9% from Collective Alternative Solutions (SAC), and 55.7% from Individual Alternative Solutions (SAI) tested positive for *E. coli*. This indicates that individual supply systems are more prone to bacterial contamination. This finding is supported by data published by Silva *et al,* 2023 [17] who evaluated the water quality of the water supply system (SAA) of a municipality in Ceará, finding that the samples analyzed in rural areas from January 2018 to December 2022, in terms of the Total Coliforms (Coliformes Totais – CT) standard, showed an unsatisfactory result for the Total Coliforms standard. In 2020, out of 153 samples analyzed, 115 (75.16%) yielded unsatisfactory results, which were attributed to inadequate treatment provided by the local supply network.

Regarding water potability, the findings of Cabral *et al* 2016[18], reinforce that water used in vulnerable communities without adequate treatment indicates health risks with the need for interventions to guarantee potability, as contamination levels by coliforms and *Escherichia coli* can trigger serious public health issues related to waterborne diseases.

However, an Australian study by Whelan and Willis, 2007[19], addressing the reality of rural communities regarding monitoring the quality of water for human consumption, highlights relevant issues, such as the small number of professionals to work in water quality monitoring programs, restricted funding, and difficulties in registering and monitoring the forms of supply. Additionally, information from Sisagua is used not only by Vigiagua professionals, but also by different institutions involved in the quality of water for human consumption, and other educational and research institutions. Therefore, the limitations of the study include exclusively the use of secondary data, which is susceptible to underreporting and inconsistencies, the absence of a qualitative evaluation that addresses the perception of surveillance professionals, and gaps in Sisagua, such as the difficulty of interpreting subjective fields.

CONCLUSION

The narrative of this study on the Water Quality Surveillance Information System for Human Consumption (SISAGUA) in Ceará demonstrated its importance as a strategic tool for monitoring water quality and managing environmental health surveillance. The analysis revealed that the system has excellent completeness in essential variables, ensuring the availability of reliable data for decision-making. However, limitations were identified in some variables, classified as regular, poor, or very poor, which can compromise the accuracy and reliability of the information, especially in alternative supply systems.

The results show that, despite the high level of acceptability and the commitment of municipalities to implementing Vigiagua, challenges still need to be addressed. The incomplete institutional and operational records highlight the need for better standardization and a commitment to complete the data, along with ongoing training for the professionals responsible for monitoring. Additionally, external factors-such as system failures and structural difficulties in certain areas-affect the execution of the program's stages, requiring adjustments to improve effectiveness.

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