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The role of health surveillance in the management of water quality in rural properties in seven municipalities of the Region of Paraná

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ABSTRACT
Sanitation in rural areas in Brazil is still very precarious, with deficits greater than in urban areas. In this sense, the central objective of this research is to evaluate the role of the Municipal Surveillance in the management of water quality in rural properties in the Midwestern region of Paraná, covering the beginning of the monitoring of water quality, the relationship of the Consolidation Ordinance No. 5 of 2017 of the Ministry of Health regarding the choices of parameters on potability indices in relation to the parameters analyzed in the Surveillance, the presence of outbreaks due to diseases arising from the consumption of contaminated water, the demand by residents and the partners who contribute to the realization of these activities. The data were obtained through the application of a semi-structured questionnaire, through the 11th Health Regional Office of Campo Mourão. It was presented that the municipalities have acted in the monitoring of water quality in an uneven way at the beginning of the activities, following the parameters of the Ordinance. The municipalities had demands and demands from residents and counted on the 11th Health Regional Office as the main partner in the monitoring support. Only Iretama presented an outbreak due to the consumption of contaminated water.

KEY-WORDS: Environmental sanitation. Environmental Health Surveillance. Water quality improvement.

1 INTRODUCTION

Basic sanitation practices in Brazil still entail countless discussions and challenges to reach the universalization of services for the population.

The current National Basic Sanitation Policy, created in 2007 and structured in the National Basic Sanitation Plan (PLANSAB), culminated in important advances in the water supply and treatment, in the collection and treatment of sewage and in the management of solid waste.

These advances were more present in the urban environment, despite still presenting numerous deficit problems.

In rural areas, basic sanitation practices are even more precarious, bringing a specific project to this location only in the year 2019, six after PLANSAB, which already stipulated the need for this Plan.

Another important point, in an attempt to improve health in rural areas, concerns the role of municipal surveillance in the management and analysis of water quality, exemplified in Consolidation Ordinance No. 5 of 2017 of the Ministry of Health.

Therefore, the main objective of the research was to evaluate the management of municipal surveillance in seven municipalities in the central western mesoregion of Paraná, which are: Altamira do Paraná; Iretama; Centenary Room; Quinta do Sol; Luiziana; Roncador and Terra Boa.

The understanding of the management of these entities with rural communities was achieved through the application of the semi-structured questionnaire, which was brokered by the 11th Regional Health (SESA) of Campo Mourão, which has acted as a partner of municipalities in microbiological analysis of the waters.

The municipalities have been actively involved in monitoring water quality, contributing to guaranteeing water with excellent potability rates for the health of these rural residents and also for improving the environment in which they live.

The municipalities did not even begin to carry out monitoring, but they had residents' demands to investigate the potability rates.

2 METHODOLOGY

The research began through a literature review on Consolidation Ordinance No. 5 of 2017 on the role of municipal surveillance, in particular, for the promotion of the quality of water consumed in rural properties. “The bibliographic research is a general overview of the main works already carried out, bearing importance, as they are capable of providing current and relevant data related to the topic” (MARCONI and LAKATOS, 2003, p. 158).

Within the bibliographical part, it culminated in describing and analyzing the implications, costs and partners that municipal surveillance has to carry out activities on the improvement of water quality.

The parameters imposed in the Ordinance and those analyzed in the surveillances were considered, identifying the length of the legislation in practice.

The application of semi-structured questionnaires with municipal surveillance showed how partnerships are carried out with other entities, funding for monitoring water quality, whether there are or have been priorities in management in rural areas, whether there are formulations of laws and other actions for the expansion of improvements in rural areas, etc.

It was pursued to apply the questionnaire in a semi-structured way so that the answers met the studied theme in a deeper way, avoiding disconnected answers with the central objective, which Gil (1990) explains as a focused interview.

To obtain general data for the municipalities, these were collected at the Brazilian Institute of Geography (IBGE) and at the National Sanitation System (SNIS).

Data were analyzed on: Rural population, municipality's economy, general data on the service and potable water supply in rural areas and the Municipal Human Development Index (HDI).

3 RESULTS

Water is a fundamental element for life, which means it is a topic of great debate today. For Freisleben et al., (2010, p. 2) “water is an indispensable resource, not only for the maintenance of life for all living beings, but also for social and economic development”.

Given this importance, it is necessary to develop actions and infrastructure to ensure quality water. “Although water is necessary for basically all human activities, we currently found problems related to the quantity and quality of this precious natural resource” (SILVA, et al, 2014, p. 44).

The problems related to contamination can be numerous, as explained by Silva and Araújo (2003),

> The final destination of domestic and industrial sewage in septic tanks, the inadequate disposal of urban and industrial solid waste, gas stations and the modernization of agriculture represent sources of groundwater contamination by pathogenic bacteria and viruses, parasites, organic substances and inorganic. (SILVA and ARAÚJO, 2003, p. 1020).

Emphasizing the reality in rural areas, water contamination occurs through contamination coming from agricultural activities and also from incorrect disposal of human and animal waste. “In rural areas, the main interference with water resources is caused by the destruction of permanent vegetation areas, the indiscriminate use of pesticides and fertilizers and the poor destination of animal and human waste” (CASALI, 2008, p. 16).

Another aggravating factor in rural areas, which contributes to the continuation of activities that are harmful to the environment and the health of residents, refers to the socioeconomic situation that many residents of rural areas still face. “The absence or inadequacy of basic sanitation, especially access to safe drinking water, is, above all, an issue related to poverty in the world and also in Brazil” (FUNASA, 2011, p. 3).

In view of the realities posed in rural areas, it is necessary to describe the role of municipal sanitary surveillance in controlling the quality of water consumed by these populations, explained by Consolidation Ordinance No. 5 of 2017.

> **Art. 4** All water intended for human consumption from an individual alternative water supply solution, regardless of the form of access for the population, is subject to water quality surveillance. (Origin: PRT MS/GM 2914/2011, Art. 4). (MINISTRY OF HEALTH, 2017)

The Ordinance describes the legal roles that surveillance must fulfill, always respecting the quality of water for human consumption.

> **Art. 12.** It is incumbent upon the Municipal Health Secretariats: (Origin: PRT MS/GM 2914/2011, Art. 12)
> I - exercise surveillance of water quality in its area of competence, in conjunction with those responsible for controlling the quality of water for human consumption; (Origin: PRT MS/GM 2914/2011, Art. 12, I) [...] (MINISTÉRIO DA SAÚDE, 2017).

Among the obligations and activities carried out by the surveillance, the Ordinance also sets out the parameters analyzed to assess the quality of water for human consumption (Table 1).

Table 1 - Microbiological parameters regarding the quality of water consumed

Water type		**Parameter**		**Maximum Allowed Value (MAV)**
Water for human consumption		*Escherichia Coli* (2)		Absence in 100 mL
		Coliformes totais (3)		Absence in 100 mL
		Escherichia Coli		Absence in 100 mL
Potable Water	Upon leaving the treatment	Total coliforms (4)	Alternative collective systems or solutions that supply less than 20,000 inhabitants	Only one sample, among the samples examined in the month, may present a positive result
	In the distribution system (reservoirs and network)		Alternative collective systems or solutions that supply more than 20,000 inhabitants	Absence in 100 mL in 95% of samples examined in the month.

Source: Consolidation Ordinance No. 5 of 2017. Org: The author himself (2021). NOTES: (1) Maximum Allowable Value. (2) Indicator of faecal contamination. (3) Treatment efficiency indicator. (4) Indicator of the integrity of the distribution system (reservoir and network).

The lack of compatibility of the parameters, added to the way the water is collected and consumed, can contribute to interventions in these catchment points, aiming to adapt to the norms required by the Ordinance.

The parameters selected for checking water quality, when presented with high levels, tend to cooperate in the spread of diseases. “The high presence of Escherichia Coli can cause acute diarrhea, motivated by the recurrent consumption of contaminated water in regions with deficits in basic sanitation practices” (MINISTÉRIO DA SAÚDE, 2010).

The high presence of Total Coliforms triggers new diseases, which, together with other pollutants, can pose a risk to public health and human life, in addition to environmental contamination.

> The determination of the concentration of Total and Thermotolerant Coliforms (Fecal) assumes importance as a parameter indicating the possibility of the existence of pathogenic microorganisms responsible for the transmission of waterborne diseases, such as typhoid fever, paratyphoid fever, bacillary dysentery and cholera. (CAJAZEIRAS, 2007 , p. 62).

In rural areas, there is the practice of alternative supply, through the consumption of water from springs, artesian wells and/or excavated wells. In order to guarantee quality water, the rural population, together with entities linked to health and environmental issues, have developed alternative systems.

FUNASA has carried out programs to improve the quality of life in rural areas. One of the programs refers to the project to universalize access to water in the semiarid region.

> The government decided to include in the Brasil Sem Miséria Plan, a program to universalize access to water for human consumption in the semiarid region, in which more than R$220 million will be invested over the next two years. “Water is food: it is based on this concept that Funasa technicians work to ensure the supply of good quality water to the rural population”, says the director of the Department of Environmental Health, Henrique Pires (FUNASA, 2011, p. 9) .

Projects to improve water quality, linked to the role of surveillance in monitoring water in rural areas, must be structured in continuous Public Policies that reach everyone,

> We emphasize that public policies that effectively reach rural communities are essential for improving sanitation conditions in the countryside, thus preventing waterborne diseases and maintaining health, improving the quality of life and saving resources that would be spent on hospital admissions and medicines. In other words, investment in sanitation means investment in life, in preserving the environment (CRISPIM, *et al*, 2018, p. 237).

The construction of legislation for basic sanitation contributes to actions to prevent water contamination, as per Item III of Article 2, which configures public basic sanitation services. “III - water supply, sanitary sewage, urban cleaning and solid waste management carried out in an adequate manner for public health, the conservation of natural resources and the protection of the environment; (Writing by Law No. 14.026, of 2020)” [...] (BRASIL, 2007).

In this way, it is intended to prevent incorrect evictions from happening, contributing to the obligation to build actions by the government in creating and managing sanitation plans. "Law 14.455/2007 (Basic Sanitation Law) brought a new perspective, as it points out the Municipal Sanitation Plans as instruments for the consolidation of service contracts between city halls and service providers in order to obtain financing" (SANTOS et al., 2015, p. 39).

Basic sanitation encompasses the health sector, so that the addition of laws, participation and discussion along with the various areas of knowledge that debate this issue

are fundamental aspects to ensure the expansion of effective actions for the community. “The scarcity of basic sanitation practices ends up exerting influence on the environment, aggravating problems of limited natural resources such as water in the Northeast and Southeast, causing infection by feco-oral transmission diseases” (MINISTÉRIO DA SAÚDE, 2015).

Investments in basic sanitation with quality provide a reduction in spending on health. The consumption of contaminated water can bring numerous diseases to the human body, such as washing food with this type of water.

> The main diseases related to drinking contaminated water are: cholera, typhoid fever, hepatitis A and acute diarrheal diseases of various etiologies: bacteria - Shigella, Escherichiacoli; viruses – Rotavirus, Norovirus and Poliovirus (poliovirus – already eradicated in Brazil); and parasites – Ameba, Giardia, Cryptosporidium, Cyclospora. Some of these diseases have a high potential for dissemination, with person-to-person transmission (faecal-oral route), thus increasing their spread in the community. (SECRETARIA DE ESTADO DA SAÚDE DE SÃO PAULO, 2009, p. 1).

The risks to human health, due to the lack of correct actions for basic sanitation in rural areas, are an aggravating factor. “Although rural populations have the right to sanitation guaranteed in Laws, the Brazilian rural environment is still lacking in such infrastructure” (ABONIZIO, 2017, p. 14).

Basic sanitation practices, which guarantee the quality of the water consumed and practices for the disposal and treatment of sewage in rural areas, can contribute both to public health and to a new relationship between residents and their livelihood. “Therefore, environmental sanitation must focus on global integration for sustainable development, ensuring the survival of biodiversity and priority issues such as the well-being of the population and environmental preservation” (FUNASA, 2010, p. 14).

At first, all municipalities in the central western mesoregion of Paraná were selected. The application of the questionnaires was intermediated through the State Health Department – 11th Regional of Campo Mourão. From the total of 25 municipalities, only 7 responded, which will be discussed. The municipalities that responded to the questionnaire were: Altamira do Paraná, Iretama, Fourth Centenary, Quinta do Sol, Luiziana, Roncador and Terra Boa (Figure 1).

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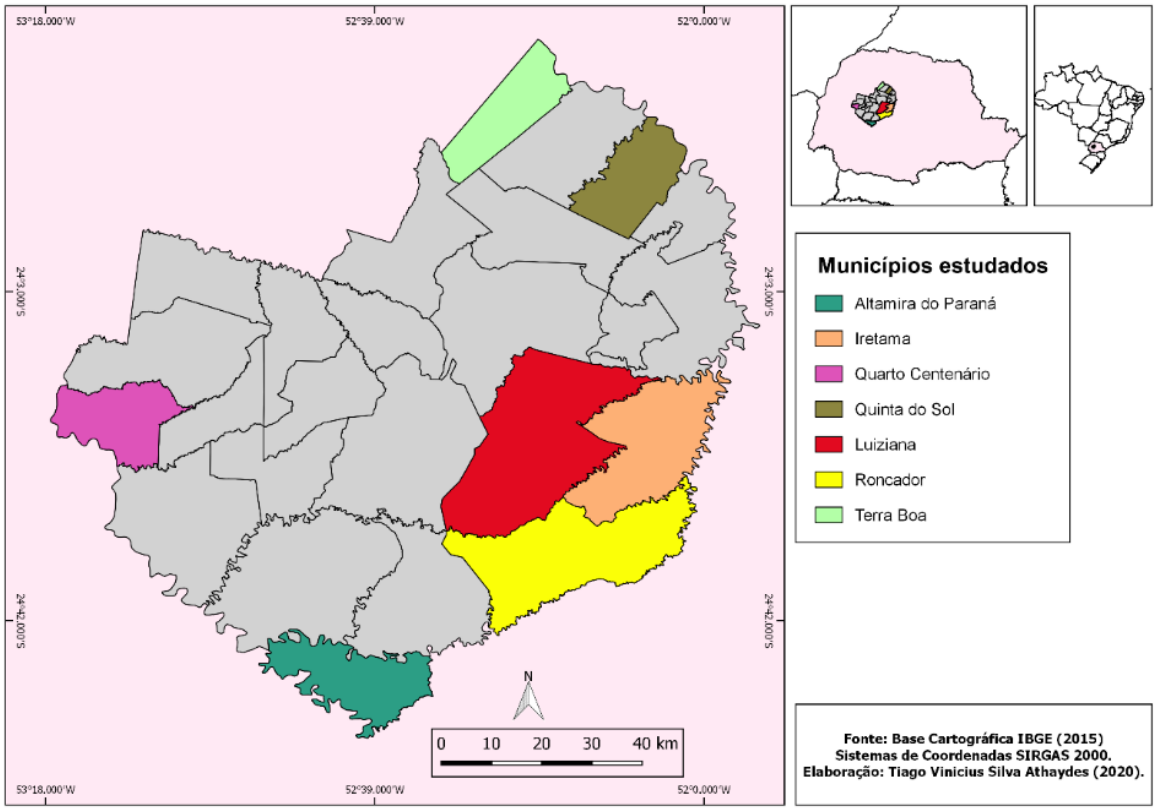
Figure 1 – Municipalities surveyed on the performance of Sanitary Surveillance in improving water quality in rural areas.



The first municipality studied was Altamira do Paraná. According to the Census, the municipality has a population of 4,306 thousand inhabitants, from which 2,135,000 inhabitants live in urban areas and 2,171 thousand inhabitants live in rural areas (IBGE, 2010).

Observing the Census, the municipality presents a balance between rural and urban population. The superiority of the rural population has greater attention from the government for health improvements in these locations. The population concentration in rural areas is related to the fact that the municipality is massively agricultural, depending on agricultural activities.

The water supply in the municipality between the rural and urban population is universal, serving around 99.95% (SNIS, 2019). The service provided by the municipality is above the average for the region, which is 90.53%, and in Brazil, which is 83.72% (SNIS, 2019).

The application of the questionnaire was organized along with the person responsible for the Municipal Surveillance. This person does not have an academic background. The municipality's surveillance has been developing the monitoring of water quality on rural properties. The parameters selected in these monitorings are: Turbidity; Total Coliforms; Escherichia Coli; Fluorine and pH.

Monitoring in the municipality took place from 2016 onwards. It was confirmed that monitoring takes place due to the rural residents demand. Surveillance has played the role of monitoring acute illnesses cases in the digestive system (diarrhoea). The municipality did not have outbreaks of water-related diseases among rural residents.

VIGIÁGUA (Health Regional) has acted as a partner for municipal surveillance in these monitoring activities. The responsible did not detail the forms of financing to carry out these monitoring. It was explained that the municipality does not have operational difficulties in carrying out these activities.

Finally, it was asked if the municipality has any municipal project for the protection of water resources in rural areas in Individual Alternative Solutions (SAI), such as the protection of springs. The answer was negative for that question.

The second municipality explained was Iretama. The municipality of Iretama has a population of 10,622,000 inhabitants (IBGE, 2010). Of the total population, 6,187 thousand inhabitants live in urban areas and 4,435 thousand inhabitants live in rural areas. Bringing the urban and rural population together requires equitable attention in health actions in the municipality.

Presenting the sanitary data for the water supply service, Iretama presented 84.07% service, showing rates below the region, which is 90.53%, and above the Brazilian average, which is 83.72% (SNIS , 2019).

The application of the questionnaire took place with the person responsible for surveillance in the municipality, who has an academic background in Psychology. Municipal surveillance has been monitoring the quality of water in rural areas since 2014.

The parameters selected for analysis are: Turbidity; Total Coliforms, Escherichia Coli, Fluorine and Chlorine. The municipality presented rural residents' demands to inspect the quality of the water consumed. The municipality has assisted in notifications in cases of acute illnesses in the digestive system.

The municipality even presented an outbreak of diseases due to the consumption of contaminated water. This event led the municipality to adopt collections, socio-educational actions and presentation of the reality to the municipal manager, who expanded the systems of water supply.

The partner for monitoring water quality is Regional Health, which the State Government has helped to finance the monitoring.

The city has operational difficulties to carry out these activities, among which there was a lot of difficulty with transport, however, about 2 months ago, the latter was made possible.

The municipality presented a project for the implementation of the Evapotranspiration Basin system, for the collection and treatment of sewage, but it was not developed due to lack of interest and had partners with the Municipal Secretariat for the Environment and Emater.

The third municipality studied was Quarto Centenário. It presents a population of 4,856 thousand inhabitants, from the total, 2,912 thousand inhabitants live in urban areas and 1,944 live in rural areas (IBGE, 2010). The service for water supply in the city reaches 87.46%, among the urban and rural population (SNIS, 2019).

The Fourth Centenary presented data below the average for the region's municipalities, which was 90.53%, and is one above the average for Brazilian municipalities, which is 83.72% (SNIS, 2019).

The questionnaire was applied to the person in charge of municipal surveillance, who does not have any academic background. The municipality has developed monitoring for water quality in rural areas, which began in 2007.

The selected parameters were: Turbidity; Total Coliform; Escherichia Coli; Fluorine and pH. There was the rural population's demand to understand the quality of water in their properties.

Surveillance does not assist in notifications in case of acute illnesses arising from the consumption of contaminated water. Surveillance has acted with preventive measures in case there is confirmation of diseases caused by the consumption of these contaminated waters. The municipality did not present outbreaks related to the consumption of contaminated water.

The Municipal Environment Department has acted as a partner in these activities. The actions are not financed, according to the answer obtained, and there are no operational difficulties in carrying out these actions either.

The municipality does not present any project or program for the protection of water resources, some activities are carried out by the municipality's Emater.

Further on, the next municipality analyzed was Quinta do Sol. It has a population of 5,088 thousand inhabitants according to the last census, from this total, 3,811 thousand inhabitants live in urban areas and 1,277 thousand inhabitants live in rural areas (IBGE, 2010).

The water supply rates in the municipality are 99.98% (SNIS, 2019). The municipality has universal service rates for this issue. Quinta do Sol presented data above the average for the region's municipalities, which was 90.53%, and above the average for Brazilian municipalities, which is 83.72% (SNIS, 2019).

The person in charge of municipal surveillance does not have an academic background. The municipality has activities for monitoring water quality. The selected parameters were: Turbidity; Total Coliforms; Escherichia Coli; Fluorine and pH.

Monitoring began in 2012. There were rural residents' demands to measure the quality of the water. Surveillance has assisted in reporting occurrences of acute illnesses in the digestive system. However, no outbreaks related to the consumption of contaminated water were reported.

The responsible did not answer about the partners in the execution of these activities and pointed out that the monitoring is financed through the VIGIASUS Program. The municipality does not present operational difficulties and does not present any program or project for the protection of water resources in rural areas for SAI's.

The next municipality was Luziana. The municipality has a population of 7,315 thousand inhabitants, from this total, 4,756 thousand inhabitants live in urban areas and 2,559 thousand inhabitants live in rural areas (IBGE, 2010).

The reality exposed for the health issue of the service for water supply in urban and rural areas in the municipality is 85.33% (SNIS, 2019). Luiziana presented data below the average for municipalities in the region, which was 90.53%, and is slightly above the average for Brazilian municipalities, which is 83.72% (SNIS, 2019).

The technical manager in Luiziana has a degree in Environmental Management. Surveillance has been involved in monitoring the quality of water on rural properties in the municipality.

The municipality has been involved in monitoring, checking the parameters of total coliforms, Escherichia Coli and Turbidity. Monitoring began in 2011. Residents of rural properties sought surveillance to examine the levels of potability of water consumed.

The environmental surveillance and the Epidemiological Department work together in order to take care of illnesses caused by water transmission. The municipality has not experienced any outbreak due to the consumption of contaminated water, if it occurs, sodium hypochlorite will be distributed.

The partnership counts on the presence of the Federal Government, State Health Department (11th Regional Health Department) and Municipal Health Department. Monitoring

is carried out at the Regional Health Department and is paid by the municipality. The difficulty faced in carrying out monitoring concerns the periods of prolonged rain, which end up harming the situation of rural roads.

The municipality has been developing some protection projects in the springs, along with the 11th Regional Health of Campo Mourão, the State University of Paraná – Campo Mourão (UNESPAR), under the supervision of Professor Jefferson Crispim, and his students. The project is called Águas da Comcam.

The sixth city discussed was Roncador. The municipality has a population of 11,537 thousand inhabitants. Of this total, 7,120 thousand inhabitants live in urban areas and 4,417 thousand inhabitants live in rural areas (IBGE, 2010).

The reality exposed for the health issue of the service for water supply in urban and rural areas in the municipality is 98.96% (SNIS, 2019). Achieving universality indices. Roncador presented data above the average of the municipalities in the region, which was 90.53%, above the Brazilian municipalities, which is 83.72% (SNIS, 2019).

The person responsible for surveillance holds a degree in Veterinary Medicine. Monitoring of water quality has been carried out and has taken place since 2014. The following parameters are monitored: Turbidity; total coliforms and Escherichia Coli. There were rural residents' demands to inspect the quality of water in rural areas.

Environmental surveillance transfers information to epidemiological surveillance on waters with altered parameters, which are passed on to the Health Agents (ACS), who carry out the work along with the residents.

The partners in the execution of monitoring are: ACS,s, Secretary of Agriculture and Emater. The municipality did not present any outbreak and also does not have municipal projects related to this theme.

Finally, the last municipality surveyed was Terra Boa. The municipality has a population of 15,776,000 inhabitants, hence, 13,051,000 inhabitants live in urban areas and 2,725 thousand inhabitants live in rural areas (IBGE, 2010).

The reality exposed for the health issue of the service for water supply in urban and rural areas is 99.99% (SNIS, 2019). The municipality achieved universality indices for this issue. Terra Boa presented data above the average for municipalities in the region, which is 90.53%, above the average for Brazilian municipalities, which is 83.72% (SNIS, 2019).

The person responsible for Surveillance holds a degree in Geography and is a specialist in Health Surveillance Management. Surveillance assists in reporting outbreaks to investigate the reasons that led to these problems. Samples are collected and notified in the Notifiable Diseases Information System (SINAN) of the Ministry of Health.

Monitoring of water quality has been taking place since 2011, the following parameters are carried out: Turbidity; Total Coliforms; E. Coli; Fluorine and pH. There were residents' demands to check the quality of water for all types of springs.

The last reported outbreak was in 2015, but no relationship with water consumption was established. Analyzes were carried out in food and water to understand these problems.

The partners that work along with the surveillance are: The 11th Regional Health; the Basic Health Units (UBS) and the Health Agents (ACS). Financing is carried out through the VIGIAGUA Program, which includes federal, state and municipal resources.

Difficulties are found in the issue of access in some locations. The municipality has participated in the Águas da Comcam Project, which carries out actions to protect springs.

After reporting the conditions and organizations of the municipalities, for the improvement of water quality, it is observed that there are similarities, among them, the parameters selected to investigate the drinking water indexes.

The similarity concerns the Ordinance of the Ministry of Health, which is held at the 11th Regional Health Department. Another similarity shown is the search for rural residents to analyze the conditions of the quality of their water.

The investigations demanded from these residents are related to the importance of the role of the State, here, represented by municipal surveillance. The importance of surveillance in this matter for rural residents is essential, since rural properties are not supplied by a water supply network, as in urban areas, and constant monitoring is carried out on potability rates.

Another highlight is related to the partnerships created along with state entities and the Federal Government. This is important in helping Municipalities, as many do not have the physical, economic and human structure to carry out all the procedures for collecting and analyzing the water quality in rural areas.

The similarities are shown, therefore, in Table 2, summarizing the actions taken by the Municipal Surveillance to improve water quality in rural areas.

Table 2 – Synthesis of actions taken by the municipal Surveillance to improve water quality in rural areas

City	Beginning	Parameters	Partners	Disease outbreak?	Was there residents' demand?
Altamira do Paraná	2016	C. Totals; E. Coli; Fluorine and pH.	Regional Health	No	Yes
Iretama	2014	C. Totals; E. Coli; Fluorine and Chlorine.	Regional Health	Yes	Yes
Quarto Centenário	2007	Turbidity; Total Coliform; Escherichia Coli; Fluorine and pH.	Secretary for Environment	No	Yes
Quinta do Sol	2012	Turbidity; Total Coliform; Escherichia Coli; Fluorine and pH.	No answer	No	Yes
Luiziana	2011	Turbidity; Total Coliform; Escherichia Coli.	Regional Health and Unespar	No	Yes
Roncador	2014	Turbidity; Total coliforms and Escherichia Coli.	Secretary for Agriculture; ACS; Emater	No	Yes
Terra Boa	2011	Turbidity; Total Coliforms; E. Coli; Fluorine and pH.	Regional Health; UBS; ACS	No	Yes

Source: Author (2021).

Municipalities have acted in a similar way in the choice of parameters, this is given by the Consolidation Ordinance and some of them have added some more parameters.

The municipalities did not start their work on an equal basis, with the beginnings of activities being uneven. Finally, the presence of partners to help with the execution of these activities was clear, which has contributed to the continuity of activities.

Conclusion

The activities managed by the actions of municipal surveillance have a sharp focus on transparency about the quality of water consumed by rural residents. Before these activities,

the rural population was not assisted by the government, regarding the potability rates of their consumed water, exposed to health risks and contamination of the environment in which they live.

The task of evaluating water quality indices is a step that can be considered with correct sanitary measures, improving the ways in which water is supplied to the rural population.

Therefore, the construction of Projects and Public Policies in the city is extremely serious for the materialization of the contamination rates decrease.

In addition to sanitary improvements for the potable water supply in rural areas, it is essential to develop other projects for the collection and treatment of domestic sewage and solid waste.

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