

## **Intersectoral collaboration and coordination mechanisms for implementing water fluoridation: challenges from a case-study in Brazil**

### **Abstract**

**Objectives:** Community water fluoridation has been associated with better oral health conditions globally and reduced dental caries. While oral health policies are governed by the health sector agenda, water fluoridation is undertaken by public, private, and mixed companies of the sanitation sector. The first aim of this study was to investigate the degree of intersectoral collaboration, and the second was to investigate how the coordination mechanisms are perceived by the sanitation agents involved in water quality management, for potential establishment of water fluoridation in a central-west state in Brazil.

**Methods:** Semi-structured interviews were conducted with chief sanitation agents from non-profit, profit, and mixed public/private companies responsible for water quality and fluoridation in a purposive sample. Theoretical frameworks of intersectoral collaboration and coordination mechanisms were used for analysis.

**Results:** Twelve interviews were conducted. Informal collaboration was identified in the sanitation sector within companies involved in water provision. The main coordination mechanisms were network-type mechanisms, which involve consultations and knowledge sharing, and market-type mechanisms, which explore new job opportunities and cost-effectiveness, especially in water quality measures. Enabling themes (enablers) were identified, such as positive attitude towards including water quality and fluoridation in a collaborative health and sanitation common agenda. Moreover, fluoridation did not meet the regulatory and surveillance agenda at the state level, and until that moment, there was no proposal of the health sector for water fluoridation.

**Conclusions:** Partnership creation, consolidation, and shared mission, especially between health and sanitation sectors, were identified as main challenges for implementing water fluoridation policy.

**Keywords:** Water Fluoridation, Intersectoral collaboration, Health Care Coordination and Monitoring, Oral Health, Public Health

## Introduction

Health determinants encompass a variety of environmental, economic, social, and behavioural conditions linked to health status of individuals and populations. The unequal distribution of these conditions also generates patterns of oral health inequalities, which highlight the need for upstream regulation/legislation and intersectoral action to promote population oral health.<sup>1</sup> Changes in structural policies require action from sectors beyond the health sector; for example, establishing policies for public water fluoridation depends on collaborations with the sanitation sector.<sup>2</sup> Moreover, intersectoral action in health promotion depends on creative inquiry, continuous learning, strategic application, and rigorous testing.<sup>3</sup>

Community water fluoridation (CWF) is the adjustment of fluoride concentration in drinking water, associated with better oral health conditions globally.<sup>4</sup> Systematic reviews have shown the benefits of water fluoridation in decreasing dental caries<sup>5,6,7,8</sup> and influencing ethnic inequalities in dental caries.<sup>9,10</sup> A study on the effects of CWF cessation in a city in Alaska showed a significant increase in caries-related procedures and associated treatment costs per child, demonstrating the negative consequences for the population.<sup>11</sup>

Over the past thirty years, governments in many countries have reduced their role in providing public services, taken over by for-profit and non-profit organizations.<sup>12</sup> Sanitation and health services are no longer implemented only by state administrations but also by social organizations, private companies, and a myriad of public-private arrangements, leading to the emergence of the need for new strategies and tools for sectoral and intersectoral management.<sup>13</sup>

For this reason, intersectoral collaboration and coordination mechanisms<sup>13</sup> have attracted the interest of researchers aiming at improving the understanding of the main barriers and facilitators for multi-sectoral work. The key elements of a positive partnership among organizations for health promotion include a common mission, active participation, leadership, trust, and inclusiveness.<sup>14</sup> Intersectoral collaborations can be expressed by a 4-stage cycle: informal collaboration, partnership creation, partnership consolidation, and partnership termination and succession.<sup>15</sup> Although water fluoridation policy is within the health sector agenda in several countries, including Brazil, the policy takes place under the responsibility of companies of the sanitation and water distribution sector – an excellent example of intersectoral collaboration to achieve gains in population health. Another example is the oral health promotion in schools in remote rural communities with other stakeholders, e.g., teachers (educational sector) are the facilitators of oral health interventions in schools.<sup>16</sup>

In Brazil, the supply of fluoridated public water has been mandatory since 1974, according to the Federal Law n. 6,050. Between 1970 and 1990, urban water supply coverage increased from 54% to 90%. During this same period, fluoridation coverage increased from 3% to 42%. However, in 2008 it was estimated that 40% of Brazilian cities where 25% of the country's population lives did not have access to this beneficial public health measure, suggesting that implementation strategies needed to be reoriented.<sup>17</sup> Federal republics with autonomous and inter-dependent governmental levels face more difficulties than unitary government countries in establishing equity-promoting policies.<sup>18</sup> One of the challenges in implementing fluoridation in all Brazilian cities is the three-level federal system approved by the Brazilian Constitution of 1988 that assures power and relative autonomy for the central government (first level), the 26 states and one Federal District (second level), and 5,570 cities (third level). Since 2007, local levels have held

the prerogative to manage the sanitation in their jurisdiction, including changes and renewal of contracts with service providers.<sup>17</sup> Moreover, although 68.3% of Brazilian people residing in cities with 50,000 inhabitants or more had access to fluoridated water, coverage in the South (88.7%) was 3.5 times greater than that in the North (25.3%).<sup>19</sup> The lack of CWF provision is greater in small municipalities owing to low priority given locally to policy, administrative fragility of local entities, poor physical structure of the water treatment plants, isolated working relations, low effectiveness of monitoring devices, and local actors' uncertainties.<sup>17</sup> These vulnerable points could be associated with difficulties in the vertical and horizontal coordination of the CWF policy, especially in the intersectoral collaboration and coordination mechanisms between health and sanitation sectors.

Investigation for elucidating salient coordination mechanisms and features of relationships maintained by different organizations and stakeholders related to fluoridation policy could give pathways and clues to help policymakers to understand the challenges for expansion and maintenance the public policy at a high level of quality.

The first aim of this study was to investigate the degree of intersectoral collaboration and the second, how the coordination mechanisms are perceived by the sanitation agents and sectors involved in water quality management in a central-west state in Brazil for elucidating potential barriers and enablers for an effective implementation of CWF.

## **Methods**

### **Theoretical framework**

Data collection and analysis was based on a framework involving the partnership life cycle<sup>15</sup> and cross-sectoral coordination mechanisms of public and private organizations<sup>13</sup>.

It was assumed that partnerships have different stages that can be defined as pre-

partnership collaboration (informal collaboration), partnership creation and consolidation, partnership program delivery, and partnership termination and succession. Coordination mechanisms represent a set of rules among and within organizations (public, private, or their interaction) and can be differentiated into three main types: hierarchical-type mechanisms (HTM) based on high degree of formality and hierarchies in which the central pattern of interaction is defined by the authority, operationalized in administrative orders, rules and planning on the one hand and dominance and authority as the basic control system on the other; market-type mechanisms (MTM) founded on competition, exchange and bargaining between actors through different types of incentives, and focus in results and cost-effectiveness; and network-type mechanisms (NTM) that takes the form of cooperation between agents whose inter-organizational relations are ruled by the acknowledgement of mutual interdependencies, trust and knowledge-sharing and consultations.<sup>13</sup>

### **Study area**

The study was carried out in Mato Grosso do Sul, a Brazilian State located in the Central-West region of the country. The estimated population is 2.500.000 inhabitants distributed in 79 cities of which nineteen have CWF as shown in Figure 1.<sup>20</sup>

### **Purposive sampling**

### **Key informants**

In this qualitative study, we selected initially seven key informants that occupied staff and strategic positions. During the fieldwork and based on the interviews, five other key informants were added to capture the diversity around the phenomenon as follows: the director of AGEPAN (acronym in Portuguese), the main agency that regulates the sanitation services in the state; the chief executive officer of SANESUL, the public-

private company that operates sanitation services in 68 cities within the state of Mato Grosso do Sul and the responsible professional by standards control of treated water; the quality water surveillance officer at the Health Secretariat of the mentioned state that drives, within its jurisdiction, the National Drinking Water Quality Surveillance Program (VIGIAGUA initials in Portuguese); the manager of the private water sanitation company responsible for the main city of the state – Campo Grande); the manager of an associated private sanitation company; and a consulting firm that provides paid assistance to projects with fluorides. We also interviewed the chief of operations and the manager of standards control from an autonomous system of water provision (SAAE); the manager of state-funded environmental agency (IMASUL, the environmental surveillance agency in the state); the officer of federal-funded measurements and standards agency (INMETRO initials in Portuguese); and the manager of water quality in the indigenous area. Therefore, we had one interviewed by selected stakeholders, excepted for SANESUL and SAAE, totalizing 12 interviews representing 10 organizations or stakeholders.

### **Data collection and analysis**

We used a qualitative content analysis based on the Framework Method. This systematic and flexible set of procedures was developed by Jane Ritchie and Liz Spencer, from the Qualitative Research Unit at the National Centre for Social Research in the United Kingdom and has been used for management and analysis of qualitative data since the 1980s. It originates from methods that identify similarities and differences in qualitative data, before focusing on the relationships between different parts of the data, thus seeking to draw descriptive and/or explanatory conclusions grouped around themes.<sup>21,22</sup> A

combined approach was applied to allow themes to be developed from the expectations and views of the study participants regarding their organizations.

Data were collected through topic-guided semi-structured interviews with 12 key informants representing different categories of stakeholders to explore their perspectives, attitudes, and expectations underlying the degree of intersectoral collaboration and coordination mechanisms. The conversation sought to explore the organizations' mission and leading strategies, activities, the perceived barriers and enablers, the internal and external relationships, and the context within which the interviewee was embedded.<sup>23</sup>

The interviewee was selected by the chief executive officer or principal manager of each organization. He/She should have the domain of the organization's strategic view. They were contacted by the official institutional email. If not answered, they were contacted by the researcher in their work office. One of the authors (RAB) made all the interviews that were performed in a specific room at the interviewees' workplace, audio-recorded in the cell phone (with permission) and then transcribed. RAB and PF became familiar with the range and diversity of the material's body and identified key ideas and recurrent themes. Then, a thematic framework within which the material can be sifted and sorted was built. The transcripts were coded based on participants' views and expectations and how they might help address the degree of intersectoral collaboration and coordination mechanisms, considering the fluoridation policy. Different interpretations of content were discussed and recoded by consensus. The excerpts were entered in a Microsoft Excel spreadsheet. The selected excerpts were charted into a framework matrix (Table 1). The narratives that illustrated the barriers and enablers for intersectoral collaboration and possible coordination mechanisms that affect water quality, including fluoridation, were emphasized. The data were compared to the water fluoridation guidelines and the oral health program whenever they were available in the cities' regulatory documents. The



Ethics Research Committee of the CEP-UFMS approved the present study (CAAE 02620418.5.0000.0021).

## **Results**

The interviewees were aged between 33 and 58, and 50% of them were male. All (100%) of the interviewees had higher education in health sciences and had attended specialization programs. The narratives were coded according to the categories related to perceived barriers, enablers, and coordination mechanisms. The excerpts exemplified the degree of "intersectoral collaboration" at the involved organizations, the "coordination mechanisms" provided by sanitation agents, their expectation of "positive partnership between health and sanitation agendas", and future possibilities to include water quality in a "common policy agenda" with the health sector. Table 1 shows each category of study outcomes, and types of organizations (public, private and mixed public/private) of the people interviewed.

An important barrier was that CWF was not in the regulatory and surveillance agencies' agendas at the state level.

“(…) we rely on the information from SNIS [Brazilian Information Sanitation Information]; we do not perform these qualifications [fluorides monitoring in the water]” (E7)

“(…) We do not control the [fluoride] in supplied water” (E4)

Another barrier was that fluoride levels were not considered an essential parameter for water quality and was not inserted in the indigenous health and sanitation agendas.

“(…) We do not consider fluorides in our inspections and laboratory analysis” (E2)

“(…) We do not have water fluoridation in the indigenous area” (E6)

“(…) The company has an interest in maintaining water quality. It has ISO 9001 accreditation and 15 accredited parameters, with potability index, water quality index, and we assemble all reports [fluorides was not included among accredited parameters]” (E8)

Some enablers were identified. For example, positive attitude about including fluorides in a common Sanitation and Health agenda.

“(… ) Our idea, within the approach, is to raise these discussions, not only fluoride but also advance in the distribution and notification to the user... several situations that we aim to discuss with operators/providers” (E4)

“(…) It [CWF] would start by discussions in the companies, involve the state, although politicians do not act in this sense" (E2)

"(…) we as an agency have not participated effectively in these discussions [fluorides].  
(…) we have some partnerships with the Attorney General of [Mato Grosso do Sul] state and we are open to interact" (E7)

“(…) We have water fluoridation, and it is important to discuss these issues in the State” (E9)

"(…) There is no agenda, but it would be important to have" (E3)

“(…) for fluoridation, we sent documentation to that Smiling Brazil program, but we got no response.” (E11)

Among the potential coordination mechanisms, network-type mechanisms (NTM) prevailed among agents' narratives, with more knowledge-sharing and consultations among organizations responsible for safe drinking water provision.

In two cases, formal collaboration agreements between a water provision company and the Federal Institute of Metrology and Standards (INMETRO, initials in Portuguese) and also between the Environmental State Agency (IMASUL, initials in Portuguese) and the National Agency of Water (ANA, acronym in Portuguese) were identified.

"(...) the last five years here, we have strengthened this intra and intersectoral relationship with SANESUL, Aguas Guariroba [a private sanitation company], and SAAE [municipal sanitation company] (...) training (...) inspections (...) joint technical meetings." (E4)

"(...) We have technical support from another city (Jaraguari) when we need (...) collegiality" (E11)

"(...) there is a cooperation agreement in which they have a technician from our staff [INMETRO] available to them [private company]. Our technician provides information and reports preventive measures regarding the verification of water indexes." (E5)

Nevertheless, one interviewee viewed collaboration as a substantial barrier for NTM mechanisms (committees), especially about including society in discussions of water quality policy.

"(...) Within committees (referring to Rivers Committees), it [CWF] is very important, but we still see that knowledge is lacking. People [from society] are there and wish to debate and have no working knowledge" (E12)

For some interviewees, both NTM and MTM coordination mechanisms were important within orientation based on results and cost-effectiveness, exploring the importance of incentives to promote better qualifications.

“(…) By formal collaboration no, we have an informal collaboration with VISA, they send professionals that help to update the skills of our technicians (…)” (E9)

“(…) some measures of water quality [pesticide levels] we delegate to another company [private] because it is cost-effective for us.” (E2)

Another autonomous system reported needing help and financial investments for implementing water fluoridation.

“(…) we need [financial] help because of the initial costs for [water] fluoridation.” (E11)

“(…) execution of (… ) projects (… ) sanitation (… ) involves new technologies (… ) new job opportunities (… ) there is always a lack of qualified labor (.. .) I provide services to public and private companies.” (E1)

For another participant, HTM coordination will be better for water quality policy and fluoridation management, with a high degree of formality, hierarchy, and rules.

“(…) [having water quality and fluoridation agenda is possible] only if it comes from the national level, goes through the state, and reaches the companies; [the company] has no political power (…), legislation is our bible.” (E2).

## **Discussion**

This study's three important findings for qualifying the water fluoridation implementation in the observed Brazilian context are highlighted. First, the main enabler identified was a

positive attitude towards including water quality and fluoridation in a collaborative and joint health and sanitation agenda. The main barrier was that water fluoridation did not meet the regulatory and surveillance agendas of organizations involved in water quality. The Health Secretariat's office in charge of the water surveillance program did not include fluoride concentration as a parameter for water quality monitoring in its policy agenda. Not doing it, sanitation companies focused on other microbiological and physical-chemical parameters, neglecting fluorides. The main regulatory agency in the area did not include fluorides concentration in its agenda. Second, the intersectoral collaboration among water companies was marked by informality. Third, the findings suggest that the coordination mechanism based on knowledge-sharing and consultations between sanitation and health sectors could streamline the intra and intersectoral collaboration. It appears to be the best way to refit the CWF implementation strategy.

Water fluoridation is one of the reasons for dental caries decline globally<sup>5,6</sup>, but its expansion remains challenging. The network-type coordination mechanism could help agents meet the norms and requirements that regulate the several sectors involved (sanitation, health, environment and others) in water quality management. Since the Brazilian constitution of 1988 and the legislation that followed in 2007, the sanitation sector has suffered profound changes. The new federal law for sanitation increased the autonomy and prerogative of municipalities to choose a public, private or mixed public/private company for water supply. Brazil has 5,570 municipalities with administrative and political autonomy, and governments are renewed every four years through free elections. Thus, local administrations hold the prerogative to manage the sanitation in their jurisdiction, including changes and renewal of contracts with service providers. If CWF is neglected, judicial and political institutions must be prompted to act and demand it from the sanitation companies.<sup>17,24</sup> When there is favourable involvement

of society's entities and one of these institutions is activated, the outcome is usually the implementation of public health technology.<sup>25</sup>

The strengths and limitations of this study need to be pointed out. As a strength, this was the first study to address the water fluoridation policy from a joint point of view of key actors in managerial positions in different agencies and companies responsible for water quality in a crucial Brazilian state. As a limitation, we did not interview healthcare services' administrative staff because water-related health aspects were not in their assignments. It is essential to highlight that although strategic sanitation agents did not mention the health sector, we could assume that the health sector also has a role in the intersectoral collaboration for water quality and fluoridation.

A study on technological innovations in the health sector in two Italian regions<sup>13</sup> showed that what 'works' in one context would not necessarily work in another. By examining the coordination practices employed during the setting up of electronic patient records, the authors observed that the region with a strong leading role of the government in the health care system maintained hierarchy-type coordination mechanisms, while the other region where health care providers were extremely autonomous, especially regarding innovation, the main coordination mechanism was of the network type. In our study, the more visible network-type coordination mechanism was aimed at crude water quality. The water quality agenda was inserted in the activities of the Rivers Committees, focusing on advocacy in maintaining the natural water quality of rivers. Network-type mechanisms were being used to coordinate the activities between state authorities and the other agents, including society.

For the degree of intersectoral collaboration, narratives showed that most sectors had informal collaborations.<sup>15</sup> The state water surveillance programme was working

informally with public/private companies in technical issues, capacitation process, and joint meetings. The capacitation of enablers through discussion forums comprising workers of the water surveillance programme and public/private companies could be an excellent opportunity to address these points; several water-related diseases<sup>26</sup> could benefit from such interventions.

Another potential barrier was that, although councillors and senior managers supported the concept of intersectoral partnership, they did not act to put it into practice, as also found by another study.<sup>27</sup> The hierarchical power of authorities often causes tension and constraints in collaborative settings, being another potential barrier.<sup>28</sup> Strict top-down structures should be replaced by a more collaborative approach in the decision-making process between health and sanitation sectors. The greater the involvement of communities in the decision-making process, the more sustainable the gains.<sup>28</sup>

In conclusion, improving the use of existing coordination mechanisms for the effective implementation of CWF is clearly needed in the investigated case. In addition, partnership creation, consolidation, and shared mission, especially among health and sanitation sectors, are challenges to be faced for implementing public water fluoridation policies.

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Table 1: Framework matrix according to themes and participants.

	Organization's characteristics of each interviewee				Study Objectives		Expectations		
	Type of organization	government -level	Type of management	department assignments related to fluoride	Role in water fluoridation	Intersectoral Collaboration	Coordination mechanisms	Shared Health and Sanitation Agenda	Policy Agenda
E4	State Health Secretariat	State/Provincial	Public	The water surveillance programme, including fluoride as a control parameter	The fluoride concentration surveillance was not included yet.	informal collaboration/collaboration creation involving procedures	NTM	positive	Yes
E5	Federal Institute of Metrology and Standards	Federal	Public	determination of standards and measures, including equipment and substances for fluorides measuring	control of equipment and standards used for fluoride measuring	project / program collaboration	NTM/MTM	neutral	No
E1	Own consulting firm	Not/applicable	Private	Not/applicable	provides paid assistance to projects with fluorides	project / program collaboration	MTM	neutral	No
E2 <sup>a</sup>	Sanitation Company	state/Provincial	Public/Private	standards and operational control, including fluoride concentration	Provides water fluoridation in only 16 cities of 68 that is responsible for water treatment	informal collaboration/collaboration creation involving procedures	HTM/MTM/NTM	positive	Yes
E3 <sup>a</sup>	Sanitation Company	State/Provincial	Public/Private	manager of company operations, including fluoride concentration	Provides water fluoridation in only 16 cities of 68 that is responsible for water treatment	project / program collaboration	NTM/MTM	positive	No
E6	Health Ministry	Federal	Public/Private	management of local Indigenous Health District	None role. It operates only indigenous area	Informal collaboration	NTM	positive	No
E7	Regulatory agency	State/Provincial	Public	inspection of contracts between sanitation companies and municipal governments	the fluoride concentration was not included yet in the inspection of the contracts	Informal Collaboration	HTM/NTM	positive	Yes

E8	Sanitation Company	municipal	Private	Manager of company operations, including fluoride concentration	Provides water fluoridation	project / program collaboration	MTM	positive	Yes
E9 <sup>b</sup>	Sanitation Company	municipal	Public	Manager of company operations,	Provides water fluoridation	Informal collaboration	NTM/MTM	positive	No
E10 <sup>b</sup>	Sanitation Company	municipal	Public	standards and operational control, including fluoride concentration	Provides water fluoridation	Informal collaboration	NTM/MTM	neutral	No
E11	Sanitation Company	municipal	Public	standards and operational control	Do not provide water fluoridation	Informal Collaboration	HTM/MTM/NTM	neutral	No
E12	Environmental Agency	State/Provincial	Public	Management of water resources	the fluoride concentration was not included in its activities	project / program collaboration	NTM	neutral	No

Note: <sup>a,b</sup> Participants that belonged to the same organization