

**POPULATION CONTROL OF THE MOSQUITO  
*Aedes aegypti* IN SANTA CATARINA - BRAZIL:  
PERCEPTION OF MUNICIPAL AND STATE MANAGERS**

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**Highlights:** (1) Control of the *Aedes aegypti* vector. (2) Effectiveness of policies and practices in controlling *Aedes aegypti*. (3) Intersectoral actions to prevent dengue fever.

PRE-PROOF

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## ABSTRACT

The aim of the study was to analyze, from the perspective of municipal and state managers, the effectiveness of policies and practices in controlling *Aedes aegypti* in Santa Catarina State. A semi-structured interview was conducted with the manager of Health Surveillance - *Ae. aegypti* control of the Santa Catarina State and managers of municipal vector control programs in the west of the state. There were difficulties in implementing the National Dengue Control Program (PNCD), considering the limitations of the work of the Endemic Disease Control Agent (ACE). Medical certificates, job deviations, absenteeism and turnover of these workers are among the problems. Health education for the community should be carried out in an intersectoral way, allied to the work of the ACEs in controlling *Ae. aegypti*. This study contributes to improving the possibilities of strategies, practices and policies for controlling *Ae. aegypti* used in Santa Catarina and Brazil.

**Keywords:** arboviruses, public health, vector control.

## INTRODUCTION

In Brazil, actions to control *Aedes aegypti* (Linnaeus, 1762) (Diptera: Culicidae) are based on the recommendations of the National Dengue Control Program (PNCD), which incorporated national and international experiences of dengue control with attributions and competencies in the three spheres of government<sup>1</sup>. Thus, public policies for vector control must be simultaneous between the three levels of government.

At municipal level, the PNCD's attributions and competencies are focused on the execution of the epidemiological and entomological health surveillance policy, management of the information and dissemination systems, development of control strategies, coordination and execution of health education and social mobilization activities and training of human resources for the execution of the program<sup>1</sup>.

Currently, Endemic Disease Control Agents (ACE) are one of the main players in mosquito control and in strengthening health surveillance actions with the community, inspecting environments, eliminating and treating breeding sites, as well as providing guidance on health promotion and disease prevention<sup>2</sup>. From this perspective, health education is

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essential in the process of increasing *Ae. aegypti* population control actions and strategies with the different sectors and actors in the community<sup>3</sup>.

Educational institutions represent an important link between health and education, resulting in benefits for individual and collective health. The education sector has taken on a leading role in preparing citizens to make decisions and create a sustainable society<sup>4</sup>. For example, the Health at School Program (PSE) enables initiatives of education and health promotion actions, especially those associated with the control of *Ae. aegypti*<sup>5</sup>.

The process of health education and intersectoral coordination strategies is essential for strengthening actions, given the numerous conditioning variables that interfere with vector control. The aim of this study was to assess, from the perspective of municipal and state managers, the effectiveness of policies and practices for controlling *Ae. aegypti* at Santa Catarina State.

## **METHODOLOGY**

This study involves interviews with municipal program managers and state Health Surveillance - *Aedes aegypti* Control. The municipalities were chosen because of their geographical proximity, all of them being in the west of Santa Catarina State and because it is a region considered to be a dengue epidemic. The interviews were carried out between September and November 2021.

Managers from the Health Departments of the municipalities of Coronel Freitas, Chapecó, Maravilha, Pinhalzinho and São Miguel do Oeste took part in the study, with one manager per municipality appointed by the team itself. At the state level, the interview was conducted with the representative of the *Ae. aegypti* Surveillance and Control Division of the Surveillance Directorate Epidemiological (DIVE) of Santa Catarina, with a total of six managers taking part.

After the consent and agreement of the institutions and participants, the interviews using a semi-structured script, were previously scheduled and carried out individually, during the managers' working hours, virtually, via Google Meet, and in person for those municipalities that consented, in view of the covid-19 pandemic, considering that they were carried out during the year 2020. The semi-structured questions guided the conversation and ensured, according

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to Minayo (2014), that all the elements of the research question could be covered, as well as making it possible to understand the point of view of the subjects relevant to the object of study.

The interviews were transcribed, organized into categories and analyzed using the 'content analysis' method, as guided by Minayo (2014). From the content analysis it was possible to identify two thematic categories: a) the work of the Endemic Disease Control Agent (ACE) and b) Health Education. The study participants were identified by number and the letter "P" (participant), P1, P2, P3, P4, P5 and P6. The research was carried out in compliance with the ethical criteria set out in Resolution 466/12 and Resolution 510/2016 of the National Health Council (CNS) of the Ministry of Health. The project that gave rise to this study was submitted to the Ethics Committee in Research Involving Human Beings and approved under opinion number 4.866.846.

## **RESULTS AND DISCUSSION**

### **The work of the Endemic Disease Control Agent (ACE)**

Transiting through the history of Brazil regarding the relationship between the environment and health, it is evident that the various transformations caused by fieldwork carried out by the health surveillance and endemic control sector have basically extended throughout the 20th century to the present day. The programs and actions of health agents in the territory were influenced by movements generated in Europe, such as the German medical police, French hygienist and English social medicine<sup>6</sup>.

In Brazil, the formation and work of ACEs can be divided into three moments: the first moment, characterized by emergency action on the yellow fever epidemic; the second moment, marked by the institutionalization of endemic control actors linked to official bodies that throughout history have changed their nomenclature; and a third moment, evidenced after the emergence of the Unified Health System (SUS) and which continues to the present day<sup>6</sup>.

In 2006, the duties of ACEs were regulated by Federal Law n°11.350<sup>7</sup>. Ministry of Health Ordinance No. 1.007/GM of 2010 defined the criteria for regulating the incorporation of ACEs into Primary Health Care. The activities will now take place exclusively within the scope of the SUS, in the exercise of surveillance, prevention and control of diseases and health

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promotion, developed in accordance with the guidelines of the SUS, strengthening surveillance actions in primary health care<sup>6</sup>.

Thus, the ACE has become the central actor in *Ae. aegypti* control actions. Between their 'thousand and one uses' and the daily struggle to guide the population on the prevention and control of arboviruses, these professionals feel extremely frustrated and, as a result, 'drying ice'<sup>8</sup>. The interviewees in this study have this perception of the important role of ACEs in controlling *Ae. aegypti* in their day-to-day activities. They added that among the most effective strategies for mosquito control are the home visits carried out by these professionals, as they described,

Talking to residents, interacting with them, pointing out possible breeding sites, the actions they need to take...<sup>(P5)</sup>

The agent's contact with the population. He gives guidance, he talks to the resident and he's there to eliminate the problem when it's happening.<sup>(P6)</sup>

... The endemic disease agent's visit to the property gives him a different view, he can observe the places where people who don't have knowledge of this area might go unnoticed and the agent ends up providing guidance.<sup>(P2)</sup>

The managers' perceptions highlight the relationships established by the agents, as Evangelista *et al.* (2019)<sup>8</sup> point out, which are based on the affective bond with the residents and with the work, the need for employment and the desire to contribute to the control of the mosquito.

The covid-19 pandemic has changed the context of intra-household visits, with regulations for differentiated work on the part of ACEs, allowing specific actions of mechanical elimination of breeding sites or treatment of deposits restricted to the peridomicile. This situation has a significant impact on the identification and treatment of deposits in the property, which could leave foci in homes<sup>9</sup>.

In addition, the community has shown a fear of receiving the ACE for fear of contamination by the virus, as well as the professionals for exposure when they enter the peridomicile to investigate breeding sites and guide the community<sup>9-10</sup>. However, we can see in the interviewees' speeches the efforts to maintain home visits, even with the impasses of the pandemic, due to the effectiveness that the measure represents in vector control.

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When it comes to intra-home visits, in circumstances other than covid-19, it was already difficult to enter properties as recommended by the PNCD. As one of the interviewees said, the ACEs can carry out intra-household visits in situations specific epidemiological situations, such as an increase in cases of arboviruses or epidemics. He added that there is resistance from residents regarding acceptance <sup>(P2)</sup>.

Despite some resistance, these professionals build alternatives in defense of a job well done and the preservation of health at work. In addition, they realize the precarious working conditions, the feeling of invisibility and marginalization symbolic and concrete, they recognize the health risks to which they are exposed, the various forms of violence and the lack of safety equipment<sup>11</sup>. The interviewees highlighted the need for ACEs to understand the importance of their role and to feel motivated to carry out activities.

Managers are concerned to make these professionals feel important and valued, to be out in the field every day, guiding and talking to people, and the need to improve working conditions so that they can carry out their activities with determination and spirit <sup>(P6, P1)</sup>. They added that absenteeism, sick leave and deviations from function are challenges to maintaining effective, high-quality and continuous activities and actions to maintain *Ae. aegypti* control actions.

...there are 81 agents in the program, but there are 60, 61 active agents, the others have reports and other activities. <sup>(P3)</sup>

...there are a lot of certificates, a lot of absenteeism, especially now during the pandemic, there were days when there were three in a team working, so it's something that doesn't just depend on management, it's beyond our control. <sup>(P3)</sup>.

The reason for leave of absence and medical certificates for ACEs was not mentioned by the interviewees. However, some authors<sup>12</sup> indicate that mental and behavioral illnesses are the third leading cause of absence from work for public servants in a municipality in Santa Catarina, and among these occupations are endemic disease agents. A review of the literature from 2007 to 2017 showed that mental disorders related to the work of ACEs are the most studied health problems, followed by skin problems, exposure to solar radiation, injuries to the musculoskeletal system, violence and ergonomic risks<sup>13</sup>.

The causes of ACEs becoming ill are identified in the study by Lima et al. (2009)<sup>14</sup> in which the main reasons for these professionals taking time off work over the years, ranged from acute and chronic poisoning, cancer, lung problems and neurological alterations, and other

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problems such as alcoholism. The absence or inadequacy of personal protective equipment (PPE) and biosafety guidelines was noted, in addition to the low level of education of many agents.

Other challenging obstacles described by the interviewees are the high turnover of these professionals and the high percentage of contractual employment. Agents of endemic diseases are hired into the public service by means of a competitive examination or administrative contract, which may be under the statutory regime (statutory employees), or the law creating the special function (temporary employees). The situation of temporary, when the fixed term ends, all the time spent on qualification, training and teaching is lost, in addition to the lack of manpower until another professional is hired. <sup>(P6, P2, P1)</sup>. It is clear that it would be more appropriate to have ACEs. One manager added that not all municipalities have enough field staff due to high turnover, mainly due to new opportunities for work <sup>(P1)</sup>. In this context, the effects of the covid-19 pandemic are being felt, as highlighted in the following statements:

And during the pandemic there were a lot of dismissals. Emergency hiring was requested and not authorized because of the pandemic. This year there was a gap in the staff... <sup>(P3)</sup> ...we have Law 173 of covid-19 (Complementary Law No. 173 of May 27, 2020) which limits us to the spending ceiling. It's difficult to hire people... <sup>(P6)</sup>.

One of the interviewees <sup>(P3)</sup> also reported that the inadequate fleet of vehicles is a problem, as it hinders the development of entomological control activities. He highlights the shortage of manpower to cover 100% of the municipality, given the increase in population, increase in properties and reduction in the number of staff. Some municipalities do not manage to make all the visits recommended by the Ministry of Health. In view of this, the PNCD and the National Guidelines for the Prevention and Control of Dengue Epidemics recommend the availability of one agent for every 800 to 1,000 properties, corresponding to a daily activity of 25 properties/day, with a workload of 8h<sup>1-15-16</sup>.

In addition to adjusting the number of endemic disease agents according to the characteristics of each municipality, these professionals need, above all, motivation, appreciation and recognition for what they do. A good working environment, with a motivated team and effective leadership is capable of improving not only the productivity and commitment of the team, but also the success of the institution as a whole. It is important to implement a policy of positions and salaries that values and encourages the professional, whose

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salary floor for ACEs was set in 2014, by Law No. 12.994. Santa Catarina is the only state in Brazil where the complementary financial aid for paying ACEs' salaries is still based on 2014<sup>(P1)</sup>. pay is the factor that causes the most dissatisfaction among ACEs, so a pay policy that minimizes dissatisfaction makes it possible for the institution to win within the whole process of work<sup>17</sup>.

Also, in Campo Grande, Mato Grosso do Sul, ACEs mentioned the lack of autonomy for legal interventions as a negative aspect of the profession<sup>18</sup>. The words of one of the managers are similar to those of the author when he reports the lack of autonomy of these professionals and their dependence on the Health Surveillance Agency, which has the power to enforce current legislation<sup>(P3)</sup>.

Considering the work of ACEs, it is clear that actions and targets need to be met and with quality, but for this to happen, inputs, infrastructure and human resources are indispensable for achieving them. The managers' reports show that there is an organizational challenge to guarantee both the occupational health of these professionals and the implementation of management of effective hiring and better working conditions to reduce absenteeism and high turnover. To do this, they need encouragement and technical support from managers and society, given the importance of the daily work they do.

### **Health Education**

There has been a lot of talk about controlling *Ae. aegypti* and preventing the diseases carried by the mosquito. Numerous campaigns and widespread publicity are constantly being carried out with the aim of raising awareness of this public health problem. However, the success of social mobilization actions for mosquito control depends on the senses, meanings, values and beliefs that society attributes to the problem. The message of social mobilization needs to become relevant to the community<sup>19</sup>.

The interviewees reported incessant searches and strategies to mobilize and sensitize the community in their municipalities, whether through the media, social media, lectures, interviews, banners in schools and health posts, as well as the dissemination of epidemiological and entomological bulletins on a weekly basis. They also carry out activities on "D" Day to Combat Dengue with mosquito costumes, handing out information materials, stickers for cars and car rallies.



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Encouraging community organization for the effective exercise of health awareness, based on the principle that health is a right of citizenship and therefore expresses quality of life<sup>20</sup>. Responsibilities need to be shared, with the participation of all social actors, in order to enhance the exercise of citizenship and the right to health and, thus, strengthen democracy and guarantee the equity and comprehensiveness of public health policies<sup>21</sup>.

The use of educational strategies is associated with positive results such as, reduction of mosquito habitats, elimination of breeding sites, reduction of vector infestation, expansion of knowledge, attitudes and practices around vector control which contribute to empowering communities<sup>22</sup>.

The integrated actions of health education, communication and social mobilization are part of the components of the PNCD, whose main objective is to stimulate changes in the population's behavior and the adoption of practices and habits to avoid the presence, reproduction and infestation of *Ae. aegypti*<sup>1</sup>. And in this process, the health education work carried out by the ACEs is essential.

Thus, physical, chemical and biological actions and interventions for vector control of *Ae. aegypti*, combined with health information, education and communication, have more positive results than they do on their own<sup>22</sup>. The author's discussions are similar to the managers' perspectives on effective mosquito control, based on strengthening the various strategies, actions and activities developed in a timely manner and with quality together with the involvement of the whole community<sup>(P1, P6)</sup>.

In this context, the interviewees emphasized that the mechanical elimination of breeding sites is the most effective measure for mosquito control<sup>(P1, P3)</sup>. Thus, health education becomes an ally in this process to keep the environment preserved and avoid the presence and reproduction of *Ae. aegypti*. In this way, health education is an important tool in the management and control of the mosquito and in the hope of reducing the use of synthetic products. As one of the managers said:

...insecticide application, eliminating the adult mosquito is very difficult to achieve. People have to open doors, windows and often the insecticide doesn't reach the mosquito, so that's why all the other actions are the main ones, the first to be carried out.  
<sup>(P1)</sup>.

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The importance of permanent health education in the search for the participation and contribution of the entire population is evident, so that the actions and strategies to control *Ae. aegypti* are effective. Educational actions help to improve knowledge and change the behavior of communities, raising awareness among the population of how to manage their environments, in the construction of a sustainable society that favors and strengthens individual and collective care. It is from this perspective that health managers highlight the importance of ACEs, of collective actions carried out both in schools and on “D” days, which contribute to controlling the mosquito population. However, they systematically highlight the difficulties of changing the population's behavior.

One of the managers said that the team often goes to the property, gives advice, helps to eliminate possible breeding sites and carries out chemical treatment for those that cannot be eliminated. The next time they visit, they are faced with the same problems of waste and materials deposited in the environment <sup>(P3)</sup>. People fail to do their part because they don't believe in the disease, because they are too comfortable and because they think that the role of prevention and the execution of activities to combat the mosquito should be carried out by the ACEs or by the public authorities<sup>23</sup>.

As reported by <sup>(P5)</sup>, the population holds the surveillance sector responsible for controlling the mosquito, but they need to understand and change their behavior and habits and assume their responsibilities. In this process, it's important that the ACE also understands its role of assisting, guiding and educating the population, so that the owner takes responsibility and carries out the actions and adjustments to the possible breeding sites. Another situation exposed by the interviewees is that the population is sometimes slow to take care of their homes and establishments, especially during periods in which the epidemiological and entomological situation is stable, or in colder seasons of the year, referring care to hot periods, such as summer <sup>(P4, P1)</sup>.

The interviewees' statements reveal the specificities and realities of each municipality in terms of the population's adherence and collaboration. Some interviewees reported that due to the dengue epidemics experienced in the municipality, the population has become more collaborative and concerned. Others reported that it was difficult for the population to adhere to the recommendations, and that vector control activities were put on the back burner. Only

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when the municipality became infested, or an epidemic occurred did they begin to take a different view and invest in actions <sup>(P6, P2)</sup>.

It is therefore essential to mobilize the community throughout the year and to maintain actions and activities regardless of entomological and epidemiological conditions. ACE and health surveillance alone cannot do an effective job of controlling *Ae. aegypti*. Therefore, educational interventions should be aimed at the whole community, in addition to homes, educational institutions and other public and private environments. The inclusion of schools as sites for interventions is important because they are a suitable space for citizen education <sup>22</sup>.

The managers described that among the actions and strategies developed to draw the attention of the population and the intersectoral nature of vector control, it also involves schools, with lectures and educational material for the different age groups <sup>(P2, P3, P4, P5, P6)</sup>. For managers, educational activities with children and young people are promising in building an aware, participative and collaborative society in the control of *Ae. aegypti* <sup>(P3, P6)</sup>.

One of the managers added the support of higher education institutions in the actions carried out with the community, for example, the clean-up efforts, which rely on the collaboration and participation of academics. There is also support from supermarkets and in the development of actions and health education in companies and meat-packing plants in the municipality. He reported on activities to eliminate possible breeding sites and guidance on the correct disposal of waste for the indigenous population and the possibility of setting up recycling in the village. <sup>(P3)</sup>

Activities involving the community, such as joint clean-up efforts and the collection of recyclable material, enable the population to actively participate in vector control. This model of care is provided for in the PNCD in terms of education and social mobilization<sup>22</sup>. Journalistic and communication media are allied as a successful strategy for these health actions, in order to bring health services closer to the population, provide opportunities for social participation and contribute to transparency in service provision<sup>24</sup>. Educational materials, when used, must have a language that generates learning.

The material must be understandable by the group to which it will be adopted. Therefore, it is necessary to consider the profiles and specificities of the public to be reached and the different socio-cultural contexts in which they are inserted. After all, the way information is presented can have an impact on how it is interpreted and used. Considering these aspects, a

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municipality created an educational folder for foreigners in order to improve communication with this population.

...in the last few days, together with the social communication sector, a pamphlet on waste separation has been created for the foreigners who live in the municipality. An educational folder in Portuguese, Creole and Spanish, so that they can understand. It's very difficult to communicate with this population <sup>(P3)</sup>.

Finally, the managers had positive expectations regarding the effective control of *Ae. aegypti*. They reported that broad knowledge of the program, learning in practice, knowing the population and how they behave, makes it possible to develop various successful actions. Also, based on health education and behavioral change of people on a daily basis, working and interacting together with the community, each with their own responsibilities and commitment, it is believed that effective population control of the mosquito can be achieved.

Educational actions show satisfactory results in the fight against *Ae. aegypti* and arboviruses, especially when there is an emphasis on collective mobilization, the use of active methods and the involvement of public management and the community. From this perspective, it is important to involve the population in caring for the environment so that it does not favor the proliferation of *Ae. aegypti* and for the public authorities to provide water and sewage infrastructure and waste collection<sup>25</sup>. It is also important that the public authorities, especially the municipalities, act as coordinators in terms of involving the population in the planning, implementation, monitoring and improvement of basic sanitation policies<sup>26</sup>. These are fundamental elements for engaging people and reducing the gap between knowledge and mosquito control actions.

## **FINAL CONSIDERATIONS**

The effectiveness of policies and practices in the control of *Ae. aegypti*, from the perspective of managers, points to peculiarities in the implementation of the PNCD due to the difficulties of the work of ACEs. In addition to the problem of certificates, job deviations, absenteeism and turnover of ACEs, it is worth noting that the period of vacation and leave of these professionals has an impact on the properties that are no longer inspected and the need to resize the workforce.

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The study shows that ACEs must understand the importance of their work and the community must understand their responsibilities and welcome these professionals with respect and participation in activities and actions to control *Ae. aegypti*. It is important to consider the indispensable engagement of the management itself to encourage and improve the working conditions of ACE.

And in this process, health information, education and communication are essential as a joint measure for mosquito control. Thus, health education must be permanent and of high quality to achieve the commitment and responsibility of institutions and the population throughout the year. We can see the efforts made by the managers of the programs to raise awareness and mobilize the community.

Health education can be an ally in the work carried out by the ACEs and in the control of *Ae. aegypti* by the community, as well as in the expectation of reducing the use of synthetic products based on sustainable measures that are less harmful to the environment, the health of workers and the exposed population.

This study contributes to understanding the difficulties and potential that the municipalities have, or don't have, in controlling the *Ae. aegypti* mosquito. This study contributes to improving the possibilities of strategies, practices and policies for vector control used in Santa Catarina and Brazil.

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