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Interdisciplinarity in the control strategy for urban vectors of arbovirus infections: a necessary dimension for Brazil

Interdisciplinaridade na estratégia de controle dos vetores urbanos das arboviroses: uma dimensão necessária para o Brasil

Interdisciplinariedad en la estrategia de control de los vectores urbanos de las arbovirosis: una dimensión necesaria para Brasil

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The complexity of large Brazilian cities has favored the proliferation of arbovirus vectors, leaving the population vulnerable to the simultaneous circulation of various arboviruses. Such complexity was largely produced in broad territories with historically disorderly occupation by socially vulnerable communities, often exposed to daily violations of basic rights. In the absence of vaccines for most arboviruses currently circulating in Brazil's urban areas, prevention depends primarily on the control of urban vectors, especially *Aedes aegypti*. The history of insufficient results in dengue prevention since the 20th century using the usual vector control strategies, highly dependent on palliative insecticides, has facilitated recirculation of the yellow fever virus and importation of new viruses into Brazil such as Zika and chikungunya in second decade of the 21st century [1,2,3,4]. The vulnerability to arbovirus circulation in Brazil's urban areas and the lack of effective preventive measures to combat vectors has created a real risk of transmission of other arboviruses such as Mayaro and the West Nile virus [5,6,7]. Meanwhile, alternative methods proposed for the control of urban vectors, featuring releases of genetically modified or Wolbachia-infected mosquitoes, have still not provided the desired results in terms of prevention, especially in large and densely populated endemic areas in Brazilian cities.

The belief system in the paradigm orienting vector control measures was heavily influenced by the advent of synthetic organic insecticides, inaugurated with DDT in the 1940s. Starting with DDT, the paradigm was consolidated with a strong technicist approach, according to which the solution to insect vector control can be achieved with technologies featuring modern insecticides. This belief persists, despite the problems from continuing and indiscriminate use of these insecticides, such as target insect resistance, environmental contamination, and cumulative toxicity in the food chain. As a response, new insecticides were developed with new classes of active ingredients, such as organophosphates (e.g., temephos) and pyrethroids (e.g., cypermethrin). The concept of integrated pest management or integrated vector control has been developed since the 1970s, improving the technicist paradigm by recommending the simultaneous use of other technologies to attenuate the dependence on chemical insecticides and obtain more rational, more effective, less toxic, and more environmentally friendly control. Other methods such as environmental management, use of pheromones, genetic control, and physical control have been valued and recommended in an integrated strategy with chemical control, aimed at reducing dependence on insecticides [8,9].

Still, the integrated strategy has failed to yield satisfactory results in controlling insect vectors of arbovirus infections in complex urban environments, even though the integrated strategy manages to achieve good efficacy in controlling insect pests in agricultural ecosystems, especially monocultures, where there are few obstacles to deploying various control measures.

Assessments of the strategies' efficiencies and decisions are easier when the criteria for analysis are basically financial. Meanwhile, in the fight against urban insect vectors, the integrated strategy is not easily achieved, because it needs to be deployed inside multiple and various private properties that can pose countless environmental and psychosocial obstacles to control activities. The territory is frequently heterogeneous, with numerous difficulties for access [10]. The measures require consent by different social actors involved in the respective limitations, conflicts, interests, cultures, preferences, fears, demands, frustrations, and suffering. The basic criterion for the assessment of targets and efficacies in vector control is the incidence of diseases in the population with the real potential risk of death. Such assessments are not trivial and are subject to ethical challenges. In addition, vector control is the responsibility of the State, which in Brazil has a common history of neglecting its constitutional obligations in many urban territories occupied by vulnerable populations.

Given the social and environmental obstacles in Brazil's complex urban spaces, the proposed solutions based on the integrated technicist paradigm have been naïve or coercive. For example, dengue programs have proposed unrealistic guidelines for vector control that would include visiting 100% of the buildings every two months in the infected municipalities [11] or visiting 100% of the buildings in locations with up to 400 buildings [12], totally ignoring the problem of difficult access to all the breeding sites, especially in permanently "closed" properties [10,13,14]. In view of these difficulties, the legal guideline established as the solution was to require entry into closed properties, which clashes with the constitutional principle of inviolability of the home [15] and ignoring that it is impossible to be certain that mosquito breeding sites will be found inside such closed properties. The guideline also ignores the practical difficulties in deploying this legal instrument in territories in which the State has a historically limited presence, and which are often dominated by armed civilian groups. The wager on involving the population to eliminate urban *Ae. aegypti* foci through mass awareness-raising campaigns has never produced the intended and sufficient prophylactic effect, probably because it ignores the various social and personal limitations to access and eliminate all the urban breeding sites, meanwhile unfairly producing guilty feelings in the victims [16].

The scenario necessarily involves acknowledging the inadequacy of the usual strategies for providing the intended prophylactic results, at least in the complex urban social and environmental reality of Brazilian cities, especially in vulnerable communities. Neither does it suffice to revise the current control policies and programs. It is necessary to rethink the adequacy of the current belief system in the technicist paradigm. The synergy of psychological, social, and environmental obstacles encountered by vector control services in Brazilian cities reveals the need to search for an interdisciplinary vision for urban vector control policies. Dialogue is needed with other knowledges and understandings, but without neglecting the basis of the integrated principle and its recommendations. For example, to conduct effective control activities, it is still essential to fully understand the target vector's biology, ecology, and behavior. In this sense, interdisciplinarity is not inconsistent with the integrated strategy.

Interdisciplinarity can be defined as intersection between activities with different logics [17]. The concept encompasses multiple interpretations and emerges in the face of complex questions in which interpretations by classical science are incapable of providing satisfactory responses [18,19,20]. This concept is not present in the beliefs of the underling paradigm in insect control methods, which is understandable since the latter was conceived in the fragmented tradition of classical science. However, interdisciplinary understanding is evidently important in routine vector control activities in complex urban spaces. It is also evident that the technicist paradigm of integrated control fails to produce satisfactory results, given the obstacles encountered in complex urban environments in large Brazilian cities, especially in socially excluded territories. The inclusion of an interdisciplinary approach with an integrated vision, encompassing various fields of knowledge, will allow a better understanding of the major social and environmental obstacles encountered by vector control services, above all in Brazil's complex urban areas. Dialogue with other forms of knowledge, especially

in the social sphere, will allow defining more feasible and viable strategies according to the different social and environmental realities.

This new multidisciplinary dimension should be addressed with empathetic listening and attitudes, seeking solutions through dialogue, principally in socially vulnerable territories with a history of exclusion and violation of rights. More than a humanist stance, empathetic and dialogical attitudes stimulate collaborative and cooperative actions in environmental management, which are extremely useful for mitigating the environmental problems responsible for the proliferation of vectors and for implementing feasible, viable, and effective environmental management, consistent with the local potentialities, limitations, and characteristics, especially in vulnerable communities [16]. The field workers responsible for vector control should also have specific skills to observe the local population's limitations and potentials, to encourage collaborative activities for environmental management for holistic vector control (e.g., mosquitoes, rats, flies, etc.), and to draw on support from other professionals and services such as social assistance, family health teams, and garbage collection services. This perspective requires special training and valuing field workers in vector control services.

In the future, Brazil may have preventive solutions with sufficient vaccines for all arbovirus infections, but this will not solve the vector control problem. Vector control in Brazilian cities will be easier and more feasible when urban spaces are planned better and when they are less unequal and violent, healthier, and more humanist. Feasible and effective vector control in Brazil's urban scenario can be achieved by wagering on the promotion of integrated, interdisciplinary, dialogical, patient, and ongoing control activities.

Additional information

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