DENGUE, ZIKA AND CHIKUNGUNYA - VECTOR CONTROL CHALLENGES FACING THE OCCURRENCE OF THE THREE ARBOVIRAL INFECTIONS - part II

Editorial

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Incorporation of new technologies into vector control

The discredit of vector control in the way it is practiced today is such that, in a controversial article recently published by British researchers, it was suggested that, in the case of ZIKV, it would be preferable not to delay the infection, allowing the natural transmission interrupt its circulation by exhaustion of the susceptibles and production of the so-called "herd immunity". According to the model developed by the authors, the Zika epidemic in Latin America would be controlled within three years, at most[1]. In the event that this assumption was valid, assuming that family planning policies in endemic areas would avoid cases of ZIKV congenital syndrome in the established period, the interruption of the traditional control measures could never be seriously taken into consideration in our context. Besides the fact that DENV immunity is specific for the four serotypes, thus preventing an analogous modeling to that adopted for ZIKV, the increase in severe dengue cases lethality[2] and the relatively high chronicity that the Chikungunya fever[3,4] demonstrated in several countries - expensive unfavorable outcomes - render the strategies for reduction of vector abundance still necessary, despite the urgent need for improvement[5,6].

Accepting that biological, socioeconomic and environmental determinants are associated with the spread of a majority of arboviral infections leads to the requirement of intersectoral strategies that transcend the exclusively chemical actions of vector control[7-9]. These, which are largely based on the routine use of larvicides for reduction of immature forms and on adulticides aerial spraying during high transmission periods, have proved inefficient in the containment of transmission and, specially, hardly sustainable in a number of varied contexts[5]. The World Health Organization (WHO) has recently reinforced the need for integration of different approaches, proposing the Integrated Vector Management (IVM) strategy as a way to achieve better results, both in reducing the vector abundance and in the containment of vector-borne diseases[6,9].

The IVM implies the optimization of resources through a process of rational decision-making that can improve vector control efficiency and cost-effectiveness. Reinforcing the importance of social participation, the availability of human/structural resources and appropriate legislation to the vector control objectives, the IVM relies on proper local knowledge of the vectors ecology and of the pattern of transmission of the diseases in question[2,9]. A correct diagnosis of the entoepidemiological situation would facilitate the integration of contextualized vector control technologies that would be more effective[9]. In addition, there seems to be no doubt that the IVM can induce a more responsible use of insecticides, conditioning it to a more accurate evaluation of economic and environmental costs, always appraised by the benefit estimates for the public health[6,9].

Several strategies based on innovative alternatives, aimed at controlling the *Aedes aegypti*, are undergoing the development and evaluation process[10], and can be briefly divided into: A) New methods and practices that improve the control of immature forms of mosquitoes (eggs, larvae and pupae); B) New control technologies of *Aedes aegypti* in their adult form[11]. Group A comprises technologies that have been successfully tested in some scenarios, especially regarding the decrease in vector infestation. Some renounce, in principle, the additional or alternative chemical control, such as the eco-bio-social approach, which focuses on strong social participation, health education, environmental management and intersectoral coordination for systematic mechanical elimination of potential breeding sites[7,10]; and the use of natural compounds with larvicidal activities, such as vegetable oils produced from citrus fruit peels[10]. In the experience with larvicides dispersers stations, held in two cities of the Amazon state, the female mosquitoes themselves carry the larvicide to inaccessible breeding grounds, treating them chemically at the time of oviposition[10,12].

In group B, it stands out the use of materials impregnated with insecticide, the introduction of the bacterium *Wolbachia* in *Aedes* mosquitoes, and the release of transgenic mosquitoes. The installation of materials impregnated with pyrethroids of long "release" duration, such as curtains and screens for elimination of adult mosquitoes, is generally used in combination with other strategies and do not exclude traditional vector control routines. The results are conflicting and preliminary analyses of cost-effectiveness leave no doubt as to the feasibility of universal incorporation of impregnated screens, for example, to the national control programs[13-15]. Juazeiro and Jacobina, in Bahia state, and Sorocaba, in the state of São Paulo, are among the first cities where transgenic mosquitoes were released in uncontrolled environment[10,16,17]. The technique used is known as "release of males carrying lethal gene" and consists in the transmission of a lethal gene from male genetically modified mosquitoes to wild females during copulation. The gene is then transmitted to the offspring, which will die in a chemotoxic process. Preliminary results showed a reduction in the population of mosquitoes over 80%[10,17]. The laboratory introduction of the symbiotic and intracellular bacterium *Wolbachia* in the vector *Aedes aegypti*, as a way to prevent future mosquito generations from becoming infected with the dengue virus, showed auspicious results in Australia, interrupting the dengue transmission and suppressing the native vector population in two small towns[18]. This bacterium is transmitted by maternal inheritance to successive generations, affecting the mosquito's ability to host the virus. The method approaches the biological control and is an environmentally sustainable strategy, since it involves no genetic manipulation of mosquitoes or introduction of insecticides. New experiments with the introduction of *Wolbachia* are underway in Brazil and Vietnam[10].

The deployment of technologies that have not been fully tested yet in large population groups, particularly those requiring the use of insecticides or release of genetically modified mosquitoes, implies a rigorous process of actions monitoring and evaluation. The cost-effectiveness of the strategies, the effectiveness in reducing the arboviruses transmission, their environmental impact, the experiments reproducibility in large clusters (the initial tests are usually held in restricted areas and under special conditions), and the occasional alterations in the resistance to larvicides and adulticides are aspects that should be thoroughly investigated and disclosed, as a way to validate their extensive dissemination[10].

Ultimately, it is urgent to restore the idea of vector control as a health prevention and promotion policy that is unrestricted to the direct fight against mosquitoes. Social and health improvements, which include increase in sanitation coverage and reduction in health inequalities, still remain as the most efficient and sustainable control strategies.

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