

Zika Virus: analysis, discussions and impacts in Brazil

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ABSTRACT : The ZikaDisease is increasing in Brazil since 2014. The causative vector is AedesAegypti, which through its bite can transmit the virus, causing microcephaly, it can causes consequences thought life. Beyond the number of microcephaly cases growth, the Zika virus generates major problems involving the whole society and economy of the country, such as the cost of medical treatment of the microcephalic child and his family that will stop working to support and follow the treatment, and also to the cost of basic sanitation, as a prime factor for mosquito control and the elaboration of public policies. Thus, the present work analyzed economic and environmental aspects for the understanding the virus' factors that provided the vector growth. A bibliographic research carried out to understand the effects of the Zika virus and its economic, social and environmental impacts. In this study, the costs related to microcephaly, the loss of income of microcephalic child's relatives and the country's investment in basic sanitation were estimated.

KEYWORDS: *Zika virus, Brazil, Microcephaly, Public policy, Costs.*

I. INTRODUCTION

Zika virus is classified as flaviviruses which are enveloped viruses with linear, single stranded RNA of positive polarity, non-segmented, in capsid icosahedral. [1] It is mainly transmitted by genus Aedes' mosquitoes and it was discovered in Uganda in 194.[2]

AedesAegypti is largely responsible for the emergence of Zika virus in Brazil. There are indications that this vector began to circulate in Brazil in 2014, but according to the Ministry of Health, registered cases only occurred in May 2015.

On November 28, 2015, the Ministry of Health confirmed that pregnant who is affected by the virus has possibility of generating microcephalic child, an irreversible brain malformation, which may be associated with mental, visual and hearing damage.

The Zika virus' consequences is a concern and it becomes a public health emergency of national importance. This situation was due to the relationship between the presence of the virus and the occurrence of microcephaly and deaths was confirmed by laboratory tests performed on newborns' samples [3].

Brazil adopted the World Health Organization (WHO) standards to determine if the baby has microcephaly. The head circumference for boys should be equal or less than 31.9 centimeters and, for girls, equal or less than 31.5 centimeters. A study published in the Science (2016) shows that Zika infection could reduce the newborns' brain by 40% [4].

II. DEVELOPMENT

The microcephalic can live for several years, it will required medical monitoring and use specific medications. Due to the high number of cases, there will be a considerable cost to the country's economy, since Brazil must meet them, providing all the necessary resources, supporting their health and well-being.

2.2.Microcephalic costs

The health sector can be considered the provide and direct payer of services related to the equation of diseases and health problems, but also the society has the diseases costs, which often remain hidden in the costs sheets.[5].

Direct costs are those resulted from health care or treatment of diseases. The main costs are hospitalization expenses, medical services, services of other health professionals, diagnostic exams and medications.[5].

Indirect costs are those incurred by the patient and third parties. They refer to loss of productivity due to the aggravation of the disease through the loss of the patient's organic and labor functions, resulting in lack of work, etc.[5].

The external cost is the damage caused to third parties without the imposition of a financial burden proportional to who caused it that results from negative social impacts caused by the disease (PEREIRA, 2014).

The possible causes of primary microcephaly are genetic and environmental, such as exposure to toxic substances, fetal alcohol syndrome, etc.[2].

Until of July 9, 2016, 174.003 cases of Zika and 1.399.480 cases of dengue were registered according to the epidemiological bulletin of the Ministry of Health [7].

There isn't specific treatment for microcephaly, but there are support actions that can aid in the development of the baby and child, and his follow-up is advocated by the Unified Health System (SUS). Each child develops different complications between respiratory, neurological and motor, is necessary the monitoring by different specialists.[8].

Nonspecific examinations should be requested in order to complement the investigation and disease staging. During the course of the disease, changes in various laboratory tests may be identified, such as mild to moderate leukopenia and thrombocytopenia, and slight elevation of serum lactate dehydrogenase, gamma glutamyltransferase and makers of inflammatory activity (C-reactive protein, fibrinogen and ferritin).

Microcephalic children have impairments in neuropsychomotor development benefit from the Early Stimulation Program that addresses the stimuli that interfere in their maturation to favor motor and cognitive development. The child should be included in this program, which should start as soon as the baby is clinically stable and extends to his 3 years old.[8].

Babies diagnosed or suspected of microcephaly are submitted from the first month of live to interventions in several areas, such as physiotherapy, speech therapy, occupational therapy, otorhinolaryngology, ophthalmology, neuropsychiatry, pediatricians and psychiatrists.[9].

The Ministry of Health reported on June 22, 2016, Brazil had 1.616 confirmed cases of microcephaly, of these 233 were caused by Zika virus, detected in examinations and still investigate another 3.007 cases of malformation. Since October 2015 (beginning of the Zika outbreak) 324 deaths were suspected of microcephaly or central nervous system abnormalities, deaths occurred after childbirth or during pregnancy[10].

Although the limitations that may arise, the life expectancy of children with microcephaly are no different from other children.[11]. Treatment up to 3 months of age requires occupational therapy exercises and, later, physiotherapy and neurology follow-up. The parents will have to accompany them in these moments what will be in working hours bringing emotional, economic and social impacts in these families.[12]

In order to ensure care in referral centers, many mothers need to travel with their children for consultation and to accurately measure the babies' perimeter, a minimal difference in measurement can delay treatment, with moderate consequences in their lives.[13].

Among the rights of the person with microcephaly the SUS must offer all the treatment options for these children with adequate care, with quality, in the right time and with guarantee of continuity of treatment [14].

The pharmaceutical assistance is directed to the acquisition of basic health care medicines. Microcephalic require expensive drugs that need to be used for long periods.[15].

The expensive for treatment outside the home, which are those related to air, land and river transport, daily for meals and overnight stay for patients and companions, and must be borne and authorized according to the budget availability of municipality and/or state.[15].

According to the Ministry of Social Development and Fight Against Hunger, mothers of children diagnosed with microcephaly can enroll in the Continuous Provision Benefit (BPC). According to the Ministry of Social Development, the BPC payment corresponds to a minimum wage and can only be received by those who have a per capita family income less than a quarter of the minimum wage, currently R\$ 220.[16].

Brazil has not yet defined the minimum necessary treatment that children with microcephaly will have to pass through the year, and it is difficult to define their exact cost. Babies are completing 1 year old with various health problems that children with microcephaly caused by syphilis and other diseases do not possess.

2.2 Environment and Zika

The lack of public policy focused on the health or inadequacy of basic sanitation in Brazil may impact on the increase in the number of cases of microcephaly caused by the Zika virus.

2.2.1 Public policies

The concept of public policies refers to a set of actions and decisions of the government, aimed at solving problems encountered in society. It is characterized as public policy the system of goals and plans designed by the three federative entities - union, states and municipalities - to achieve the well-being of the population.[17].

Public Policy has two fundamental elements: public intentionality and the public problem. The public policy marking process, also known as the public policy cycle, consists of five key activities: agenda setting, formulation, decision making, implementation and evaluation. They are discrete yet interrelated sets of activities in which public managers can engage to achieve the goals of their society and government policies.[18].

Public sanitation services are subject to a public policy, formulated with social participation, and understood as the set of principles and directives that conform social and/or governmental aspirations in the regulation of planning, execution, operation, regulation, supervision and evaluation of these services.[14].

Health public policies are projects developed by the Government, with the assistance of public and private entities, with the aim of preserving the right to health. Public policies require financial investment for the elaboration of functional and beneficial actions for the Brazilian population.[19].

2.2.2 Basic Sanitation

Sanitation is the set of measures aimed at preserving or modifying environmental conditions in order to prevent diseases and promote health, improve the quality of life of the population and the productivity of the individual and facilitate economic activity .[20].

Data on basic sanitation in Brazil are unsatisfactory, according to the Diagnosis of Water and Sewage Services, in 2013, based on documents from the National Sanitation Information System (SNIS). A survey of 154.7 million Brazilians, only 49.6% have sewage collection and 39% have treated sewage. Only São Paulo, Minas Gerais and the Federal District have an average urban sewage collection rate above 70%. In other states, the service of urban sewage collection network reaches indices below 40% on average. According to the same source 82,5% of a total of 165.7 million Brazilians receive assistance from the urban water supply network.[21].

The 2011 Sanitation Atlas shows that in the northern region, the population receives more untreated water – over 25% of the water destined for human consumption in this region is not treated. The water supply covers almost the entire country, 99,4%. According to the study, there are 33 Brazilian municipalities without total water supply. However, there are another 793, most of them in the northeast region, in which alternative supply is made through cisterns or other mechanisms.[22].

The sewage system promotes the interruption of the human contamination chain and the improvement of solid waste management reduces the environmental impact and eliminates or hinders the proliferation of vectors.

III. ESTIMATES OF THE MICROCEPHAL COST

For the diagnosis of microcephaly are spent around R\$ 390,45 per person, this only with first evaluation exams. This value can be increased due to the need of each patient since the effects of microcephaly are variable.

Health professionals spend about R \$ 997.89 per hour of work, that is, every time the patient needs 1 hour of all these professionals, the government will spend this amount per person. The value for treatment of a microcephaly patient can not be accurately estimated as the consequences vary from case to case and there is no plan or protocol indicating which treatment is correct for the individual.

Because it is a new anomaly, the microcephaly caused by zika has no treatment tested, approved and prescribed. It is being developed as children grow and sequelae arise. There are mild cases, other critics and some, fatal.[10].

Thus, it can be considered an estimate that if a microcephalic individual goes through the doctor once every 6 months throughout their life and considering the life expectancy of 75 years (life expectancy of the Brazilian in 2014, estimated by the IBGE), the cost would be R\$ 19.522,50. This would be a very simplified estimate, since it is necessary to follow up with several health professionals, including for the prescription of medicines and definitions of the respective doses.

Early stimulation of the microcephalus is an important stage for development, especially in the first 6 years of life. They are spent around R\$ 131,000 per patient. Since psychology is the area that will most require resources, being responsible for 57% of this total, physiotherapy is the area that corresponds to the smallest slice, only 4%. Adding to the expenses with doctors and early stimulation, the total cost would be R\$ 150.807,30.

According to Decree 8.818 of 12/29/2015, the Brazilian minimum wage is R\$ 888, 00. According to Law 8,213 of July 24, 1991, art. 29-c, inc.I and II, the contribution time for men is 35 years and for women, 30 years. Then, in this period, the person who stopped working to care for and monitor the microcephalus, stopped capturing R\$ 400.400,00, if man or R\$ 343.200,00, if woman.

Thus, the total expenditure of microcephaly would be R\$ 494.007,30, if the woman stopped working to take care of the child, and R\$ 551.207,30 if the man stayed at home to take care of the microcephalous child, that is, the average cost would be R\$ 522.607,30.

Until July 2016, 1,749 cases of microcephaly have been confirmed.[4], thus, the cost of all cases of the disease will be R\$ 914.040.167, 70.

According to the Transparency Portal of the Federal Government, spending on Basic Sanitation in 2015 was R\$ 113.173.943, 21. In the year 2016, consulted on September 7 of the same year, the expense was R\$ 38.010.741, 53, that is, spent the equivalent of 33, 59% of the year 2015. The government will spend 8 times more with the microcephaly of what it spent with basic sanitation in 2015 or 24 times what it spent until September 2016 with this service.

Basic sanitation, in addition to zika, can prevent other diseases, including those with the same vector, such as dengue and chikungunya, which cause concern to Brazilians in all summers during the rainy season, when the accumulation of water are frequent.

The Ministry of Health reported in 2016 the first international agreement to develop vaccine against the Zika virus. The Brazilian government and the University of Texas Medical Branch of the United States will conduct the research jointly. For this, the Brazilian government will make available \$ 1.9 million over the next five years. According to the work schedule, the forecast is for product development in two years.[23].

IV. CONCLUSION

With the increase of cases of infection by Zika virus, an increase occurred in cases of microcephaly in Brazil. The virus came to the country due to the diminution of the borders, which contributed to the spread of the virus across several regions of the globe. In addition, Brazil presents favorable climatic conditions for vector proliferation, increasing the number of cases rapidly.

The objective of the present study was to estimate the costs related to microcephaly caused by Zika virus infection and to address possible public policies for sanitation, vector combat and patient care.

Is possible observed that microcephaly expenses exceeded by 2400% the expenditures that Brazil made with basic sanitation until September 2016. Basic sanitation, besides contributing to the reduction of cases of microcephaly, also leads to a decrease in cases of dengue, zika, chikungunya and other related diseases (cholera, diarrhea, etc.), but do not have the due attention for public policies of the Brazilian government.

The difficulty found in the elaboration of this work was the lack of a protocol that determined a basic treatment for microcephalus. All the doctors we contact claim that the treatment is variable, as the sequelae will differ depending on the region of the brain most affected, although they claim to know how to proceed with the correct treatment. Thus, it was not possible to establish a position of what would be the minimum expenditure of each patient, which made it a challenge to simulate the values involved in the treatment of microcephaly.

Thus, it may incur the risk of exceeding the fiscal targets with the transfer of the resource to public health, since cases have increased significantly and have not conducted a study of how much resources would be required.

We suggest as a study the deepening of the environmental aspects related to the proliferation of the vector in residential areas, besides how the virus has advanced throughout the world and what would be the measures of prophylaxis so that Brazil was not reached, besides the definition of protocol base for the treatment of the microcephaly.

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