

Mini Review

Boosting Preparedness and Emergency Response Systems Capacity against Zika and Other Emerging Outbreaks in Low Resource and Vulnerable Settings

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Abstract

There is an urgent need to foster the development and establishment of robust and effective preparedness and emergency response systems capacity, and strengthening community-based programs and activities in improving *Aedes*-related Zika virus epidemics, mosquito's larva breeding sites prevention and smart ecological management in vulnerable settings worldwide.

Keywords: Zika virus; Preparedness; Emergency response; Capacity; Outbreaks; Vulnerability

Introduction

Globalization of trade and travel coupled with climate changes public and global warming impacts on health and epidemiologic transitions are worrisome health challenges and issues amidst scientific and technological advancements. Ongoing Zika virus (ZIKV) epidemics assessment has prevalence, infectivity intensity using various routes, clinical complications in fetal, childhood and maternal development and growth required more operational research in establishing accurate/reliable information and knowledge on short and long-term impacts on the quality of life and disability in affected and vulnerable populations [1,2,3].

In absence of anti-Zika drugs and vaccines since its discovery and isolation in 1947 and 1954 in Uganda and Nigeria, respectively, the ongoing speed of spread of Zika epidemics in over 30 countries including the Americas of which over two million are affected and/or vulnerable population with 80% ZIKV asymptomatic hosts or carriers have been documented [1-4]. Potentially, more than 4,000 cases of babies with microcephaly and imbalanced brain development have been linked to ZIKV infectiousness in Brazil and Colombia [1,4]. Since 1954, there has been significant decline or rare cases of Zika incidence and no country has developed or implemented a local or national Zika control program except for other arbovirus as such as dengue, Chikungunya and yellow fever. Until recently in 2007 in the Pacific islands in 2015 to date in ZIKV epidemics in Brazil and neighboring Latin America countries (including the Caribbean islands) and similar to the West Africa Ebola outbreak in 2014-2015, unmistakably revealed the weaker facets of local and national preparedness and emergency response, structures and operational needs [2-3]. Strengthening surveillance, rapid response and core

laboratory capacities is needed in accordance with Integrated Diseases Surveillance and Response (IDSR) and International Health Regulations, (IHR, 2005) implementation in guiding policies and action plans [3,5]. Similarly, provide evidence in boosting policy-makers, implementers and all stakeholders (e.g.: local and international) commitment and funding in improving the health systems capacities in over 30 ZIKV-affected countries worldwide with *Aedes* mosquito-transmitted Zika virus disease, an estimated over two million people are at high risk including pregnant women in these *Aedes* mosquito-prone settings [2,5].

However, various transmission routes including mosquito bite, unprotected sexual intercourse, infected needles and sharp objects and blood products transfusion from infected patients have been confirmed, whereas mother-child placenta and breastfeeding and other routes require further investigation [1-4,6]. These might be considerably an underestimated burden as undiagnosed affected communities and asymptomatic populations in the tropics and subtropics including Latin America continent requires further operational research for evidence decision-making polices and interventions [5-7]. This paper aimed at assessing novel approaches and strategies boosting preparedness and emergency response systems capacity against Zika and other emerging outbreaks in averting and containing Zika epidemics and spread globalized ecological and climatic changes impacts in low resource and vulnerable settings.

Nurturing new and robust political commitment and sustained investment partnerships innovations amongst governments, private sectors and other stakeholders is urgently needed in the applications of epidemiological, sociocultural, behavioural and molecular approaches and strategies in tackling the growing emerging threat

and epidemics [7,8]. Developing comprehensive local, community and national action plans and priorities to revamp more reliable, accessible and cost effective predictive and preventive methods (e.g.: diagnostics and vaccines) and tools are imperative. These are vital in accelerating vigilance communication and participatory resilience culture of global population, patients, professionals and health providers towards service delivery and quality outcomes, and global health security [2,4].

Evidence-based and sustainable policy decision making and financial allocation priorities in vector-borne threats and epidemics operational research and programs are core. These include improved community shared responsibility and participation for more vigilance and risk communication [2,9] Leveraging on cutting-edge technological advancements in strengthening contextual and cultural cost-effective health systems, rethinking on new educational and training curricula at all levels and appropriate risk assessment and communication mitigation measures opportunities and benefits.

Establishing Zika and emerging epidemics robust and effective community and public health laboratory preparedness and emergency response systems capacity development is an urgent need. Development of new, rapid more sensitive and field adaptable or point-of-care ZIKV tests, safe anti-Zika drugs and vaccine validation and regulatory approval should be prioritized as a critical step to safeguard against the use of low-quality tests related misdiagnosis and inappropriate treatments [6,7,10]. In recent developments, the WHO indicated that new diagnostic tests may be available soon (at least 18 months away) based on investments from biotechnology companies clinical trials for potential vaccines [1,6,11,12]. Smart and proactive preparedness and healthcare providers' alertness in public response about Zika and other emerging epidemics should be established or reinforced to provide support to public health laboratories for clinical research with diagnostic investigations; confirmation and prompt reporting of both domestically and internationally-acquired or transmitted cases at all levels [2,3,10]. To date, no vaccine or cure exists for Zika emergence in the region where populations lack immunity to the virus. Investing in Research and Development (R&D) through fostering public-private partnerships and collaboration is needed. These are essential strategies to combat rapidly expanding vectors and virus and accelerating diagnostic and vaccine R&D. This is to fast-track different pipelines of effective actions, ranging from development of a human vaccine to genetic modification of mosquitos to curb the fueled multiple gaps, unknowns and uncertainties surrounding the Zika epidemic [2,3,6,8,9,11,12]. Likewise advancing efforts for more sensitive and field adaptable diagnostic methods and support local and regional digitally-integrated vector-borne disease early-warning and surveillance systems, and interactive strategies developments and applications are imperative. These require robust and pragmatic governments and stakeholders' commitment and investment, broad and participatory implementation of large-scale health, environmental and developmental preparedness and emergency response programmes (Figure 1).

Likewise, cultural and contextual community engagement and health education outreach and campaigns are critical in empowering the public, care providers, pregnant women and their partners. Genuine efforts in improving epidemiologic surveillance and

expanding laboratory smart diagnostic capacity will build into better control of virus transmission [3,4,8,9,12]. Proactive stewardship and leadership is needed in continuously Surveillance, vigilance and monitoring *Aedes* risk factors and determinants in establishing the most effective and valuable indicators and predictors of Zika and other emerging outbreaks forecasting and temporal-spatial early-warning signals systems [12,13].

Importantly, rapid, reliable and low cost field adaptable diagnostics for mass population screening and R&D in safe and effective anti-Zika drugs and vaccine for potential safe Zika immunization implementation is imperative. These are advances in improving health services, and support for low-income pregnant women and in enhancing the ability of Zika-affected countries smart response activities [1,13]. Generating evidence-based information in forecasting or modeling of potential threats and epidemics is essential for guiding decision-making policies, mitigation and adaptation strategies. Applications of cutting-edge technologies, infrastructure and resource capacities can strengthen local or national capability in preparedness and smart response to interrupt and contain the potential future risk of infectious disease threats and epidemics [2,12,13].

Strengthening local and national laboratories surveillance and monitoring capacities to test for Zika and investigate the transmission competence of its associated mosquito vectors and evolution for competence and virulence is very limited. These laboratories should be able to rapidly identify, respond to, contain and track cases [5,12,14]. Strengthening local and public health laboratories capacities to detect, diagnose and trace Zika, Ebola and other emerging pathogen threats highlights the ever-increasing role and value of national public health evidence-decision making policy, budget allocation and programs in protecting vulnerable communities [5]. Simple and inexpensive point-of-care, more readily accessible, rapid and timely mass screening of ZIKV using nano-fluids diagnostic kits in achieving diagnosis is needed. Long-term upgrading of facilities within the tiered laboratories network to respond to any potential epidemics, and treatment monitoring in remote vulnerable populations is advocated [2,5,14,15].

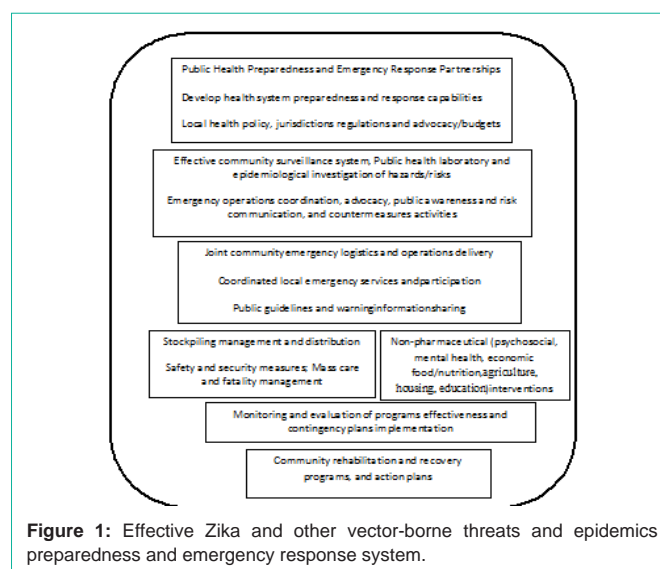


Figure 1: Effective Zika and other vector-borne threats and epidemics preparedness and emergency response system.

Strengthening communities' adaptations of proven effective educative approaches and targeted preventive strategies are needed in fostering vulnerable key populations, including pregnant women, their partners, and health care professionals. There is an urgent need to develop and implement sustainable digital surveillance systems in entry airports, land cross-borders and seaport monitoring and tracking Zika and other emerging viral diseases. In order to elucidate better the pathophysiology and immune response of arboviruses-related complications (link of ZIKV infection to neurological, birth defect microcephaly and stillbirth incidence rates), it is important to increase research on maternal-child health over space and time [1,2,7]. Moreover adoption and adaptation of CDC Pregnancy Risk Assessment Monitoring System in improving tracking and monitoring Zika-related fetal development and birth defects, Guillain Barre syndrome (GBS) and related motherhood-childhood complications in all Zika-affected and *Aedes* endemic prone countries are advisable [1,2,5,7]. Building public health preparedness and emergency response capacity in line with the WHO could-serve as platforms to fast-track assessment and provide early short and long-term solutions to address Zika and other emerging outbreaks disasters [2,14,15].

As well strengthening multi-sectoral and cross-sectoral partnerships in response to emerging threat and epidemic drivers, while recognizing that health vulnerability is shaped by access, availability, coverage and policies in environment, international trade and travel, mechanization of agriculture, housing or education coupled with coordinated smart actions during outbreaks [1,7,9,12]. Enhancing local and international capacity for virus surveillance to scale-up our understanding of the growing vector ecology and evolution, vector-virus interactions, expanding Field Epidemiology Training programs to new epidemics preparedness and emergency response, modernized laboratory testing, healthcare professionals and providers training are urgently needed in improving integrated vector-borne surveillance, effective case management and communication in at-risk settings or countries [2,15]. In doing so, regular monitoring and evaluation of preparedness and emergency response programs performance and effectiveness at all levels, in particular in remote, hard-to-reach rural communities is critical to enable innovative measures success, filling technical gaps and drawbacks in most vector-borne diseases and epidemics susceptible countries worldwide.

In conclusion, increasing preparedness and emergency response systems capacity needed against Zika and other emerging threats and outbreaks vulnerable settings requires boosting political commitment and investment against global emerging threats. Fostering sustained establishment of robust and effective readiness and smart response systems capacity is crucial in improving community-based programs in *Aedes* and other mosquito larval breeding sites elimination

and smart management. Ultimately, collective responsibility and participation in scaling-up emerging epidemics vigilance, continuous integrated vector management programs and laboratories surveillance and monitoring systems in early-warning metrics and emergency response at all levels in susceptible settings is imperative.

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