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Editorial

Dengue: A runaway epidemic and a bewildered public health worker

Dengue in all its varieties and forms has been causing havoc across the globe and India is no exception. World Health Organization, while recognizing the dangers of this disease, has included dengue in their theme of 2014 for the control of Vector Borne Diseases. Out of an estimated 96 million cases globally of dengue every year, 70% occur in Asia,¹ with India alone contributing to 34% of all cases.^{2,3} In fact, from a disease virus which jumped the species barrier only about a thousand years ago, dengue has transformed from sporadic cases among humans till a few decades back to that causing large scale outbreaks in various parts of the globe today.⁴

The disease is no longer limited to the hot and humid conditions of the tropics. In fact, in India itself, dengue outbreaks have been reported both from areas which are having subtropical and desert conditions as has been brought out by Kunwar et al and Cariappa et al in two recent articles published in this issue.^{5,6} Various reasons for its spread have been postulated including rapid, unplanned economic development, urbanization with sub-standard housing, irregular water supply, poor environmental sanitation, inefficient garbage removal and the unrestricted use of non-biodegradable bags/containers by the population. The rapid spread globally could be linked to the popularity of air travel.⁷

All these reasons, however, do not fully explain the explosive spread of dengue across such diverse ecological conditions. Change in weather patterns globally have been considered as contributing to vector bionomics. This may be further influenced by inherent characteristics of vector resistance. Genetic changes in the virus too may be influencing the infectivity, survivability and spread of dengue. Initial reports of a new DENV-5 as put forth by Mustafa et al in an article published in this issue have put a serious question mark on our understanding of the virus transmission dynamics and evolution of disease.⁸

Both the virus and the insect vector have proved difficult to control. With large scale morbidity and even mortality due to its severe forms, dengue fever today poses questions to all public health workers, who are left searching for a suitable and sustainable response to control it.

Public health challenge

The time-tested public health strategies for control of any communicable disease include control of reservoir of infection,

blocking channels of disease transmission, protecting the susceptible population through drugs and vaccines, and finally, raising awareness about the disease through (Information, Education, Communication) IEC.⁹ Only limited success has been met in applying any of these measures in control of dengue. The reasons are complex.

Immunity and vaccine development

Both isolation of an infected reservoir of dengue infection as well as protecting a susceptible host through vaccination has not been practical. With four known serotypes (DENV 1, DENV 2, DENV 3 and DENV 4) already causing outbreaks at disparate locations and no cross immunity, a tetravalent Dengue vaccine was considered the only way forward. However, sustained efforts to develop a dengue vaccine have remained elusive over the last sixty years. The Phase 3 trials in Thailand in 2013 with the candidate vaccine Chimerivax has also not been very encouraging, with poor protection against DENV 2.¹⁰ Reports of a new strain DENV 5 further complicate the issue. In addition, concern has been expressed about the antibody-dependent enhancement (ADE) of dengue virus in individuals exposed to natural infection, with its association with complications like Dengue Shock Syndrome and Dengue Hemorrhagic Fever.¹¹ These issues need to be factored while developing a dengue vaccine.

Vectorial capacity

The only practical control measure, therefore, remains blocking the channel of transmission, both by improving measures against the vector *Aedes* mosquito, as well enhancing societal response against it through sustained IEC efforts. This has been the strategy world over, but the results have been mixed.

The *Aedes* mosquito is an incredibly efficient vector and wreaks havoc on a susceptible population within a very short period. As reported after most dengue outbreaks, gaps exist in administrative preparations in countering the vector in time.⁵ The peak of the epidemic curve of any dengue outbreak closely follows unseasonal rains. Inadequate timely response to control potential breeding spots allows the vector density to build up and allows the infection cycle to get established in that area. Thereafter, it becomes even more difficult and labor intensive to control the vector because of the sheer volume of

peri-domestic breeding sites. Vector breeding in multi-storied buildings in today's urban sprawls further aggravate this problem. With trans-ovarian or trans-stadial transmission of the dengue virus in the *Aedes* vector now being accepted, vector control measures get further compromised.

Dengue prevention and control

Unlike any other disease in recent times, dengue has brought out the importance of involving the community and its role in disease prevention. There remain gaps between knowledge, attitude and behavioral practices in the community as regards dengue prevention. While stringent enforcement of legislations against mosquitogenic conditions in households by the Singapore Govt. has paid dividends, implementation of similar public health legislations elsewhere remain inadequate. Behavior Change Communication, therefore, needs to become the focus. Perceived threat to self and family due to dengue complications can influence behavior of the community, while perceived benefits of their actions in helping vector control could influence the outcome, as brought out in the Health Belief Model of human health-related behavior.

Tailor-made systematic approach

In absence of an effective vaccine against dengue, a tailor-made comprehensive strategy of vector control needs to be evolved, based on appreciation of the local conditions and circumstances. Past outbreaks of dengue were usually caused by a single DENV and were seen at an interval of 2–4 years, allowing sufficient number of susceptible to build up. However, with simultaneous circulation of all four DENV, yearly outbreaks are common today, usually caused by two or more strains. Ideally, therefore, preventive activities should begin as soon as one comes out of the preceding year's outbreak.

A systematic approach would involve development of an action plan involving all stake holders. Based on the feedback of the previous years, this action plan should clearly spell out the role and responsibilities of each agency. The plan must include periodic review of activities and preparation at all levels, allowing options for any mid-course corrections. Inputs need to be sought from all agencies having domain expertise and incorporated into the action plan. Sensitization of general population of the area must be carried out repeatedly using all possible IEC methods. It has to be stressed that the general population is as much a stake holder, and that the success of the vector control measures will depend largely on their compliance with the advisories against dengue. This systematic approach will involve appreciation of the problem, forecasting of transmission patterns, and interaction with all agencies, practicing the drills and finally tackling the outbreak. All these aspects have been adequately highlighted in the two articles in the current issue.^{5,6}

Future challenges

Most of the dengue outbreaks in last few decades have originated in Asia. The recent case of DENV 5 in Sarawak has drawn

attention to the virus making species jump from simians to humans. The worldwide surveillance network provides the mechanism of issuing alerts and travel advisories, making a coordinated global response possible. Zoonotic vector-borne infections will continue to pose even greater challenges in the future, making zoonotic serosurveillance in fringe areas and hot spots of intense viral activity a priority area of medical research. Research and development of a safe and effective vaccine against dengue will have to be persisted with concurrently.¹² Emerging economic prowess of most of these affected regions would help in according it the priority it deserves.

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<http://dx.doi.org/10.1016/j.mjafi.2014.12.002>

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