

**ORIGINAL ARTICLE****YELLOW FEVER: THE CHALLENGES AHEAD IN INDIA**Mohan Joshi<sup>1</sup>, Raghvendra Gumashta<sup>2</sup>, N.B. Kasturwar<sup>3</sup>, Mohd. Junaid<sup>2</sup><sup>1</sup> Associate Professor, <sup>2</sup> Resident, <sup>3</sup> Professor & Head, Department of Community Medicine, N.K.P. Salve Institute of Medical Sciences & Research Centre, Nagpur, India**Correspondence:**

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**ABSTRACT**

Looking into the vast threats of possible silent introduction of yellow fever virus into India, we have studied the various probable responsible factors, situations and circumstances along-with ways & means of ensuring adequate prevention cum control measures in case of any inadvertent identified presence of this virus in the Indian territories. Thus recommended evidence based analytical approach, designed and implemented in word and spirit, will go a long way in generating confidence not only among the beneficiary general population of India, but will also give a sigh of relief from the possible grave public health threats of yellow fever to the policy makers, programme managers and health functionaries already overloaded with health care challenges of multiple types, dimensions and magnitude. A strategic policy initiative is the answer to address the critical issues based on suggestions deliberated herein.

**Key Words:** aedes aegypti index, arbo-viral, cross immunity, ecological barrier, endemic, epidemiological triad, surveillance, sylvatic, transovarian

**INTRODUCTION:**

The international control of yellow fever, one of the major medical challenges of the century, poses un-assessed public health challenges of multifaceted nature towards safety and survival of the vulnerable population of developing countries like India. In view of the already existing favorable geo-social scenario and other factors, it becomes imperative to examine in detail about the perceived threats of presence and subsequent transmission of yellow fever in India. If we go by the geographical location of India, it is too far away from African and South American continents regularly reporting very few cases and mortality data of yellow fever with possibilities of millions of cases and thousands of death going generally unreported in the region. Population mobility is a main factor in globalization of **public health** threats and risks.<sup>1</sup>

Arbo-viral diseases like Dengue, Japanese Encephalitis, West Nile Fever, Kyasanur Forest Disease, Chikungunya etc are already contributing to the morbidities of varied nature and proportion in India. The presence of new arbo-viral diseases like yellow fever, being reported from any part of the country, may become an unwelcome surprise as a public health emergency requiring dealing with immediate urgent challenges for implementing prevention and control measures of unprecedented magnitude in terms of the target population, fiscal liabilities, mortalities, impact on the overall health scenario and lagging behind in the achievements of overall development goals.

Despite sustained global cum regional initiatives and international measures<sup>2-3</sup> in the form of vaccine supply, programme support, surveillance, treatment, information education & communication initiatives, the containment of yellow fever virus to the jungles has not been

possible in the Americas and Africa. The surprising and sudden reporting of yellow fever cases after 34 years of silence in countries like Paraguay<sup>4</sup> raises alarm about the long term threats of yellow fever, even if either it gets controlled to the undetectable levels for decades or it is not reported at all in the earlier decades. While African continent reported 47 cases & 6 mortalities in year 2008 and 20 cases & 3 mortalities in year 2009, the Americas reported 102 cases & 42 mortalities in year 2008 and 55 cases & 18 mortalities in year 2009 as per reports of World Health Organisation.<sup>5</sup> Although the number of cases officially reported by World Health Organisation in January 2011 for the year 2008 and 2009 in Africa and Americas were negligible, but there are an estimated 200,000 cases and 30,000 deaths worldwide each year.<sup>6</sup>

### **MATERIAL & METHOD:**

An exhaustive review of available literature, current global scenario, health challenges in India, present policy initiatives and impact assessment reports of national health programmes especially National Vector Borne Disease Control Programme was conducted. These consolidated findings were also studied across spectrum of epidemiological triad along with the reach, quality and limitations of present health care scenario in India.

### **RESULT & DISCUSSION:**

The need of hour is to examine extensively the points & routes of entry for yellow fever in India, the probable shortcomings in prevention and control measures and the necessity of an integrated public health response system & mechanism in place. International travelers coming from the endemic countries by air, sea or land routes pose direct definite threats since leaving even a single traveller un-checked for possession of valid 'international certificate of yellow fever vaccination' at the airport or seaport can create havoc, if he/she has been a case of yellow fever or has been in the incubation period at the time of arrival. He/she can be the source of flavivirus infection in the humans for generating innumerable uncontrolled urban and rural cycles of yellow fever in the country.

In addition, the mosquitoes in the aircrafts and ships from the endemic areas may also transmit

the infection, if no proper & appropriate internationally laid down procedures are followed for aerosol spray. The possibilities of such lapses cannot be ruled out in view of un-assessed but high volume of travel & transport loads from endemic countries. In-transit international travelers and unvaccinated cabin crew of flights or ships may also go undetected, if due precautions and care is not exercised, for yellow fever vaccination status. India like any other non-endemic country can have no access to the real time information of the 'Aedes aegypti index' in the towns and seaports of endemic countries and therefore transmission possibilities for yellow fever always do exist through cargo or shipment transport by air or sea route reaching India within 6 days, the incubation period of yellow fever, of departure from or through an endemic country. There may be cases of non observance of protocol for checking of valid 'International Certificate of Yellow Fever Vaccination' for the travelers embarking in India directly from endemic countries. Such lapses or laxities may inadvertently invite the yellow fever resulting in the unbreakable chain of infections & events leading to sufferings of unimaginable magnitude for the unvaccinated masses of India.

The initiation of biological warfare by terrorists or the enemy countries or a person of destructive mindset may either trigger sylvatic (monkey-mosquito-monkey) cycle or urban (man-mosquito-man) cycle of yellow fever or both the cycles simultaneously/in succession. Entry of unvaccinated travellers belonging to or from endemic countries in India, within 6 days of their departure from home country, by indirect flight or land route through one or more number of neighbouring countries, who may or may not strictly adhere to the international norms all the times, also requires careful & close monitoring at all the international borders.

The reported transovarian transmission of the virus<sup>7</sup> in mosquitoes during adverse conditions, viz. extended dry seasons, in the absence of susceptible hosts may enhance the coverage of geographical areas beyond political boundaries of the endemic countries to reach the countries or areas, which never observed such cases. The successiveness of such cycles or events may lead to gradual entry of this infection to the countries, the travelers from whom are not presently required to produce a valid 'International Certificate of Yellow Fever Vaccination'. Hence, there is an existing

possibility of silent entry of this infection through the incoming travelers or cargo of the non-endemic countries to India. India is categorized as 'Yellow Fever Receptive Area', an area in which yellow fever does not exist, but where conditions would permit its development if introduced.<sup>8</sup> And, hence unvaccinated & susceptible Indian population, abundant presence of *aedes aegypti*, favourable climatic conditions of more than 24 degree Celsius and 60% relative humidity prevailing over large geographic area/during rainy seasons and susceptibility of common monkey of India (*Macacus rhesus* and *M. sinicus*) to yellow fever virus are among the key factors which can be intervened, as per the presence of one or combination of more than one of these factors.

Above all those reasons cited in the preceding paragraphs, the non existence of any quick public health response mechanism or adequate & immediate availability of yellow fever vaccines for curbing propagation of subsequent infection from the first suspected/reported case of yellow fever in the country is most important and needs urgent attention of public health authorities. Fostering and sustaining high-level political commitment, improving the planning and monitoring of immunisation services at all levels, adequate community mobilisation, efficient coordination of current and future immunisation partners<sup>9</sup> along with mitigation exercises are required to be necessarily ensured for sustainable programme management towards prevention and control of yellow fever in the country.

### RECOMMENDATIONS:

As evidenced above, there is need of the following national initiatives for the near absolute protection of the country from entry of the dreaded yellow fever virus, if a suspected/confirmed case is detected anywhere in India/neighbouring countries, as a national emergency:

(a) Initiate national consultations on drafting of the national policy on 'Prevention and control of yellow fever in India' and finalize it in close consultation with the 'World Health Organization' and experienced 'Public Health Experts' of the endemic countries;

(b) Duly approve and implement national policy, as agreed through national consensus/consultations and drafted as above;

Develop and ensure a quick and sustainable public health response to the emergency situations including keeping 'National and State Task Forces' ready with adequate administrative, financial and resource mechanisms and powers;

(c) Sign an international treaty for quickest availability of 17 D vaccines in estimated doses required (may be in millions) for immediate vaccinations, as and when required. In addition, an arrangement may also be made at national level among vaccine manufacturers to supply 17D vaccine, when needed at short notice;

(d) Keeping a pool fund always available in the national health budget for smooth and fast availability of ear marked funds for the purpose of initiating a prevention and control programme on a large scale in the country;

(e) Inter ministerial commitments and related measures by all the concerned departments for ensuring and supervising the surveillance of yellow fever, round the clock, at all airports, seaports and land entry points in the country. Illegal immigrants, who mostly remain unchecked if not caught, also pose threats since their status of travel to and fro to India from endemic countries remains unknown, undetected and therefore make the population vulnerable for infection and disease;

(f) At least dual checks at all national entry points for a valid 'International Certificate of Yellow Fever Vaccination' for travelers directly or indirectly immigrating in India from endemic countries;

(g) Ensuring all possible ways of vector control i.e. *aedes aegypti* in the country through awareness campaigns, training of health staff, rigorous surveillance & monitoring of all arbo-viral diseases known to be prevalent in India;

(h) Conducting large scale research studies to evaluate the level of protection provided for yellow fever, if any, by Japanese Encephalitis Vaccine being used for immunization purposes towards protection from Japanese Encephalitis. The role of 'genetic factors' as well as 'cross immunity' may also be evaluated as a research study. Indian *Aedes* mosquitoes may be less efficient vectors than those of Africa and South America. Indians might have developed cross immunity by suffering from other arboviral diseases such as Dengue fever, Kyasanur Forest Disease (KFD) and Japanese Encephalitis (JE), which has provided an 'ecological barrier'.

Indians might have developed antimosquito antibodies, following bites by *Aedes* mosquitoes.<sup>10</sup> However, all these assumptions require well designed and thorough epidemiological, entomological and clinical studies;

(i) Surveying areas for 'IgM/IgG antibody titres' against yellow fever, where sub-clinical infection may be anticipated particularly near the port or entry point with 'Aedes Aegypti Index' more than 1, the value of which should necessarily be below 1 in all endemic countries.

(j) Surveying adventurous home tourist returning from their tours in yellow fever endemic countries for any sub-clinical infection;

(k) Ensuring all other measures, as suggested/recommended from time to time by various 'Associations, Agencies, Teaching & Research Institutions of Public Health Experts of India'.

## CONCLUSION

The grave threats posed by yellow fever require urgent, immediate and comprehensive public health attention. Yellow fever has not yet entered in India. No stone should be left unturned for checking the entry of yellow fever in India. The systems, expertise and services put in place for prevention and control of yellow fever in India shall go a long way in minimizing the health, developmental and economic adversities in India.

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