Urban Malaria Scheme - Past, Present & Future

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Abstract

Urban Malaria, as a specific problem in India, was first recognized in 1969, after an in- depth review of the situation of malaria in India was done by Madhok Committee. However, main malaria vector in urban areas of India is *An. stephensi,* which was first recognized in early part of the 20th century. Many of the local bodies carrying out anti- larval operations earlier failed to continue the same due to paucity of funds. During that time, malaria in urban areas was not considered as a major problem because the epidemics recorded earlier in Bombay, Delhi, Lucknow etc. could immediately be contained. Based on recommendations of Madhok Committee to control malaria in urban areas, the Urban Malaria Scheme (UMS) was launched in the country in 1971–7 2. A large scale migration of population, creation of slum clusters, construction activities and water storage practices have contributed in the establishment of malaria foci. Urban malaria control is therefore based on source reduction, larviciding, minor engineering interventions, legislative measures, building bye laws and limited spraying of indoor residual spray in peri- urban and jhuggies. Initially 131 towns with a population of > 40,000 and reporting > 2 API were included in the UMS. Later in 1978, due to merger of National Filaria control programme, 206 towns were also brought under vector control support and the preventive measures against malaria vector breeding in clean water as well as filaria vector breeding in polluted water were integrated. Though there has been a well structured separate programme for prevention and control of malaria in urban areas since 1971, the priority attached to it and its implementation has been an issue primarily because it is the responsibility of the local body. Moreover, in recent past, upsurge in cases of Dengue and Chikungunya in urban areas has diverted attention on both disease surveillance and vector control. Coincidently, the vectors of malaria and dengue/ Chikungunya in urban areas breed in clean water and control strategies are same but surveillance with limited resources has affected in assessing the actual magnitude of problem. This has resulted in upsurge in cases and deaths due to malaria in Mumbai during 2010. Historical background and future vision of Urban Malaria Scheme has been discussed in present article.

Keywords: **UMS: Urban Malaria Scheme, VBD (Vector Borne Diseases), KMC: Kolkata Municipal Corporation, An. stephensi: Anopheles stephensi, DF/ DHF: Dengue Fever/ Dengue Haemorrhagic Fever, MPO: Modified Plan of Operation, NMCP: National Malaria Control Programme, NMEP: National Malaria Eradication Programme, UA: urban agglomerations.**

Introduction

Malaria is a major public health problem in India since long and active transmission has been reported from almost all area expects those that are 2000 meters above sea level. Malaria in India is reported largely as unstable being local and focal phenomenon and outbreaks do occur after an interval of several years depending on various factors viz., climatic, ecological, vector biology,

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breeding potential and human factors.[1, 2] Historically, in India, urban malaria was the problem in port cities and later invasion of *An. stephensi* in towns along the rivers or excessive digging of wells introduced malaria in other towns e.g. Delhi, Lucknow, Hyderabad etc. Malaria entered most of the Indian cities along with the piped water supply and the process is leading to the invasion of *An. stephensi* in the urban areas followed by the *Aedes aegypti*. The rapid urbanization and deficient water supply necessitated the water storage practices, favouring creation of more mosquitogenic conditions, thereby resulting in increased transmission of vector borne diseases. Malaria till the 1950s was considered a rural disease. Before launching of the National Malaria Control Programme, in 1953, there used to be 75 million malaria cases and 0.8 million deaths in the country. When malaria was declined and disappearing in the rural India, cases were multiplying in the urban areas with epidemics. Spraying under NMCP produced spectacular success and therefore in 1958, the control programme was converted to National Malaria Eradication Programme (NMEP). The urban areas were not included in NMEP and towns with a population of 40,000 and above were considered hypo- endemic or malaria free.

Malaria control in urban areas was the responsibility of local bodies and NMEP was not made accountable either for field operations or for the monitoring. The progress of implementation was slow and it took two decades to cover all the identified towns. Urban population increased from 62 million in 1951 to 130 million in 2010. According to 1991 census, class I towns (>100,000 population) were 300 and class II towns (<50,000 to 100,000) were 345; and the total number of urban conglomerations plus the towns were 3,768. From 1981 to 1991, population of class I cities in Andhra Pradesh, Madhya Pradesh, Gujarat, Punjab, U.P and Pondicherry had increased by 50% and this increase was highest in Kerala (100.85%). In the last 5 decades, urbanization has swallowed 1 million hectare of agricultural land. In 1991, 25.7% of the total Indian population lived in towns. The 1981 census defined the towns as Statutory town- Municipal Committee/ Board, Corporation, notified area or minimum population of 5,000 people (75% male population engaged in non- agricultural activity, population density at least 400 per square km). Main malaria vector *An. stephensi* continued to expand its territories and entered new towns. The invasion was further facilitated by piped water supply. The opening of hinterlands by a network of roads, electrification, rural water supply, tropical aggregation of labour, migration of population, and lands under industrial development provided additional vector- breeding opportunities and disease transmission. Malaria in peri- urban and industrial townships is transmitted by *An. stephensi* and *An. culicifacies*. While *An. stephensi* was implicated in malaria transmission, its distribution was not delimited in the country. Climatic conditions, water- storage practices, and erratic water supply added to the problem in almost all towns in the plains by building up some population of *An. stephensi* and thereby increasing the possibility of malaria transmission.

The country's census 2011 reveals that India has 7935 towns with more than 377 million people (31.16%). Class 1 UA (urban agglomerations)/ towns with a population of at least 100,000 are 468 (264.9 million persons constituting 70% urban population). Million plus UA/ city population was 160.7 million persons (or 42.6% of the urban population). Among these, three mega cities with more than 10 million people are Greater Mumbai, Delhi, and Kolkata, considering the increase in urban areas and the upsurge in reported cases of malaria and other vector borne diseases (VBDs).

Malaria cases in 131 towns showed upsurge from 102829 in 2007 to 206498 in 2010. Thereafter, the reported cases have declined. Urban malaria contributed 10– 12% cases in the country. In some states like Tamil Nadu, urban malaria is the most prominent; Chennai reported 64% cases whereas Mumbai, Maharashtra reported 55% malaria cases. Mumbai alone reported 145 malaria deaths during 2010, which is the main concern that in spite of good hospital facility, malaria fatality is encountered.

Historical background

Considering the recommendations of the Health Survey and Development Committee of Government of India, 1946 and also keeping in view the wide- spread adverse effect of malaria on the national health economy, industrial and agricultural growth in the country, the Planning Commission accorded the highest priority to a nation- wide Malaria Control Programme. The remarkable success of the National Malaria Control Programme (NMCP) and the fact that malaria had been eradicated in certain countries paved the way for launching the National Malaria Eradication Programme (NMEP) in the country in 1958. In the plan of operations under NMEP, all roofed structures in the rural areas received insecticidal coverage during attack phase except those in urban towns with population over 40,000. In such areas, the residual insecticidal coverage was confined only to the houses in the peripheral belt to a depth of 1 to 1.5 km. In the remaining areas of such towns and cities, anti- larval measures were recommended.

The local bodies were given the responsibility of implementing anti- larval operations. Many of the local bodies carrying out anti- larval operations earlier failed to continue the same due to paucity of funds. During that time, malaria in urban areas was not considered as a major problem because the epidemics recorded earlier in Bombay, Delhi, Lucknow etc. could immediately be contained. The problem of *An. stephensi* - transmitted malaria in India was initially confined to the port cities. The problem was noticed gradually when the implementation of control activities under NMEP brought down malaria incidence markedly by 1963- 65, but at the same time an increasing trend of malaria was observed in some towns/ cities.[3- 5] This was mainly because *An. culicifacies* supplemented malaria transmission being maintained by *An. stephensi* in some pockets. *An. stephensi* breeds mainly in wells and cisterns, which are manmade and of permanent nature whereas *An.culicifacies* breeds in agricultural grassland mostly found in peri- urban areas. Secondly, the tremendous development activities including stone quarry and mining, and specially construction activities, attracted aggregation of labour leading to mushrooming of slums which served as focal points of dissemination of infection.[6- 8] In 1961, there were 310 cities and towns with a population of 79 million which steadily increased to 100 million by 1967. Malaria control in these towns was the responsibility of the local bodies like Municipalities, corporations etc. The local bodies were often under- staffed, inadequately financed and most importantly suffered from the lack of qualified persons.

During 1963- 1968, malaria in urban areas surfaced as a big problem in several states like Tamil Nadu, Andhra Pradesh, Gujarat, Rajasthan, Maharashtra etc. Major factors that contributed for increasing malaria problems in urban areas mainly included trans- migration of population, rapid urbanization, lack of adequate water disposal system in developing towns and habit of storing water for human use. It also led to spread of malaria from urban areas to rural areas that had already been cleared of malaria in early sixties as a consequence of successful implementation of National Malaria Eradication Programme. Malaria spread to the rural areas again mainly because of frequent movement of people to big cities in search of employment who on their return carried malaria infection with them to their native village resulting in focal out- breaks.

Urban malaria, as a specific problem in India, was first recognized in 1969, when an in- depth review of the situation of malaria in India was undertaken by Madhok Commitie.[9] This committee reviewed the problem and found that 10 urban areas in Andhra Pradesh and Tamil Nadu contributed 11.2 percent of the total malaria cases in the two states during 1963. The committee felt that if effective anti- larval measures were not undertaken in urban area, the proliferation of malaria cases from urban to rural area might spread on a larger scale, in many states, and hence recommended adequate central assistance for tackling the problem. Malaria control methods developed by Covell facilitated a rational approach for urban and industrial malaria control.[10- 14] Thus the spread and increasing trends of malaria in urban areas necessitated the concerted effort of malaria control in urban areas with a problem of mainly *An. stephensi* as a malaria vector. The Urban Malaria Scheme (UMS) was sanctioned during November 1971. Initially 23 towns having more 40,000 population with API 2 or more were covered under this scheme, which was extended to 131 towns in a phased manner. The expenditure on this scheme was treated as plan expenditure in centrally sponsored sector. [15]

Urban Malaria - Present Scenario

The central assistance under this scheme was treated as 100% grant to the State Government in kind or cash. From 1979- 80, the expenditure on this scheme is being shared between the Central and State Government on 50:50 basis. After 23 towns in 1971- 72, five more towns were added but due to budget constraints no more towns were brought under this scheme till 1976. Addition of 38 towns in 1976- 77, 12 towns in 1979- 80 and 17 towns in 1980- 81 was approved. Gradually more towns were brought under UMS and presently, 131 towns and cities in 19 states and union territories are under the Urban Malaria Scheme covering a population of about 100 million. [16- 17]

Objectives

The main objective of Urban Malaria Scheme (UMS) is to control malaria by reducing vector population in urban areas through recurrent anti- larval measures, since indoor residual insecticidal spray, in general, is not acceptable to the urban population.

The norms for establishment of Urban Malaria Scheme (UMS) are as follows:

(i) The towns should have a minimum population of 40,000 (now 50,000).

(ii) The API should be 2 or above.

(iii) The towns should promulgate and strictly implement the civic by- laws to prevent/

(iv) Eliminate domestic and peri- domestic breeding places.

Control Strategy

1. Anti- larval measures on weekly intervals.
2. Source reduction i.e. land filling/ drainage through minor engineering methods.
3. Biological control by introduction of larvivorous fish.
4. Anti- parasitic measures through passive surveillance for detection of cases and complete treatment.
5. Legislative measures (Enactment of byelaws).

Indoor space spray is recommended during outbreak situations in and around 50 houses with pyrethrum extract. Civic bye- laws exist in some locations (e.g. Municipal Corporation of Greater Mumbai, National Capital Territory of Delhi, Chandigarh, Bhopal, Agartala, Navi Mumbai Municipal Corporation, Thane, and Goa) which stipulate that individuals must help eliminate domestic and peri- domestic breeding places. Building bye- laws are also implemented in some towns (e.g. Navi Mumbai Corporation) which require precautions to be taken in order to prevent congenial conditions for vector breeding on the exterior of buildings, and curing tanks to be kept larvae- free during construction and to be dismantled before the issuing of occupancy certificates. The use of biological method i.e. Gambusia, use of different larvicides and inter-sectoral coordination for the control of malaria vector in urban areas is well documented.[18- 20]

Organizational Set Up

The Urban Malaria Scheme is a centrally sponsored state programme and is being operated mainly by the local administrative bodies under the active supervision of state health authorities. The municipal health authorities in the towns were undertaking some sort of anti- larval measures before the initiation of Urban Malaria Scheme and had the same staff in this regard. Therefore, the infrastructures provided under UMS by the state were attached to Municipal authorities for better functioning of anti- larval operation. The scheme is thus being implemented at the following level:

1. Town Level: Biologist is the in- charge of this scheme for its proper execution. He has been provided with adequate staff following a well planned staffing pattern.
2. State Level: Addl. Director (Malaria & Filaria)/ Joint Director (Malaria & Filaria) or Deputy Director (Malaria & Filaria) or State Malariologist is the incharge of the scheme at the state level.
3. Central Level: Directorate of NVBDCP (then NMEP) at Central level monitors the urban malaria scheme and provides technical guidance needed for effective implementation of the scheme. It supplies the approved items as per norms directly to the urban malaria towns.

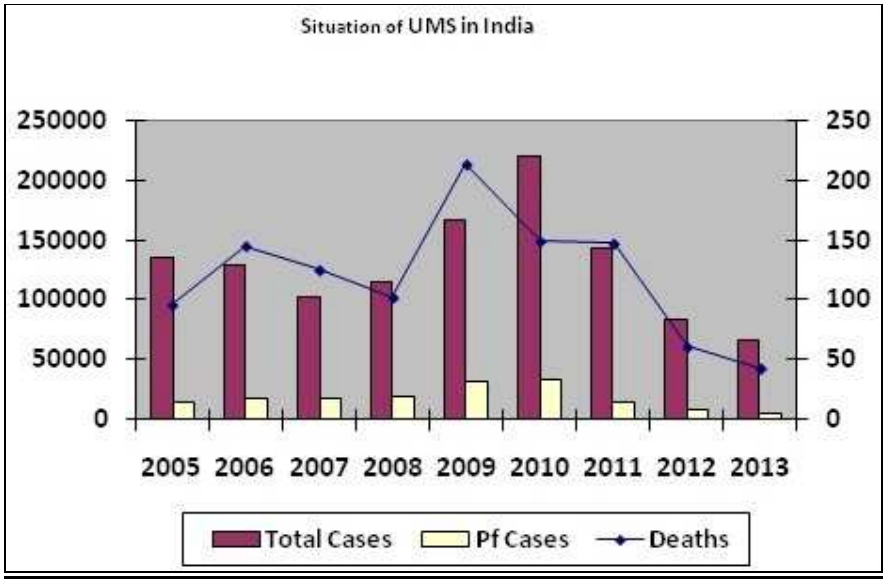
Disease situation

About 10% of the total cases of malaria are reported from urban areas. Maximum numbers of malaria cases are reported from Chennai, Vishakhapatnam, Vadodara, Kolkata, Mumbai, Vijayawada, Ahemdabad etc. Cities and towns in the states of Gujarat (Ahmedabad Municipal Corporation (AMC) and 17 towns), Maharashtra (Municipal Corporation of Greater Mumbai (MCGM) and 14 towns), Tamil Nadu (Chennai Municipal Corporation (CMC) and 11 towns) and West Bengal (KMC) together have been contributing the most in the total malaria cases, Pf cases and deaths due to malaria reported from 131 towns under UMS in the 19 states. The current disease burden of urban malaria since 2004 is shown in the table given on the next page.

Year	Population	Total cases	P.f. cases	Deaths
2004	95814228	150917	19659	62
2005	102423064	135249	14905	96
2006	105782505	129531	17278	145
2007	112448027	102829	18038	125
2008	113334073	113810	18963	102
2009	114699850	166065	31134	213
2010	116136978	206498	32665	149
2011	130316971	142502	13910	147
2012	130329138	82554	8236	61
2013	131279000	65568	5463	43

Table 1.Current Disease Burden of Malaria in UMS Towns

The epidemiological data revealed that there was a rising trend in malaria cases and deaths in some towns under UMS. More than 75 cases and more than 85% *P. falciparum* under UMS were contributed by Kolkata, Chennai, Mumbai, and Ahemdabad Corportation. Recently there was an outbreak of malaria in Mumbai city resulting in 145 deaths. The number of malaria cases and deaths has shown a declining trend since 2010 (fig. below).



Issues and challenges

There are many factors contributing to the rise of vector borne diseases including malaria and these challenges need focused attention. The major ones are described below:

(i) **Increasing urbanization:** The proportion of urban population to the total population has increased in the last few decades. This has been triggered by rural "push" (for earning livelihood and "urban pull" (for availing both medicare/ education opportunities) phenomenon.

(ii) **Poor disease surveillance activities:** While there is an extensive mechanism for active surveillance for detection of malaria cases in rural areas, there is no comparable mechanism in urban towns.

(iii) **Haphazard growth of towns:** Haphazard and unplanned growth of towns has resulted in creation of "urban slum" with poor housing and sanitary conditions, promoting vector mosquito breeding potential for malaria, filarial and dengue fever/ Dengue haemorrhagic fever.

(iv) **Drinking water supply:** In urban towns, the increasing population pressure has burst the water supply system at its seams. Regular water supply has now been replaced by intermittent supply (Delhi), and in towns located in water scarcity areas, supplies are restricted to 2 to 3 times in a week (Hyderabad & Chennai). Water storage practices in artificial containers have generated breeding potential of *Ae. stephensi,* vectors of urban malaria and *Aedes aegypti,* the vector of DF/ DHF.

(v) **Development project with Health Impact Assessment (HIA):** Development project activities without health impact assessment have resulted in malaria outbreaks in short terms and endemic malaria with foci of *P. falciparum* resistance strains in long term.

(vi) **Spatial Spread of Urban Areas:** Urban towns are expanding under population pressure spatially. There is growth of sub-cities, for example, Gurgaon sub- city, Greater Noida, Dwarka in National Capital Territory of Delhi, Navi Mumbai in Greater Mumbai etc. These projects lack infrastructure, water supply, solid waste removal resulting in heavy vector breeding potential. Vertical growth further complicated the problem with its water storage problem.

(vii) **Inadequate health infrastructure:** With rapid growth of population in urban towns, existing staff strength has not correspondingly increased, and is therefore inadequate for service delivery.

Future Vision for prevention of malaria and other VBD in Urban areas

In view of the aforesaid, it is apparent that earlier *An. stephensi* was the sole vector and the matching infrastructure was provided to control this species. With expansion of urban areas, even rural villages have now become urban villages, carrying high breeding potential for *An. culicifacies*, which require different control strategy. More than that, there is upsurge in the number of dengue and Chikungunya cases in urban situation due to changing dynamics of vector borne diseases. Imported cases of filaria are being reported in the metro- cities and need to be taken care of to interrupt active transmission and to avoid the precipitation of problem in future. In addition to malaria, control of dengue, chikungunya and filariasis require different control strategies and additional human resource with matching budgetary provision**.** Vector control activities should be evidence based on entomological surveillance and sub paradigm specific comprising more than one control strategies placed synergistically in an integrated vector management mode (IVM). Emphasis should be on source reduction, environmental and engineering methods of control, i.e. appropriate solid waste disposal and drainage, use of larvivorous fish in rain filled stagnant waters along road sides/ railway lines, abandoned cellars at construction sites and quarry pits and excavated pits of brick kilns, use of insecticide treated bed nets/ curtains in slums and use of larvicides at sites which cannot be drained. All activities should be supported by legislative measures.

Urban malaria scheme needs to be addressed now as Urban VBDs Control Scheme. The community intervention through their active involvement for prevention and control of VBDs is very essential, particularly, in source reduction, in and around their premises. The emphasis should be on inter- sectoral linkages with non- health sector (all development project) to ensure health impact assessment, Communication for Behaviour Impact (COMBI) – approach for community participation for sustainability of source reduction, application of larvicides and proper health seeking behaviour, and training of health/ non health sector in Health Impact Assessment of development projects. Proposed strategy not only fulfils these gaps but will be more cost effective and sustainable.

It is proposed to enhance the capacity of exiting 133 urban cities inclusive of 2 new towns to manage all VBDs prevalent in the urban areas. The vector control measures will focus to deal with all VBDs and special emphasis would be given for implementation of health impact assessment (HIA) component in all major developmental projects through enforcing appropriate legislature measures. The key lessons learnt during XI plan period and current challenges with respect to urban areas have already been outlined in the overall malaria

component. Based on it, the objectives of preventing mortality and morbidity due to VBDs with improved surveillance and source reduction with the help of entomological surveillance and monitoring have been highlighted under XII Plan for UMS which will be addressed under National Health Mission (NHM) encompassing both National Rural Health Mission (NRHM) and National Urban Health Mission (NUHM).

Proposed Strategy

The strategies to be implemented and additional inputs required to combat the challenges discussed in the article should be as under:

(i) Detection and management of malaria cases and other VBDs

(ii) Integrated Vector Management

(iii) Capacity building and BCC

(iv) Intersectional coordination

(v) Legislative measures - Building bye- laws

a) Sanction plans of buildings to have pre-requisites like not to construct any structure on the exterior of buildings capable of holding rain water, and

b) Clauses to be included in the contract for builders to keep "curing tanks" free of mosquito breeding during construction phase and dismantling of the same before issuance of occupancy certificate.

c) Conditions of penalty clause to be imposed on builders/ house- owners with time line for not complying with the measures of preventing/ treating mosquito breeding sites in the premises.

Inputs required

- Infrastructure development for the control of malaria in urban towns in the light of increase in area and population.
- Enhanced surveillance in slum area; IRS in slum areas
- Malaria clinics for detection and treatment in slum areas
- Improvement in management and information system to be connected, by networking, to the districts/ state and National levels.
- Implementation of civic- by- law with special staff and legal cell with compounding penalty based on socio-economic factor.
- Operational research on drug/ vector resistance studies in different geographical region including small, medium and township.
- Screening of population of migrated labourers coming from endemic districts at construction sites and industries.
- Contribution of funds from the builders and industries for undertaking anti-mosquito measures.
- Urban Malaria Scheme to be expanded to newly identified towns.
- Support for establishment and maintenance of hatcheries.
- Training/ re- training of health/ non- health sector personnel and volunteers.
- Linkage with computerized Management Information System under NVBDCP.

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