Vector Borne Diseases in Kolkata Municipal Corporation (KMC): Achievements and Challenges


Abstract

The proposal to control malaria in towns, named as Urban Malaria Scheme was approved during 1971 and it was envisaged that 131 towns would be covered under the scheme in a phased manner. Madhok Committee in 1970 investigated the problem and assessed that 10 to 12% of the total cases of malaria were contributed by urban areas. The committee recommended anti larval measures for containment of urban malaria, because it was feared that proliferation from urban to rural may spread and nullify the gains already made. Demographic and societal changes, unplanned urbanization, construction activities, increase in slum clusters, large scale migration contributed to increased vector breeding potential in urban areas. Insufficient capacities of the civic bodies to deal with water supply, sewage and solid waste disposal led to an all round disruption. Intermittent water supply led to increased water storage practices, which resulted in extensive breeding of An. stephensi, vector of urban malaria.

During XII Plan, it has been proposed to provide diagnostic and treatment facilities by establishment of malaria clinics @ 1 clinic per 20000 population with special focus to urban slums, involvement of other sectors/ private providers for diagnosis, treatment and reporting, Integrated Vector Management by larval control through source reduction, chemical larviciding and use of larvivorous fish and minor engineering and also adoption of Model civic bye- laws for prevention and control of vector breeding. The issue of increase in slum clusters, influx of population, construction activities, water scarcity, and storage practices need to be kept in mind for making a comprehensive action plan to deal with the vector borne disease in urban areas. The role of private practitioners in the urban areas is very crucial in the diagnosis and treatment following national guidelines.

Presently, UMS is functional in metro cities namely Delhi, Mumbai, Kolkata, Chenna, Hyderabad, Bangalore, and Ahmedabad. The epidemiological situation is totally dependent on the local inherent factors such as level of migratory population, construction activities, developmental projects, creation of slum clusters and water storage practices etc., which play a key role in the transmission dynamics of VBDs in these mega cities. An attempt has been made to bring out the present situation of vector borne diseases (VBDs) in Kolkata Municipal Corporation (KMC) with respect to ongoing implementation of NVBDCP strategy for the prevention and control and the challenges faced.


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Introduction

The implementation of urban malaria scheme (UMS) in 1971-72 and the modified plan of operation (MPO) in 1977 improved the malaria situation for 5-6 yrs. Malaria cases were reduced to about 2 million \(^1\). Easy availability of drugs under the MPO prevented deaths due to malaria and reduced morbidity, a peculiar feature of malaria during the resurgence. Malaria in urban areas is mainly contributed by large scale rural-urban migration triggered by rural “push” (for earning livelihood) and urban “pull” (for availing both Medicare/educational opportunities) phenomenon. Demographic and social changes, unplanned urbanization, completion of projects in total disregard of health impact assessment and incorporation of non eco-friendly technologies contributed to increased vector breeding potential. Insufficient capacities of the civic bodies to deal with water supply, sewage, and solid waste disposal led to all round disruptions. Intermittent water supply led to increased water storage practices, which resulted in extensive breeding of An. stephensi, the vector of urban malaria and Aedes aegypti, the vector of Dengue Fever/Dengue Haemorrhagic Fever (DF/DHF) in all households.

The control of malaria in the urban areas was thought of an important strategy as a programme complimentary to the NVBDCP for rural areas. Modified Plan of Operation (MPO) was designed and submitted to the Cabinet to tackle the malaria situation in both urban and rural areas in the country simultaneously. \(^3\) Under MPO, it was decided to initiate anti-larval and anti-parasitic measures to abate the malaria transmission in the urban areas \(^4\). The proposal to control malaria in towns named as Urban Malaria Scheme was approved during 1971 and it was envisaged that 131 towns would be covered under the scheme in a phased manner. This scheme was sanctioned during November 1971 and the expenditure on this scheme is treated as plan expenditure in centrally sponsored sector. The central assistance under this scheme was treated as 100 per cent grant to the State Governments in kind. From 1979-80, the expenditure on this scheme is being shared between the Centre and the State Governments on 50:50 basis. At present, Urban Malaria Scheme is protecting 115.2 million populations from malaria as well as from other mosquito borne diseases in 131 towns in 19 states and union territories.

Presently, under NVBDCP, the control of urban malaria lies primarily in persuading the concerned offices in urban areas for implementation of urban byelaws to prevent mosquito breeding in domestic and peri-domestic areas or residential blocks, government/commercial buildings, and construction sites. Use of larvivorous fish in the water bodies such as slow moving streams, lakes, ornamental ponds, etc. is also recommended. Larvicides are used for water bodies, which are unsuitable for fish use. Awareness campaigns are also undertaken by Municipal Bodies/Urban Area Authorities. \(^6\) \(^\text{--12}\) However, constraints exist in implementation of these activities including inadequate infrastructure and poor active surveillance activities.

Profile

The total area of Kolkata Municipal Corporation is approx. 206.2 sq. km, with a population of 4567535 as per census 2011. There are 15 boroughs, with 144 KMC wards, 139 ward health units and 143 KMC-run malaria clinics. The floating population is approx. 6 million and the number of slum clusters is approx. 5202. Average monthly temperature ranges from 19.8\(^0\) C in January to 30.9\(^0\) C. Average relative humidity varies from 68.1% in January 2013 to 83.6% in August 2014. Annual rainfall remains between 1400-2300 mm. 34% of the city’s population is slum population.

Human Resource

There are 5 Dy. CMHOs and 15 Borough Health Officers with 145 medical officers in KMC presently working for curative and control work. There is one Chief Vector Control Officer and 3 Consultant Entomologists for entomological activities. 20 health supervisors, 262 Bailiff, 68 malaria health assistants, 163 laboratory technicians, 78 SFWs, and 1161 field workers are being deputed for the implementation of VBDs programme in KMC. 518 honorary health workers and 1728 seasonal staff are deputed for domestic checking of breeding places during dengue season.
<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>No. of BS examined</th>
<th>No. of BS +ve</th>
<th>SPR (%)</th>
<th>Pf cases</th>
<th>ABER (%)</th>
<th>API</th>
<th>Death</th>
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<td>355293</td>
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<td>2014 (till Aug.)</td>
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<td>2876</td>
<td>2876</td>
<td>2.8</td>
<td>45</td>
<td>1.6</td>
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Table 1. Malaria Situation in KMC

The number of malaria cases in Kolkata Municipal Corporation (KMC) has shown a decline from 14226 cases (2010) to 1073 cases (2013). The proportion of Pf has been between 6 to 10 percent and the rest of the cases are due to *P. vivax*. Annual Parasite Incidence (API) has gone down in KMC from 7.9 to 4.9. Slide Positivity Rate has also shown a decline from 27.2 % to 7.7%. There has been only one death during the year 2010 in KMC.

Map 1. KMC area showing ward wise Malaria cases in 2012

Map 2. KMC area showing ward wise Malaria cases in 2013
Malaria and Climate Data for KMC (2006-2013)

Month wise data analysis of the malaria trend in KMC from 2006 – 2013 shows that there is direct relationship of increase in the average number of malaria cases reported from August to October with temperature, rainfall and humidity. The following graph depicts the month wise average number of malaria incidence with average temperature, rainfall, and humidity.

![Graph showing Malaria cases and the climatic conditions in KMC]

Dengue Problem in KMC Area

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Cases</th>
<th>Deaths</th>
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<tr>
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<td>3546</td>
<td>12</td>
</tr>
<tr>
<td>2006</td>
<td>394</td>
<td>1</td>
</tr>
<tr>
<td>2007</td>
<td>30</td>
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<td>2012</td>
<td>1852</td>
<td>2</td>
</tr>
<tr>
<td>2013</td>
<td>238</td>
<td>0</td>
</tr>
<tr>
<td>2014</td>
<td>196</td>
<td>0</td>
</tr>
<tr>
<td>(Till August)</td>
<td></td>
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There was sudden increase in the dengue cases during 2012, when 1852 cases were reported after 2005 (3546 cases). During 2013, 238 cases were reported and a total of 196 dengue cases have been reported till Aug. 2014.
Japanese Encephalitis in KMC

No report concerning indigenous case of JE was found in the past. Two patients were found positive with JE IgM antibody during 2014. One died and one is admitted and recovering. No mosquito larvae belonging to the species *Culex vishnui* (incriminated JE- vector in West Bengal) was found. Sero-surveillance for JE was undertaken in the affected areas and 24 samples were collected and tested for JE IgG antibody. All were found negative. Publicity against vector-borne diseases by auto-kening has been going in each KMC ward since July 2014, twice a week. Campaign against JE too has been incorporated in the publicity programme.

Activities for control of VBDs in KMC

EDCT of malaria is being done through 143 clinics with the treatment of every *Pf* case with ACT. Free facilities are being provided for detection of dengue NS1 antigen and IgM antibody through 5 dedicated dengue detection centres by employing the method of ELISA. Workshop on VBDs for Practising Primary Care Physicians of Kolkata was organised on 13th January. Workshop for Ward Councillors and Ward MOs of KMC was organised on 14th January. High-level meeting involving ministers of concerned departments and ward councillors was organised on 29th January. Dengue-reports were provided to patients through SMS alerts. It is comparable with the SMS info in case of bank transactions. This is a first-of-its-kind initiative in India. Drive for destruction of Mother Foci of vector mosquitoes has been initiated since January.

House visits by 650 Honorary Health Workers for fever surveillance is being made since February. Awareness-raising meetings in different wards involving ward councillors, citizens, local practising physicians were being organised since March (500 meetings were organised). 20000 banners were put up in different KMC wards. 5000 banners were put up at Durga Puja Pandals. Publicity was also done through 750 hoardings.

Distribution of 3 lakh booklets (175000 Bengali, 75000 Hindi, and 50000 Urdu) among the distinguished fellow-citizens was done through ward councillors. Distribution of multilingual multicoloured leaflets (0.8 million each against malaria and dengue) was done. Leaflets titled “Jal Bachief Masha Niyanshan” (75000 Bengali, 50000 Hindi, and 25000 Urdu) were distributed among slum-dwellers. Infrastructural development: 6 Central Rapid Action Teams were formed during 2010-2011. Apart from this, 15 Borough RATs (@ 1 Br RAT per borough) were formed in March 2013.

One efficient staff was made to work as Ward Vector Control In-charge and one staff as Borough Vector Control In-charge. Mobility support to each CRAT and BRAT was provided with a hired vehicle. System for recording daily vector control activities in each ward of KMC as per the format prepared by Entomologists, was introduced. Br RATs and Central Rats too began recording their activities on a daily basis as per the
formats provided by the department. Source elimination drive at medical colleges, hospitals, students’ hostels, office buildings, market places, construction sites, schools, educational institutions, etc was undertaken. Two such vans, each fitted with such screen, plied in KMC area for 10 hours every day during August and September. Publicity was done through CESC bills in July and August. 9 FM channels were also used for the publicity purpose for one month in September. Larvicidal spray was done in sewerage canals using 20 KMC- owned small rowing- boats as transport to destroy Culex larvae.

Entomological activities of KMC

Monitoring and Supervision: To monitor vector control activities in different wards of KMC and undertake contingency measures for prevention of any mosquito- borne disease, the health department of KMC formed 4 Rapid Action Teams (RATs, in short) in December 2010 and another 2 Rapid Action Teams in September 2011. Comprising 10-12 agency- provided trained field workers each, the 6 RATs are named as Central Rapid Action Teams, and they monitor vector control activities in 2-3 boroughs each. In March 2013, additional 15 Rapid Action Teams comprising 6 field workers each — named as Borough RATs — were formed by the department and placed at different boroughs of KMC @ 1 RAT per borough. Both the Central and Borough RATs work following the technical guidelines of 3 Consultant Entomologists of KMC. Mobility support with a hired vehicle has been provided to each RAT.

Joint Anti- mosquit o Drive Mounted Since August 2010: To destroy mosquito larvae, a joint drive involving the personnel of health and SWM, building, drainage and water supply departments of KMC, has been going on in different vulnerable wards of KMC since August 2010 on a regular basis. The drive has proved highly effective. Pertinently, this sort of drive is very important for destruction of the larvae of Aedes aegypti, which, unlike many other mosquito species, is an aggressive breeder; and, given the chance, it could breed in heaps of garbage, too, especially during rainy season.

Data Bank on Potential Mosquito Breeding Sources Prepared: A first-of-its-kind data bank on permanent potential mosquito breeding sources has been prepared by the Vector Control Department to streamline the activities for detection and destruction of mosquito larvae all across the KMC area. The data bank consists of 9048 pages containing information regarding prevalence of different kinds of potential mosquito breeding sources in all the 144 wards of KMC together with their addresses. These data were collected during 2013 by using a format prepared by the Entomologists of the department.

Going by the information obtained — there are 44,211 open masonry tanks, 4,704 open overhead water tanks, 3,829 sites with accumulated seepage water beneath overhead water tanks, 12,403 wells, 17,460 open surface drains, 3,115 ponds, 5,202 slum clusters, and 3,802 under- construction buildings. This is a historic initiative of KMC. This data bank will help streamline vector control activities KMC area.

Non- medical Staff Assigned with Vector Control Responsibilities: To step up vector control activities in KMC area, one sincere staff at ward- level and one staff at borough- level were designated to work as the Ward Vector Control In- charge (Ward VCI) and Borough Vector Control In- charge (Borough VCI) respectively.

Data Recording System Introduced: Information regarding mosquito breeding sources — including their type, addresses, type of mosquito larvae detected in them (Anopheles/ Aedes/ Culex), measures undertaken by the field workers for destruction of mosquito larvae, etc — is now recorded every day in each and every ward of KMC. The record is kept as per the format prepared by the Entomologists of KMC. Earlier, the department did not have any such system to record vector control activities. Apart from this, 15 Borough Rapid Action Teams and 6 Central Rapid Action Teams too record the findings of their inspection/ field visits as per the formats provided by the Vector Control Department.

Three-tier Monitoring System Introduced: The KMC area is divided into 15 boroughs comprising a total of 144 wards. There are 6-8 Field Workers in each ward to carry out larvicidal spray. Activities of FWs in a ward are crosschecked by the concerned Ward VCI. A Borough VCI monitors vector control activities in different wards of the respective borough with the assistance of the Borough RAT placed under him. Activities of 15 Br RATs are cross- checked by Consultant Entomologists with the assistance of 6 Central RATs. This entire three-tier monitoring system works as per the guidelines provided by Consultant Entomologists. There are 3 Consultant Entomologists in KMC.
Each Entomologist of KMC monitors field activities in different wards of 5 boroughs. They visit 2-3 wards each day during 10.30 am to 2.30 pm and crosscheck vector control activities in fields and report their observations directly to the Hon'ble MMIC (Health), Mr. Atin Ghosh, at weekly intervals. The 3 Consultant Entomologists work under the administrative control of the Chief Vector Control Officer.

**Larval Indices of *Aedes aegypti* Calculated by Consultant Entomologists on a Monthly Basis:**
By reckoning three indices of *Aedes aegypti* such as House Index (% of houses positive for *Aedes aegypti* breeding containers), Breteau Index (number of *Aedes aegypti* breeding containers per 100 houses) and Container Index (% of water containers positive for *Aedes aegypti* larvae), the Consultant Entomologists of KMC have since January 2011 been measuring larval densities of this vector mosquito in different wards of KMC, following the instructions of Mr. Ghosh. The prime objective of undertaking such surveillance is to make an assessment of the impact of ongoing field activities in different wards of KMC regarding *Aedes* control.

**Use of Pupal Index (PI) of *Aedes aegypti* as a means of Nabbing Deceitful Field Workers:**
Presence of *Aedes* pupae in a water holding site/container in and around a house anywhere in KMC area is an indication that the house has not been inspected by the concerned vector control staff over the past one week. By calculating the **Pupal Index** of *Aedes aegypti* (number of containers with *Aedes aegypti* pupae per 100 houses) in a ward, it is possible to get an idea of the quality of the ongoing anti-*Aedes* drive in the ward. In other words, nabbing deceitful FWs is possible by calculating this index. Greater the PI, lesser is the intensity of *Aedes* control drive.

**Antilarval operations:**
1. Need-based larvicidal spray goes in all the 144 wards of KMC. 2. Larvicides used are NVBDCP- approved Bti-WP, Bti-12AS and Temephos 50% EC. 3. Larvicidal spray is done only in those breeding sites from which accumulated water cannot be removed or managed otherwise. 4. In Kolkata, *Anopheles stephensi* breeds more in rainwater containers than in chlorinated water containers. Hence during rainy season, attempt to remove accumulated rainwater from localities is made by the service of the Drainage Department of KMC. 5. *Aedes aegypti* is a small container breeder. 6. During rainy season, heaps of garbage holding rainwater in different kinds of small discarded items (plastic cups, tea-pots, coconut shells, tin cans, tyres, etc) also turn into breeding grounds of *Aedes aegypti*.

To deal with this problem, arrangements for disposal of garbage are made on a regular basis by involving the department of Solid Waste Management of KMC.


1. **Maintaining a close liaison with sentinel hospitals and dengue detection centres of KMC:** The department will keep in touch with all the city-based sentinel hospitals to get the early signal of an impending outbreak of dengue/chikungunya in KMC area. Information concerning detection of dengue or chikungunya cases by private pathological laboratories and other such non-government health establishments too will be collected on a regular basis. This will help pinpoint the wards requiring greater attention for control of dengue and chikungunya.

2. **Mapping of vulnerable wards:** This will be done in January using the last year’s data and on the basis of the map prepared; preventive activities will be stepped up from February.

3. **Reorientation of vector control staff:** This will be done in January using the last year’s data and on the basis of the map prepared; preventive activities will be stepped up from February.

4. **Disposal of tyres:** During rainy season, tyres in Kolkata turn into suitable breeding sites of *Aedes aegypti*. Hence old tyres, if found stacked in the open space will be removed with the help of the department of solid waste management of KMC. Scraps, coconut shells, plastic containers, glasses and other such discarded items too will be disposed properly by this department, and the job will be done in the pre-monsoon period, especially during May - June.

5. **House-to-house visits by Honorary Health Workers and 100 days Workers:** Both *Anopheles stephensi* and *Aedes aegypti* commonly breed in freshwater containers/sites in and around human-dwellings. To deal with the problem, house-to-house visits at weekly intervals will be intensified in all high-risk wards. Such drive will continue throughout the year.

6. **Periodic visits to places of congregations:**
Places of congregations such as schools, colleges, medical colleges, hospitals, workplaces, market areas, hostels and office buildings will be kept under strict vigil, and inspection of these places will be done by Rapid Action Teams (6 Central
Rapid Action Teams and 15 Borough Rapid Action Teams) on a regular basis to prevent breeding of Aedes aegypti. This drive will continue throughout the year.

7. Monitoring of larval densities of Anopheles stephensi and Aedes aegypti: To monitor the impact of KMC- sponsored vector control activities, larval indices of both Anopheles stephensi and Aedes aegypti (i.e. HI, CI, and BI) will be calculated throughout the year in all the vulnerable wards of KMC by the Entomologists.

8. Use of larvivorous fish: Basement water tanks and other such big perennial water storage tanks will be stuffed with guppy fish Poecilia reticulata.

9. Larvicidal spray: Need- based larvicidal spray will be done in all the 144 wards throughout the year. Containers/ sites that cannot be managed otherwise will be subjected to such spray.

10. Issuance of notices u/S 496 (2) of the KMC Act, 1980: To prevent mosquito breeding at construction sites and human- dwellings, notices under Section 496 (2) of the KMC Act, 1980, will be issued to promoters/ developers/ house- owners as and when required.

11. Fogging with pyrethrum (2% extract): Fogging is unlikely to have any impact on adult vector mosquito population, except when applied indoors. In view of this, only indoor fogging with pyrethrum (2% extract) will be done as a contingency measure exclusively in and around dengue/ Falciparum malaria positive households @ 50 households surrounding each positive household following the advice of Consultant Entomologists.

12. Observation of anti- malaria month through IEC activities: Anti- malaria month will be observed in June through various mass awareness campaigns.

13. Observation of anti- dengue month through IEC activities: Anti- dengue month will be observed in July through various IEC activities. Mass awareness campaign will be made through TV channels, FM radios, newspapers, leaflets and other means. Ward Councillors too will be involved at ward- level IEC campaign. Campaign will continue till October.

Discussion

An. stephensi is well established in metro and mega cities having water supply through pipes or overhead tanks or underground tanks. There is lack of infrastructure with most of the municipalities/ corporations. The issue of increase in slum clusters, influx of population, construction activities, water scarcity and storage practices need to be kept in mind for making a comprehensive action plan to deal with the vector borne disease in urban areas. The role of private practitioners in the urban areas is very crucial in the diagnosis and treatment following national guidelines. Malaria control in urban areas requires careful study and intensive larval control based on the species sanitation approach developed by Covell.

During XII Plan, it has been proposed to provide diagnostic and treatment facilities by establishment of malaria clinics @ 1 clinic per 20000 population with special focus to urban slums, involvement of other sectors/ private providers for diagnosis, treatment and reporting. Integrated Vector Management by larval control through source reduction, chemical larviciding and use of larvivorous fish and minor engineering and also adoption of Model civic bye- laws for prevention and control of vector breeding.

The Government of India has launched the National Urban Health Mission (NUHM) as a sub- mission under the National Health Mission (NHM), with the National Rural Health Mission (NRHM) being the other sub- mission. NUHM seeks to improve the health status of the urban population particularly slum dwellers and other vulnerable sections by facilitating their access to quality health care. NUHM would cover all state capitals, district headquarters and other cities/ towns with a population of 50,000 and above (as per census 2011) in a phased manner. Cities and towns with population below 50,000 will be covered under NRHM.

Key features of NUHM includes Urban- Primary Health Centre (U-PHC): Functional for approximately 50,000 population, the U-PHC would be located within or near a slum, and Urban- Community Health Centre (U-CHC) and Referral Hospitals: 30- 50 bedded U-CHC providing inpatient care in cities with population of above five lakhs, wherever required and 75-100 bedded U- CHC facilities in metros. Outreach services will be provided through Female Health Workers (FHWs)/ Auxiliary Nursing Midwives (ANMs) headquartered at the UPHCs. Provision of Mahila Arogya Samiti (MAS) and Link Worker/ ASHA area of about 1000- 2500 persons/ between 200- 500 households has also been kept to serve as an effective and demand- generating link between the health facility and the urban slum.
population. It becomes very important now from NVBDCP point of view under NUHM to make concerted efforts in strengthening of diagnosis and treatment of not only malaria but also other vector borne diseases i.e. Dengue, Chikungunya, Lymphatic Filariasis and Japanese Encephalitis, which are also posing public health problems in some urban towns.

However, the issues for the VBDs in KMC namely the expansion of urban area (horizontal and vertical), large scale migration, construction activities, inter-sectoral coordination, implementation of civic bye-laws and inadequate monitoring and supervision will remain major challenges in future to overcome.

References

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