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## **Research Article**

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# A community based model for effective malaria control in a known endemic area of a metropolitan city

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#### **ABSTRACT**

**Background:** Malaria is a global health problem causing impact on Health and socio economic development of country. Mumbai city with high density population is endemic region with unstable malaria transmission. Surveillance data of malaria cases in tertiary care hospital indicated the need for strategic plan for community based effective interventions. This highlights sharing information, strengthening community partnerships and a structured plan for malaria control in addition to the regular surveillance activities of public health department.

**Methods:** 2 city zonal areas (wards) having high prevalence of malaria cases and deaths in the previous year were identified as study units. One of the 2 wards was designated as control unit where no interventions (were executed by the investigator). In study area activities were implemented in three phases. 1) Preparatory - baseline epidemiological survey, enlistment of risk factors. 2) Interventional - enlistment and elimination of breeding places, mobilizing supportive community participation, team building with PSM department faculty, public health department staff, general practitioners, youth club members and the co-operative societies. 3) Evaluation - compliance of housing societies, analysis of indicators& comparison of prevalence with previous year.

**Results:** In study area no deaths are reported in 2010. 12 deaths in 2010 in control area. Also number of malaria cases in 2010 in study area were drastically reduced as compared to 2009.

**Conclusions:** Malaria control is essentially a multidimensional event dependant on active community participation. Malaria control cannot be achieved in isolation by singular efforts of the Public Health Department alone. A community based multipronged approach is necessary for malaria control in urban area.

Keywords: Community partnerships, Structured action plan

#### INTRODUCTION

Malaria is a global health problem causing unacceptable burden on health and economic development of various countries. In India in 2010 total malaria cases were 1.04 million. Out of which pf cases were 0.56 million. Total deaths were 547 & API was 1.36.About 10% of total cases of malaria are reported from urban area. In 2010 from urban area there were 111486 cases of malaria out

of which pf were 15332(13.75%). The SPR was 2.81, SFR was 0.39 while total deaths reported were 118.<sup>2</sup>

In Mumbai under NVBDCP the regular surveillance activities undertaken by public health department of Mumbai are suspect malaria case detection, blood smear collection, treatment of cases, indoor residual spraying.<sup>3</sup>

Under IDSP surveillance data of malaria cases compiled on a daily basis in tertiary care hospital indicated that there was a need for evolving local innovative strategies to strengthen regular surveillance activities as recommended in strategic model for urban malaria control through NVBDCP.<sup>4</sup>

The surveillance data when analyzed epidemiologically provided insights into the time, place, person distribution of malaria cases in the community. Thus the existing trend of malaria in the study area was assessed& appropriate interventions strengthening the malaria control activities were evolved. Need based interventions then utilized in the study areas have led to evolving a strategic model for community based activities.

#### **METHODS**

#### Study design

The present study is prospective interventional study undertaken during the monsoon period, from June to September 2010.

#### Data collection

The study was carried out in 3 phases - preparatory phase, intervention phase and evaluation phase.

#### Preparatory phase

In preparatory phase scrutiny and analysis of past & present malaria cases was done. Cases were mapped to identify highly prevalent area in Mumbai city. Based on malaria surveillance case records of tertiary care hospital IDSP unit, area with high morbidity and mortality were identified as study area. The F south and G south ward areas indicated high prevalence of cases. Out of these two wards F south ward areas was selected as study area. The F south area was divided in 6 residential units within one zone reporting maximum number of malaria cases and deaths were identified. The cluster area was designated as intervention area & the rest of area was designated as internal control area.

The area comprises of 6 residential units with a population of 6330. Advocacy meetings with public health department were held initially to explain the plan. Team for community surveillance activity was formulated which comprises of public health department staff, health post staff, members of youth club, faculty and residents from PSM department. The schedule for activities was planned according to community convenience. Meetings with general practitioners were held fortnightly.

#### Description of study community

Study community comprises of 6 residential units with around 1000 households and 6330 population. These households are about 200 meter away from railway tract. The area includes a non-functioning mill and 2

construction sites. There is one health post for providing health care services. Two youth clubs are functioning in the area. There are organized dwellings and few slum inhabitants near railway tracts, surrounded by new building construction sites.

There was abundant presence of potential breeding sites such as flower pots, scrap material, uncovered storage and overhead tanks.

#### RESULTS

A standardised protocol for community action as a part disease surveillance for vector borne diseases is evolved as evident in Table 1.

Table 1: The various activities carried out include.

| Various activities carried out include |  |
|--|--|
| Preparatory phase                      |  |

Baseline epidemiological survey

Community survey

Estimation of indices

Morbidity and mortality indicator assessment

Enlistment of risk factors

#### **Interventional phase**

*Operational:* 

Sensitization of local housing society executive members through interventions and correspondence for ensuring establishment of malaria proof overhead tanks and other measures

Enlistment of breeding places

Elimination of breeding places

Follow up

Need assessment

Managerial:

Planning & coordinating various activities of malaria control in the community. Handholding by Public Health personnel for preparation of microaction plan by the community.

Advocacy:

Meetings held with general practitioners, public health department staff, youth club, members, local leaders

Health education given to community

Mobilization of community for local meetings

Promotion of 'Sunday service day'

Display of boards at strategic places highlighting control measures adapted by a family locally

Liasional:

Joint collaboration effort with public health department in elimination of breeding places.

# **Evaluation phase**

Coverage of housing societies

Extent of mosquito proof tanks

Coverage of population with IEC

Assessment of indicators of malaria control

Compilation and analysis of disease indicators through IDSP

Comparison of prevalence with previous year

A comparison of occurrence of diagnosed malaria cases in the years 2009 and 2010 in the interventional area shows number of cases as 135 and 334 respectively. In control area the cumulative number of cases of malaria is 2360 in the year 2009 and 4692 in the year 2010. In 2009 the prevalence of Plasmodium vivax infection amongst total cases shows no difference, 97 cases (71.85%) in 2009 and 237 (70.95%) in 2010 in the interventional area.

Similar pattern is reflected in control area including predilection for both Plasmodium vivax and plasmodium falciparum infection.

The total number of deaths reported in the year 2010 is 11 in the control area where as it is nil in the study area, where interventions were planned in a structured sequential manner (Table 2).

| Table 2: Morbidity and mortality profile of malaria in study area | Table 2: Morbidity | and mortality | profile of malaria | a in study area |
|---|--------------------|---------------|--------------------|-----------------|
|---|--------------------|---------------|--------------------|-----------------|

| Morbidity & mortality profile   | Interventional area<br>(Study area) |              | Control group<br>(Entire ward area) |               |  |
|---------------------------------|-------------------------------------|--------------|-------------------------------------|---------------|--|
|                                 | 2009                                | 2010         | 2009                                | 2010          |  |
| Total No. of cases month wise   | 135 (100%)                          | 334 (100%)   | 2360 (100%)                         | 4692 (100%)   |  |
| July                            | 20 (14.81%)                         | 230 (68.86%) | 327 (3.85%)                         | 2312 (49.27%) |  |
| August                          | 39 (28.88%)                         | 71 (21.25%)  | 604 (28.02%)                        | 1315(28.02%)  |  |
| September                       | 31 (22.96%)                         | 19 (5.68%)   | 671 (28.43%)                        | 606 (12.91%)  |  |
| October                         | 45 (33.33%)                         | 14 (4.19%)   | 758 (32.11%)                        | 459 (9.78%)   |  |
| Total No. of cases species wise | 135 (100%)                          | 334 (100%)   | 2360 (100%)                         | 4692 (100%)   |  |
| Plasmodium Vivax                | 97 (71.85%)                         | 237 (70.95%) | 1830 (77.54%)                       | 3624 (77.25%) |  |
| Plasmodium falciparum           | 38 (28.15%)                         | 89 (26.65%)  | 477 (20.21%)                        | 780 (16.62%)  |  |
| Mixed infection                 | -                                   | 8 (2.40%)    | 53 (2.24%)                          | 108 (2.35%)   |  |
| Total No. of deaths month wise  | 2                                   | 0            | 4                                   | 11            |  |
| July                            | -                                   | -            | 1                                   | 2             |  |
| August                          | -                                   | -            | 1                                   | 3             |  |
| September                       | -                                   | -            | 1                                   | 3             |  |
| October                         | -                                   | -            | 1                                   | 3             |  |
| Total population                | 6200                                | 6330         | 353569                              | 359580        |  |

The slide positivity rate in the study area is 20.7% in the peak month of September 2010 where as it is 5.2% in the

control area. But the control area includes both fever and non-fever cases in the denominator, hence the reduced SPR in the control area is illusive (Table 3).

Table 3: Year and month wise SPR of study and control area.

| Area                      | Month     | SPR (2009) | Total BS (2009) | SPR (2010) | Total BS (2010) | Z score | P value | Significance |
|---------------------------|-----------|------------|-----------------|------------|-----------------|---------|---------|--------------|
|                           | July      | 6.3        | 315             | 32.5       | 708             | 11.749  | 0.000   | HS           |
| Study area                | August    | 10.9       | 357             | 15.9       | 447             | - 2.09  | 0.02    | HS           |
| (fever cases only)        | September | 14.4       | 215             | 20.7       | 92              | - 1.29  | 0.119   | NS           |
|                           | October   | 28.3       | 159             | 17.8       | 119             | 3.557   | 0.001   | HS           |
|                           | July      | 4.9        | 6735            | 13.5       | 15791           | -22.730 | 0.000   | HS           |
| Control area              | August    | 7.1        | 8518            | 8.3        | 15901           | - 3.390 | 0.000   | HS           |
| (fever & non fever cases) | September | 10.7       | 6297            | 5.2        | 11568           | 12.475  | 0.000   | HS           |
|                           | October   | 14.6       | 5177            | 5.2        | 8815            | 17.255  | 0.000   | HS           |

The monthly blood examination rate in the year 2010 in the study area is 1.45 in correlation with SPR of 20.7. But in the control area MBER is 3.21 in correlation with SPR of 5.2 in control area. This indicates that MBER as an

indicator correlates with the situational analysis and impact of interventions in the study area (Table 4). The activities performed in the interventional areas facilitated enlistment of preventive actions completing the canvas of disease surveillance in malaria control.

**Table 4: Estimation of malaria indices.** 

|                               | MBEI     | ₹       | SPR     |       |  |  |
|-------------------------------|----------|---------|---------|-------|--|--|
|                               | 2009     | 2010    | 2009    | 2010  |  |  |
| Study area (Fever cases only) |          |         |         |       |  |  |
| July                          | 5.08     | 11.18   | 6.3     | 32.5  |  |  |
| August                        | 5.75     | 7.06    | 10.9    | 15.9  |  |  |
| September                     | 3.46     | 1.45    | 14.4    | 20.7  |  |  |
| October                       | 2.56     | 1.87    | 28.3    | 17.8  |  |  |
| Control are                   | ea (Feve | r & non | fever c | ases) |  |  |
| July                          | 1.90     | 4.39    | 4.9     | 13.5  |  |  |
| August                        | 2.40     | 4.42    | 7.1     | 8.3   |  |  |
| September                     | 1.78     | 3.21    | 10.7    | 5.2   |  |  |
| October                       | 1.46     | 2.45    | 14.6    | 5.2   |  |  |

Table 5: Community based interventions in study area (6 months).

| Community based interventions in study are                                   | ea (6 months) |
|--|---------------|
| Number of households visited   | 1000          |
| Total Population covered   | 6330          |
| Total number of overhead tanks   | 8             |
| Number of overhead tanks made mosquito proof                                 | 2             |
| Number of overhead tanks already mosquito proof                              | 6             |
| IEC material distributed (handouts, pamphlets)                               | 1000          |
| IEC material used (posters, banners)   | 12            |
| Advocacy meetings held with - NGO, PP and CHS members, members of youth club | 4             |
| Actual and potential breeding places identified and eliminated               | 6             |
| Total follow up visits conducted by MPW (every weekly)                       | 24            |
| Estimation of indices done   | MBER, SPR     |
| Key-epidemiological factors identified                                       | 4             |
| Health education sessions conducted  | 2             |

Table 6: Epidemiological determinants of malaria in study area.

| Epidemiological factors  | Number   |
|--|----------|
| New Construction sites   | 2        |
| Presence of railway tract  | 1        |
| Presence of non-functioning mill for several years   | 1        |
| Actual and potential breeding places i.e. flower pots, scrap material, uncovered water storage tanks, overhead tanks etc. in houses. | Abundant |

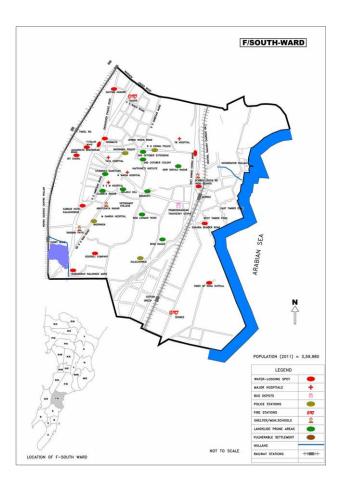


Figure 1: Map of the area - The highlighted area is intervention area while rest of the ward area is internal control area.

## **DISCUSSION**

The preparatory phase of the study enabled the investigators to plan the subsequent phases of intervention and evaluation. The high risk pockets with in the study area could be mapped and strategic actions could be focussed in the study community.

The operational, managerial, advocacy and liasioning with public health department ensured community participation, total compliance of control measures including active disease surveillance. The actual and potential breeding sites were not only eliminated but further development of breeding sites was also prevented during the designated period i.e. monsoon and post monsoon period (Table1).

The number of cases increased by 2-2.5% in both study and control areas. The peak number of cases are seen in the month of July in both the areas. The impact of multipronged interventions becomes evident in the month of August reaching upto disease control status by the end of October. The prevalence of mixed infections in malaria is more evident in control area and the presence of plasmodium falciparum cases show reduction in both the areas. However the number of Plasmodium vivax

cases predominates in both the areas. The number of deaths due to malaria is distinctly more in control area. In study area, there are no deaths in the year 2010. This is probably attributable to the consistent interventions implemented in study area since year 2009 (Table 2).<sup>5,6</sup>

The slide positivity rate in study area is estimated amongst the total number of fever cases only whereas in control area it is estimated with the denominator including both fever and non-fever cases (as per available data). Hence SPR appears to be higher in study area as compared to the control area, the "at risk" population is clearly defined in the study area and therefore the sequential decrease in the SPR in the study area is an indirect indication of the effect of the interventions carried out in the study area (Table 3).<sup>7,8</sup>

The decrease in MBER is evident in study area in the year 2010 as compared to the control area. The SPR reduction is more pronounced in the study area in 2010 as compared to the year 2009. The variations in SPR in control area becomes indeterminate, since the denominator includes both fever and non-fever cases (Table 4).

The outcomes of the interventions are correlated with active community participation in malaria control activities. The enlistment of key epidemiological factors identified in the study area indicate the complexity and diversity of the problem of malaria and its control measures (Table 5, 6).

#### **CONCLUSIONS**

Malaria control is essentially a multi-dimensional, multi-factorial event which requires active community participation. Malaria control cannot be achieved in isolation by singular efforts of the public health department alone. A multipronged approach as enlisted in Table 1 is practical & relevant to the strategy of malaria control in the urban area. Following community based activities can be undertaken to reduce malaria burden in the community

- The local housing society members must be actively involved in the elimination of breeding places &promotion of awareness programmes in their residential premises.
- 2) Key executive members of local housing societies be involved through interactive meetings conducted under convenorship of local health authority with other stakeholders. (Viz. local municipal councillor, engineering department, insecticidal officer, public works department etc.)
- An appeal in writing from the local health authority to all housing society members regarding malaria prevention and control measures must be made during pre-monsoon period.

- 4) Micro action plan for societies should be developed by the society members themselves and be duly endorsed by the local health authorities as per activities specified in the interventional phase of the study (Table 1 & 5). Local public health authority must monitor compliance of these activities.
- 5) Vector control measures under Mumbai, municipal corporation act section 380, 381A,B,D, 374, 375, 471, 472, 488 should be stringently implemented to create a sense of self responsibility towards malaria control measures. <sup>10</sup>
- 6) A malaria free housing society during the monsoon period from June to October should be facilitated for their consistent achievement by the local health authority.
- Promotion of 'Sunday service day' in interest of malaria control in the monsoon period will be meaningfully utilized for community based malaria control activity.
- 8) Key messages for malaria control, should be displayed at strategic points in the housing society areas.
- Need based interventions structured as per the convenience of the community is the key for provoking community participation in malaria control.

Sensitisation, motivation and sustainable involvement of community through supportive handholding supervision are vital for success of malaria control activities, in the local community.

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