Volume : 1 | Issue : 5 | Nov 2012 • ISSN No 2277 - 8160

Research Paper | Medical Science

A Comparative Study in Purview of Malaria and Dengue on Changes in Vector Indices in Ahmedabad (India)

Dr Anand Solanki	Assistant Professor Dept of Community Medicine, AMC MET Medical College & LG Hospital, Ahmedabad
Dr Urvish Joshi	Assistant Professor Dept of Community Medicine, AMC MET Medical College & LG Hospital, Ahmedabad
Dr Umesh Oza	Associate Professor Dept of Community Medicine, AMC MET Medical College & LG Hospital, Ahmedabad
Dr Rajashree Bhatt	Assistant Professor Dept of Community Medicine, BJ Medical College & Civil Hospital, Ahmedabad
Dr Sheetal Vyas	Professor & Head Dept of Community Medicine, AMC MET Medical College & LG Hospital, Ahmedabad
Dr Mahesh Chauhan	Tutor Dept of Community Medicine, AMC MET Medical College & LG Hospital, Ahmedabad
Dr Pinkal Patel	Tutor Dept of Community Medicine, AMC MET Medical College & LG Hospital, Ahmedabad
Dr Margeyi Mehta	Assistant Professor Dept of Biochemistry, Govt. Medical College and SSG Hospital, Vadodara

ABSTRACT

Introduction *Malaria is one of the major public health problems in India. Malaria and Dengue cases are on rise in major cities including Ahmedabad owing to rapid urbanization, industrialization and humidity. Monsoon patterns are changing due to global warming. Present study was carried out to compare the vector breeding in Ahmedabad in 2011 and 2012 in different quarters.*

Methodology *Field areas (urban slums) catered under public health service delivery of total 9 wards of south zone under AMC were selected based on systematic random sampling, were checked for vector breeding sites for first two quarters of 2011 and 2012. House Index, Brateu Index, Container Index and attack rate of fever were calculated and compared.*

Results *All indices (HI, BI, CI & AR) reduced in corresponding quarters of 2011 and 2012. The quarterly-compared difference in HI or BI reduction (From 1.8 to 0.67 in Q1 and from 1.85 to 0.92 in Q2) was statistically insignificant. Inter-year CI reduced from 0.5 to 0.28 in Q1 and from 0.6 to 0.33 in Q2. Fever attack rate also reduced. Differences were statistically significant. In 2011, inter-quarter HI, BI and CI decreased while fever attack rate remained unchanged. In 2012, inter-quarter HI, BI, CI and fever attack rate rose in second quarter and differences were statistically significant especially for CI and fever attack rate.*

Conclusions *All indices rose in one year from 2011 to 2012. The same indices also rose within an individual year. Rise in indices from Q1 (non-transmission season) to Q2 (pre-transmission/transmission season) is logical but the same rise is quite significant in 2012 which makes the review of ongoing vector control measures imperative. Source reduction is the key towards effective malaria control.*

KEYWORDS: House index, Brateu index, container index, attack rate of malaria, dengue, urban vector-borne diseases

INTRODUCTION

After sub-Saharan Africa having the highest burden of malaria cases and deaths, in Asia, India is one of the badly affected country in terms of vector-borne diseases especially malaria and dengue [1], Malaria is one of the major public health problems in the country. There are about 216 million cases of malaria (with an uncertainty range of 149 million to 274 million) and an estimated 655 000 deaths in 2010 (with an uncertainty range of 537 000 to 907 000). [1] Approximately 2 to 3 million new cases of malaria arise every year and it still remains the most important cause of morbidity and mortality in India. [2] I All preventive and control measures for vector-borne diseases are implemented through National vector borne disease control program (NVBDCP) in India and the programme is vertically implemented nation-wide.

Around 1.5 million laboratory confirmed cases of malaria are annually reported in India. In Gujarat, 89764 malaria cases were reported in 2011 with 127 deaths with 17.9% of them being P. falciparum (Pf) cases. In 2012, the total malaria cases in the state are 13420 by the month of May with Pf cases proportion reduced to 7.1% [3]. In Ahmedabad city the number of cases was 7,158 with P. Falciparum cases 1265 and percentage being 17.7% [4]. Dengue cases are on rise in major cities of the country and Ahmedabad is also reporting higher dengue cases from October 2012. [4, 5]

Ahmedabad is the financial capital of Gujarat state worth 6 million population and one of the biggest as well as fastest developing cities in India. Rapid urbanization, immense industrialization and constantly humid temperature are some of the factors responsible for mosquito breeding and resultant urban epidemic of malaria. Government healthcare delivery and implementation of NVBDCP in the urban areas are through 56 Urban Health Centers spread in 6 zones.

Vectors for malaria and dengue are species of anopheline and aedes mosquitoes respectively. Generally, the vector breeding increases during transmission seasons which is considered to be the rainy season. Transmission season for malaria in the city of Ahmedabad is believed to be from May to August. Monsoon patterns in the country are changing which might be the result of global warming. With changing trends in monsoons, breeding patterns of vectors are also assumed to be changing. Data of recent years are suggestive of the same. Compared to 2011, a significant rise in the number of cases of plasmodium vivax (Pv) has been observed in the city of Ahmedabad in 2012 [6, 7]. Efforts have been made to understand possible parasitological and vector-related changes or mutations.

Present study was carried out to observe and compare the vector breeding in the city of Ahmedabad in two consecutive years of 2011 and 2012 in different transmission and non-transmission months.

METHODOLOGY

Almost 6 million of population of the metro city of Ahmedabad is catered by 6 different geographical zones. More than half of the city population is slum. Ahmedabad Municipal Corporation (AMC) takes care of the healthcare service delivery in these areas through Urban Health Centers (UHCs). Private practitioners also render their services to the population.

Study area & design
Data of recent years are suggestive of higher incidence of malaria and dengue cases, especially in the south zone which includes 9 wards, worth total population of almost 1 million. Field areas catered under public health service delivery of total 9 wards of south zone were selected based on systematic random sampling and their data were included in the study. All field practice areas of the UHCs were visited by the medical professionals with entomological expertise of AMC MET Medical College and LG Hospital (Ahmedabad) for two consecutive years of 2011 and 2012. Aedes and anopheles were the vectors in question.

Study tool
Intra-domestic breeding in the visited areas was checked manually with team of experts from Department of Community Medicine, AMC MET Medical College, Ahmedabad. A pre-set, pre-tested format which was adapted from the national programmatic guidelines for malaria surveillance was also used for obtaining data.

Study variables
House Index (HI), Brateu Index (BI), Container Index (CI) and attack rate of fever (AR) in the studied houses were calculated and compared.

Study period
Data of 6 months from January to June for both the years (2011 and 2012) were taken into consideration. 6 months of each year were divided into two quarters. First quarter (Q1) stood for months of January, February and March while second quarter (Q2) stood for April, May and June. Vector breeding and disease transmission season in this part of the world is considered to be in monsoon months. The purpose to consider these 2 quarters for analysis was to analyze the operational efficiency of the ongoing activities in preparatory phase (in terms of vector control) as well as during actual vector-breeding/disease-transmission season.

Analysis
Data entry was done in MS Excel and analysis was carried out in MedCalc v10.

Study limitation
Only intra-domestic breeding was taken into consideration to assess the burden on individual level. Peri-domestic breeding in public places like construction sites, ponds, etc. was excluded from observations. Further studies can be carried out involving the latter.

RESULTS
No. of supervised wards reduced to 22 in 2012 from 31 in 2011 in the corresponding quarters (from 16 wards to 10 wards in Q1 and from 15 wards to 12 wards in Q2). [Table 1]

Urban slums were monitored for the said objectives. The population covered for objectified supervision was almost the same in both the years (11,751 individuals in 2011 and 11,797 individuals in 2012). [Table 1]

From 2011 to 2012, no. of houses as well as containers found positive for vector breeding reduced from 22 to 9 in first quarter and from 27 to 12 in second quarter. Similarly, no. of fever cases found in the reviewed habitats reduced from 9 to 1 in first quarter and from 11 to 4 in second quarter for both the years. [Table 1]

Indices were compared for 2011 and 2012 (inter-year comparison between 2011 and 2012).

House index (HI) reduced in 2012 compared to 2011 in both corresponding quarters (From 1.8 to 0.67 in Q1 and from 1.85 to 0.92 in Q2). The findings were similar for the Brateu's index (BI) as well. The quarterly-compared difference in HI or BI reduction was statistically not significant. [Table II]

Container index (CI) also reduced in 2012 compared to 2011 in both corresponding quarters (From 0.5 to 0.28 in Q1 and from 0.6 to 0.33 in Q2). This quarterly-compared difference in CI reduction was statistically significant. [$\chi 2$ 5.17 at df 1, $p < 0.05$ for first quarter and $\chi 2$ 5.6 at df 1, $p < 0.05$ for second quarter] [Table II]

Fever attack rate also reduced in 2012 compared to 2011 in both corresponding quarters. (From 0.1 to 0.01 in Q1 and from 0.15 to 0.07 in Q2). The quarterly-compared difference in fever attack rate was statistically highly significant. [$\chi 2$ 144.7 at df 1, $p < 0.001$ for first quarter and $\chi 2$ 67.013 at df 1, $p < 0.001$ for second quarter] [Table II]

Besides the 'inter-year' comparisons, 'intra-year' indices were also compared.

In 2011, HI, BI and CI decreased from first quarter to second quarter (the rise was 0.6, 0.6 and 0.15 respectively). None of these changes were statistically significant. Similarly, no difference was observed in fever attack rate from first quarter of 2011 to second quarter of 2011. [Table II, Chart I]

In 2012, HI, BI and CI rose from first quarter to second quarter (the rise was 0.25, 0.25 and 0.05 respectively). The increase in HI and BI were statistically significant [$\chi 2$ 5.36 at df 1, $p < 0.05$] while it was statistically highly significant in the case of CI [$\chi 2$ 14.3 at df 1, $p < 0.001$]. Similarly, there was a rise of 0.06 in fever attack rate from first quarter of 2012 to second quarter and this increase was statistically highly significant. [$\chi 2$ 591.4 at df 1, $p < 0.001$] [Table II, Chart II]

Table 1 – Year and quarter-wise break-up of reviewed population and positive habitats

Year	Year Quarter	Population covered	No. of houses covered	No. of houses positive for vector breeding	No. of containers checked	No. of containers positive for vector breeding	No. of fever cases found
2011	Quarter 1	4209	800	22	2702	22	9
2012		5189	1000	9	2649	9	1
2011	Quarter 2	7542	1500	27	4751	27	11
2012		6608	1300	12	3551	12	4

Table II – Inter and intra-year comparison of indices between corresponding quarters of 2011 and 2012

Year	2011	2012	Decrease	Statistical significance at 95% CI	2011	2012	Decrease	Statistical significance
	Quarter 1				Quarter 2			
House Index (HI)	1.83	0.67	1.16	$\chi 2 = 1.06$ at df 1, $P = 0.30$	1.23	0.92	0.31	$\chi 2 = 1.46$ at df 1, $P = 0.2275$
Container Index (CI)	0.55	0.28	0.27	$\chi 2 = 5.17$ at df 1, $P < 0.05$	0.40	0.33	0.07	$\chi 2 = 5.60$ at df 1, $P < 0.05$
Brateu's Index (BI)	1.83	0.67	1.16	$\chi 2 = 1.06$ at df 1, $P = 0.30$	1.23	0.92	0.31	$\chi 2 = 1.46$ at df 1, $P = 0.2275$
Attack rate of fever	0.15	0.01	0.14	$\chi 2 = 144.72$ at df 1, $P < 0.001$	0.10	0.07	0.03	$\chi 2 = 67.01$ at df 1, $P < 0.001$

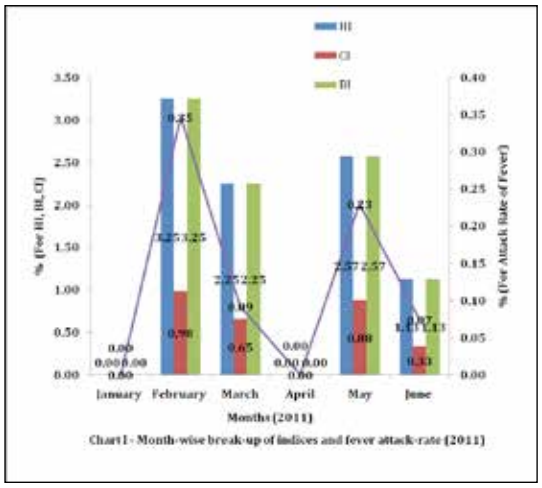

Chart I - Month-wise break-up of indices and fever attack-rate (2011)

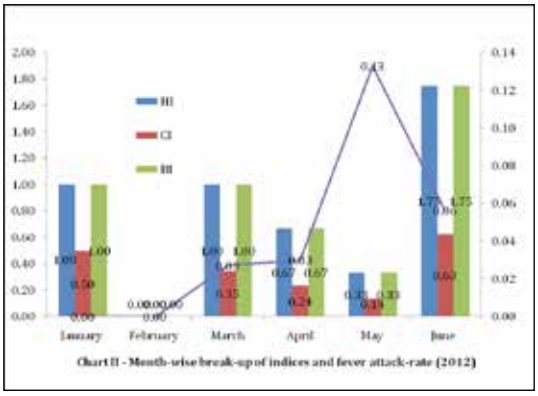

Chart II - Month-wise break-up of indices and fever attack-rate (2012)

DISCUSSION

Breeding-related indices mainly HI, BI and CI were taken into consideration.

All indices (HI, BI and CI) for 2012 were higher compared to 2011. Corresponding quarters of two years were compared. The rise in indices over a year is suggestive of level of operational efficiency of the healthcare machinery involved in malaria control in the study period.

Consecutively, the rise in CI and attack rate is statistically significant. This suggests that the number of containers found positive for mosquito larva breeding have increased over one year. The population in reviewed areas has remained almost stagnant over one year, still the number of fever cases in the same i.e. the attack rate has increased significantly from 2011 to 2012. This is alarming because the fever cases have increased in corresponding quarters of two years within an almost stagnant population and hence it calls for stringent review of ongoing measures. The rise is minimal in case of HI and BI and statistically not significant.

Intra-year analysis also suggests the rise in HI, BI, CI and attack rate in both the years of 2011 and 2012. Interestingly, the difference of these indices in two quarters of 2011 is minimal and statistically insignificant, but for 2012, the rise in all these indices is statistically significant in both the quarters. Specifically speaking, the rise observed in CI and attack rate is statistically highly significant. This indicates that the number of positive containers as well as number of fever cases in community is increasing over two quarters of 2012.

First quarter comprises the winter months i.e. January, February and March and they are not considered to be the transmission season. Second quarter approaches the malaria transmission season with months of April, May and June. It's expected that the indices would routinely increase from first to second quarter. The rise is not quite significant in two quarters of 2011 but the same is quite significant in 2012. Besides, in 2012, highly significant rise of CI and attack rate indicate not only the problem burden but also where the solution lies. A single house can have multiple containers positive for mosquito breeding and similarly, can have more than one family member positive for malaria. Source reduction is the key towards effective malaria control and efforts directed towards the same are the need of hour.

Moreover, the fever cases along with vector are on a definite rise in ongoing 2012, the critical period for the same can be considered to have started from March based on the chart. This significant intra-year rise in 2012 compared to 2011 highlights the need to monitor the epidemiological, meteorological, entomological as well as demographic characteristics of the areas and to identify the lacunae in the existing program in order to tackle the change in patterns and trends effectively.

Generally, malaria transmission seasons in India is considered to be from the month of May. Malaria month is also observed in May. The change in our study might be due to seasonal changes over the years in monsoon patterns as well as dynamics of vector. Concerted source reduction and larvicidal efforts can be re-scheduled and therefore are recommended from the month of March onwards. This, of course, needs further validation from other large-scale studies in the similar areas.

CONCLUSIONS

All vector-breeding indices (HI, BI and CI) rose in one year from 2011 to 2012. The same indices also have risen within an individual year. This suggests the improvement required in the measures taken for vector control by the healthcare machinery involved in malaria control.

More containers are found positive for vector breeding and number of fever cases also has increased in corresponding time of two years in an almost stagnant population. Careful review of ongoing activities is warranted.

Intra-year analysis also suggests the rise in HI, BI, CI and attack rate in both the years of 2011 and 2012.

Rise in indices from first quarter (non-transmission season) to second quarter (pre-transmission/transmission season) is logical but the same rise is quite significant in 2012 which makes the review of ongoing vector control measures imperative.

A single house can have more than one containers positive for mosquito breeding more than one family member positive for the disease. Source reduction is the key towards effective malaria control which will prevent the disease burden in the community and eventually will lessen diagnostic and therapeutic burden on the system.

The significant intra-year rise in indices in 2012 compared to 2011 calls for monitoring in changing epidemiological, meteorological, entomological as well as demographic patterns.

ACKNOWLEDGEMENT

We acknowledge the support of all concerned healthcare functionaries of Ahmedabad Municipal Corporation towards the study completion.

CONFLICT OF INTEREST

Nil. The study was neither funded nor financially assisted by any organization or agency.

REFERENCES

1. Malaria, Fact sheet N°94 April 2012, available at: www.who.int/mediacentre/factsheets/fs094/en/index.html Accessed on July 7th, 2012 | 2. Sharma VP. Current scenario of malaria in India.Parasitology 1999; 41: 349–53 | 3. Malaria situation in India, available at: http://nvbdcp.gov.in/Doc/malaria-situation-may12.pdf; last accessed on 12th July 2012 | 4. Media report; available on: http://articles.timesofindia.indiatimes.com/2012-10-28/ahmedabad/34780099_1_dengue-cases-disease-control-programme-dengue-and-other-mosquito | 5. Media report; available on: http://www.dnaindia.com/india/report_vect-horrific-20-dengue-cases-recorded-in-a-day_1756731 | 6. Vyas S, Solanki A, Joshi U, Nayak H. Death Audit of Deaths Due to Malaria At LG Hospital, Ahmedabad (Gujarat) During The Year 2011. 2012;3(2):352-356 | 7. Media report: http://articles.timesofindia.indiatimes.com/2012-05-23/ahmedabad/31827392_1_malaria-cases-mosquito-malaria-research; last accessed on 12th July 2012