Estimating the Economic Burden of Malaria and Assessing Its Relationship with Socio-Economic Condition in Rohtak and Mewat Districts of Haryana, India

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Authors' contributions

This work was carried out in collaboration between all authors. Author AK designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors AK and PKS collected the data. Author RK analyses and edited the study performed. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Aim: Malaria continues to remain a serious public health problem and causes significant economic burden especially among the poor tribal and marginalised communities in the tropical and sub-tropical countries of the World. In view of the lack of information in respect of malaria and economic losses in Haryana, an attempt was made to assess the relationship between the occurrence of malaria and socio-economic conditions as well as to estimate the direct and indirect costs incurred due to malaria in Rohtak and Mewat districts of Haryana.
Methodology: A community based cross-sectional survey was carried out in a highly malaria endemic cluster of six selected villages of Rohtak and Mewat region of Haryana, to estimate the

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economic burden in terms of direct and indirect costs of malaria.

Results: The study revealed that on an average a household incurred a total cost of Rs.1835 (29.77 US$) in Rohtak district and Rs 2027 (32.91 US$) in Mewat district as direct and indirect cost per patient. It was estimated that direct costs due to malaria consumed 36-40% of annual income of poor households and 3-4% of high income households suggesting that the burden of malaria is significantly higher among poor households.

Conclusion: The study revealed that malaria posses a significant economic burden on poor households both through out-of-pocket expenditure and man-days lost. To reduce the economic burden of malaria implementation of suitable intervention measures with focus on poor and marginalised along with better allocation of resources and health care facilities at the Government hospitals must be taken into consideration. It is also needed the intensification of IEC (Information, Education and Communication) campaigns regarding malaria to enhance awareness and solicit community participation.

1. INTRODUCTION

Malaria continues to remain the most important human disease transmitted by mosquitoes in the tropical and sub-tropical regions, especially in the developing countries of the world where it accounts for around 220 million cases and at least 0.6 million deaths per year [1]. In Southeast-Asia region, developing countries like India account for 61% of the malaria cases and about 70% of them belongs to people with low socio-economic status [2]. Usually, such group of people tend to be affected most adversely by mosquito borne diseases especially malaria as they have limited access to health services, information and protective measures which in turn reduce the productivity of the individual and hence reduces the average GDP (Gross Domestic Potential) of the country. According to Gallup and Sachs, the average GDP in malarious countries in 1995 was US $ 1,526, compared with US $ 8,268 in countries without intensive malaria [3]. Studies conducted earlier have examined the economic burden of the disease [4-9] but there is paucity of information in relation to economic aspects of malaria from the study area. Castro and Mokate suggested that economic cost of diseases can be analysed at two levels *i.e.* macro-economic and micro-economic. The macroeconomic analysis could be estimated in terms of Gross national product (GNP) per capita while the microeconomic analysis focus on the impact of disease on individuals and households in terms of direct and indirect costs [10]. In view of the above, the present study was undertaken in two districts of Haryana *viz.* Rohtak and Mewat, where malaria remains the commonest disease among the economically vulnerable section of the community leading to loss of healthy days and

productive life. Moreover, in 1996 during an outbreak, 1300 confirmed deaths were reported in Mewat district due to malaria alone [11]. The study aims to contribute towards a micro-level analysis that can explore the link between malaria and the socio-economic conditions and estimate the economic burden of malaria so as to plan and implement appropriate control measures.

2. MATERIALS AND METHODS

2.1 Study Area

Mewat district in Haryana is an integral part of traditionally known malaria epidemic belt of the North western Plain of India with a total population of 1,089,263 according to census 2011. It is situated adjacent to Gurgaon between 26° and 30° North latitude and 76° and 78° East longitude with an average annual rainfall of 336-440 mm [12], while Rohtak district with a total population of 1,058,683 falls under 28.89° North latitude and 76.57° East longitude with an average annual rainfall of 458 mm [13]. The total number of literates in Mewat district is 454,222 (41.7%) [14], while in Rohtak district the number of literates is 749,548 (70.8%) [15]. According to a survey conducted by the Ministry of Rural Development, Government of India in 2007, about 27.69% of the population in Mewat region lives below poverty line (BPL) while in Rohtak the figure amounts to only 18.64%. Favourable temperature (28±2°C) and relative humidity (70-80%) during the rainy season in both the districts create congenial conditions for mosquito proliferation and malaria transmission. Other factors like socio-economic status, poor living conditions, lack of awareness, sanitation and

level of education plays an important role in transmission of the disease.

2.2 Study Design

This community based cross-sectional survey was carried out between October and December 2013 in highly endemic six villages selected from Mewat and Rohtak districts. The villages were selected based on the data collected from District Malaria Officer, where more cases were reported during the last five years. The selected villages from Mewat district were Ujina (28.088 N;77.023 E), Nagina (27.917 N;76.983 E), Pinangwan (27.9 N;77.1 E) while villages selected from Rohtak district were Kalanaur (28.83 N; 76.4 E), Meham (28.98 N;76.3 E) and Bhaulat (28.9 E; 76.7 E). It was observed that malaria case were more frequent in Mewat district in comparison to Rohtak having a direct correlation with the number of BPL (Below Poverty Line) families in both the areas.

2.3 Data Collection

Data was collected from a convenient sample of 825 respondents from different professions and age groups, representing all types of the communities from the study areas by using a well designed standardized pre-structured questionnaire. Informed and free consent of all the respondents was obtained prior to the study. Children below age of 10 were assisted by their guardians. The first author with the help of Accredited Social Health Activists (ASHA) workers and others was involved in the survey.

2.4 Direct Cost Estimation

Direct costs of malaria treatment included all cash expenditures like consultation fees of the doctor, blood examination, anti-malaria drugs, self-treatment before consulting the doctor, transport and food during treatment by patients etc. These costs were noted on the questionnaire as mentioned by the participant but where respondent could not recall the specific amounts of expenditure, tentative realistic figures were recorded. The sum of all cash expenditures as direct cost for seeking malaria treatment was calculated.

2.5 Indirect Cost Estimation

Indirect Costs of malaria treatment include parameters like patient income loss, income loss of attendant and expenditure on food and attendant. While estimating the indirect cost, certain assumptions were considered. For example, participants below age of 18 and above 60 were not considered as active work force, which means their cost of labour was zero. Further, opportunity cost of labour was also considered zero for housewives. Beside this, all working adult malaria patients were asked about their daily income if the malaria did not attack them. Similarly, caretakers were also asked about their daily earnings per day if they did not have to take care of the malaria patients especially children. The income loss of patient and companion was then calculated by multiplying total number of days lost with daily income.

2.6 Malaria and School Absenteeism

Participants specially school going children were asked either directly or through a guardian about the number of days they could not attend the school due to malaria. To calculate the mean number of days of school absenteeism, the total number of school days of all the patients excluding holidays were divided by the total number of school children who had gone through one or more malaria episode.

2.7 Statistical Analysis

Data collected was analysed statistically using STATA version 10. Chi-Square test was used for Comparison of characteristics between Rohtak and Mewat villages. The *P*-value less than 0.05 was considered significant.

3. RESULTS

3.1 Malaria Treatment Sources

The primary treatment sources used by the respondents in both study areas were Primary Health Centres (PHCs), Hospitals, private clinics, traditional sources such as herbalist and services from drug shops. However, it was observed as shown in Fig. 1 that the majority of the respondents in Rohtak region (51%) and in Mewat (63%) region preferred to go to private clinics for the treatment of malaria which was significantly associated with the difference in education level in both region (*P* = 0.05). Further, only 44% of the respondents in Rohtak region and 29% of the respondents in Mewat region preferred to take treatment from Government hospitals. Moreover, a small portion of malaria patients opted for home based-self-treatment or traditional sources for the treatment of malaria. Only 2.5% of the respondents from Mewat region

went to drug shops for self medication which was half the percentage of respondents as observed in Rohtak region.

3.2 Age & Sex-Wise Distribution of Malaria Patients

Out of 825 respondents surveyed from both regions 45 individuals from Rohtak region and 79 individuals from Mewat region were reported to be attacked by malaria as given in Table 1. It was observed that the majority (40%) of malaria patients in Rohtak region belonged to age group of 26 and above while in Mewat region participants in age group between 6 to 15*i.e.* school going children had high incidence (41.7%) of malaria.

3.3 Malaria Episodes and the Economic Status

The distribution of malaria patients and socio-economic status of the household is depicted in Table 2. Out of a total of 124 malaria patients from both study areas, 42% of the individuals belonged to low income class while 17% were in the upper economic class. The difference was found significant (*P* < 0.05 *i.e.* 0.00015).

3.4 Direct Cost Estimation

All the direct costs which mainly include medication and consultation fees especially in private clinics in both study areas are shown in Table 3. The treatment cost per episode in Government Hospitals excluding medication & consultation fees was between 2.43 US$ (Rs 150/-) and 3.25 US$ (Rs 200/-) while in private clinics this figure ranges from 8.93-12.17 US$ (Rs 550 – Rs 750/-) which was around 4-5 times higher than in the Government hospitals. The total average of direct cost per malaria episode in Rohtak region was 11.38 US$ (Rs 701/-) while this was 13.31 US$ (Rs 820/-) in Mewat region leading to an enormous cost to households living below poverty line (BPL). However, there was no

significant difference in the cost per case in both regions due to the nearly homogeneous nature of occupation and the use of almost similar health facilities by the respondents.

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3.6 Indirect Cost Estimation

The study revealed that on an average 10-15 working days were lost by the malaria patients during a single malaria episode but the number of days increased in case of severe cases. Hence, a total time of 1240 – 1800 days was lost by the 124 malaria patients in both regions. Of these lost productive days, 65% were lost by men and the remaining 35% were lost by women. The total estimated cost of these productive days lost was estimated to be 551.82 US$ (Rs 34,000/-) in Rohtak region and 1006.26 US$ (Rs 62,000/-) in Mewat region as depicted in Table 4. However, while comparing the values of all the parameters of indirect cost in both study areas all the values were found to be significant.

Table 1. Age & sex-wise distribution of Malaria patients

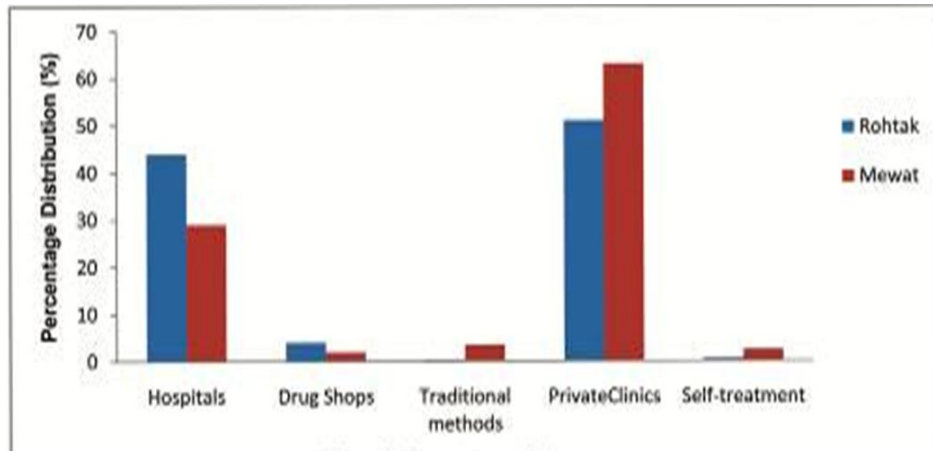| Age (In yrs) | Total number of malaria patients | | | | | |
| | Rohtak | | | Mewat | | |
	Male	Female	Total	Male	Female	Total
0-5	4	2	6	2	3	5
6-15	4	3	7	13	20	33
16-25	7	7	14	5	8	13
26-above	8	10	18	17	11	28
Total	**23**	**22**	**45**	**37**	**42**	**79**

Fig. 1. Treatment Sources

Table 2. Relationship of malaria & economic status of households

Economic status (US$)	Rohtak			Mewat		
	Male	Female	Total	Male	Female	Total
<=81.23	9	7	16	18	21	39
81.23-162.30	5	8	13	12	17	29
162.30-324.60	6	4	10	5	3	8
324.60-811.51	3	3	6	2	1	3
>811.51	-	-	-	-	-	-
Total	23	22	45	37	42	79

Table 3. Direct cost estimation in Rohtak and Mewat districts

Direct cost (US$)	Rohtak	Mewat	Overall
Consultation fees	74.66	162.30	236.96
Blood examination	45.44	146.07	191.51
Anti-malarial drugs	111.99	292.14	404.13
Self-treatment	8.93	6.17	15.09
Transport	68.17	191.51	259.68
Food during treatment	202.88	253.19	456.06
Total	512.07 US$	1051.38 US$	1563.43 US$
Average cost per person	11.37 US$	13.30 US$	12.60 US$

Table 4. Indirect cost estimation in Rohtak and Mewat districts

Indirect cost (US$)	Rohtak	Mewat	Overall
Patient income loss	551.82	1006.26	1558.08
Income loss of companion	75.47	254.00	329.47
Transport of companion	40.58	140.39	180.96
Food for companion	47.07	147.69	194.76
Total cost	714.94 US$	1548.34 US$	2263.27 US$
Average cost per person	15.88 US$	19.59 US$	18.25 US$

There was no significant difference in the total average indirect cost calculated per malaria episode in Rohtak region and Mewat region. The percentage of total direct and indirect costs per malaria episode in both study areas is shown in Figs. 2 and 3.

3.7 Estimation of School Absenteeism Due to Malaria

It was estimated that on an average a school going children was absent from school for 7-15 days due to a malaria episode. However, in

severe cases the days lost due to malaria would be apparently increased.

4. DISCUSSION

Studies conducted earlier estimated the direct and indirect costs of malaria [7-9,16-19] at the household level in certain situations. Few studies also showed how costs of malaria vary with socio-economic status *i.e.* poor tend to spend a significant portion of their income on the treatment of malaria [8,20-22]. The findings of the present study revealed that the majority of respondents in Rohtak (51%) and Mewat (63%) region preferred to go private clinics for the treatment of malaria as compared to Government hospitals where only 44% in Rohtak and 29% in Mewat region seek treatment. As observed, this difference was significant in Mewat region (*P*=0.05) because of scarce resources, poor health facilities and unavailability of proper staff in Government hospitals. Self-medication *i.e.* use of reserved drugs from previous treatment, use of traditional sources and purchase of drugs from local drug stores without prescription by doctor were also reported in small proportion in both study areas which was related to factors like differences in income and education level of the respondents. The evidence of such habits among the communities is a serious matter of concern since this may lead to drug resistance and repeated attacks of malaria episodes which in turn lead the heavy economic burden especially among the poors. These findings are in accordance to the earlier studies done in Uganda and in many other parts of Africa [23].
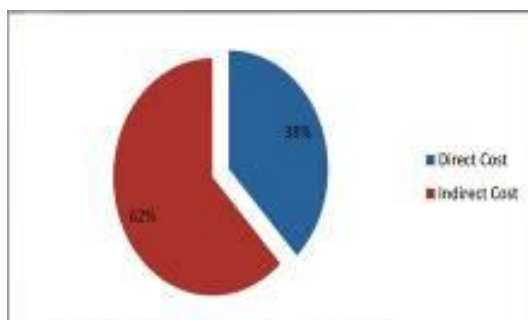
Fig. 2. Proportion of direct and indirect cost of malaria treatment in Rohtak district

It was observed that a high proportion of malaria patients in Rohtak region belonged to young and middle age group, which is in agreement to a similar study conducted in Nepal [24]. Moreover, adult males were more affected as compared to the females because of exposure and more outdoor activities. But in Mewat region mainly school going children and middle age group patients were affected. The study also envisaged the relationship of malaria and socio-economic status of the household and is in agreement to other similar studies done in the past [8,20,25]. The results revealed that the majority of malaria patients belonged to the low socio-economic status, and were mostly daily- wage workers, hawkers or vendors. Hence, on account of their low income they cannot afford better living conditions which in turn act as a supportive ground for occurrence of malaria.
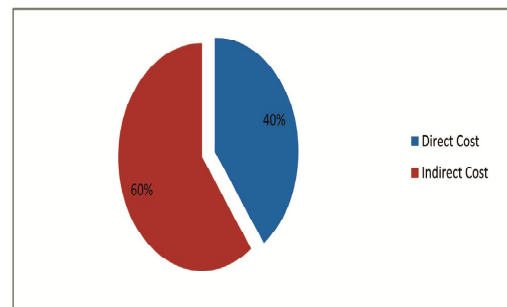
Fig. 3. Proportion of direct and indirect cost of malaria treatment in Mewat district

In regards to the direct and indirect costs of treatment per malaria episode, on an average, the direct costs account for the less expenditure as compared to the indirect costs in both the study areas, which has already been reported earlier [26-30]. This reflects the potential impact of malaria on the households income and their future economic development. Moreover, the economic burden of the malaria per episode was higher in Mewat region as compared to the Rohtak region.

5. CONCLUSION

The present study showed that the economic burden of malaria was higher for socio-economically weak people as compared to rich people in both the study areas which was associated with unhygienic living conditions and poor level of education. It was also estimated that direct costs of malaria consumed 36-40 % of annual income of poor households and 3-4% income of high income households. Hence, to reduce the direct medical costs, Government should improve quality of care at public hospitals and allocate sufficient resources and staff at the Government hospitals. In addition some tax-or

insurance based financing systems must be implemented to protect poor households from out-of-pocket expenditure for the treatment of malaria.

Besides, the improvement of health services is also a necessity for the poor and needy population.

It is also necessary to enhance the Information, Education and Communication (IEC) campaigns and the effective health education in schools on preventive measures against malaria, which may reduce its incidence and help to achieve a sharp reduction of its economic burden.

ETHICAL APPROVAL

All authors hereby declare that all participants involved gave informed consent.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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