ECONOMIC IMPACT OF CHIKUNGUNYA EPIDEMIC: OUT-OF-POCKET HEALTH EXPENDITURES DURING THE 2007 OUTBREAK IN KERALA, INDIA

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Abstract. The southern state of Kerala, India was seriously affected by a chikungunya epidemic in 2007. As this outbreak was the first of its kind, the morbidity incurred by the epidemic was a challenge to the state's public health system. A cross sectional survey was conducted in five districts of Kerala that were seriously affected by the epidemic, using a two-stage cluster sampling technique to select households, and the patients were identified using a syndromic case definition. We calculated the direct health expenditure of families and checked whether it exceed the margins of catastrophic health expenditure (CHE). The median (IQR) total out-of-pocket (OOP) health expenditure in the study population was USD7.4 (16.7). The OOP health expenditure did not show any significant association with increasing per-capita monthly income.The major share (47.4%) of the costs was utilized for buying medicines, but costs for transportation (17.2%), consultations (16.6%), and diagnoses (9.9%) also contributed significantly to the total OOP health expenditure. The OOP health expenditure was high in private sector facilities, especially in tertiary care hospitals. For more than 15% of the respondents, the OOP was more than double their average monthly family income.The chikungunya outbreak of 2007 had significantly contributed to the OOP expenditure of the affected community in Kerala.The OOP health expenditure incurred was high, irrespective of the level of income. Governments should attempt to ensure comprehensive financial protection by covering the costs of care, along with loss of productivity.

Keywords: out-of-pocket health expenditure, catastrophic health expenditure, economic burden of chikungunya, chikungunya epidemic, Kerala, India

INTRODUCTION

Chikungunya is a disease with significant morbidity, typically presenting with fever and incapacitating arthralgia,which is erratic, relapsing, and incapacitating in nature (Robinson, 1955; Pialoux *et al*, 2007; Lakshmi *et al*, 2008). Day-biting mosquitoes, *Ae. aegypti* and *Ae. albopictus* the main vectors for chikungunya (Zeller, 1998; Jeandel *et al*, 2004), can spread the disease rapidly among human beings, and can impose a major burden on the population

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and the health system as demonstrated in the Reunion Islands epidemic (Parola *et al*, 2006). The reports from the Reunion Islands also suggested that this is a public health problem with significant economic burdens for both the individual patients and the society (Soumahoro *et al*, 2011).

India was one of those countries most seriously affected by the chikungunya pandemic of 2006-2007. Although Kerala contributed only 5.8% of chikungunya cases of India in 2006, the contribution increased to 55.8% in 2007 (Kumar *et al*, 2008). The A226V mutation of the virus was identified in Kerala in late 2007 (Kumar *et al*, 2008), which contributed to the clinical severity as well as the economic burden. It has also been documented that chikungunya was caused by the domestic and environmental conditions of Kerala and had a major impact on the morbidity pattern of the state (Anish *et al*, 2011; Vijayakumar *et al*, 2010, 2011). Chikungunya is a neglected tropical disease, and there is little information available on the impact of this illness on the socio-economic status of the community. The economic burden of the disease varied from state to state, depending upon the population's physical status and financial access to health care and diagnostic measures.

The aim of the study was to assess the economic burden in terms of out-of-pocket health expenditure incurred by the affected population of Kerala from the chikungunya epidemic of 2007. These findings would be necessary for effective planning and resource allocation in the health care services.

MATERIALS AND METHODS

Five districts that were worst hit during 2007 epidemic in Kerala were studied using a cross sectional survey methodology. These districts were Kollam, Alappuzha, Kottayam, Pathanamthitta, and Iddukki (Kannan *et al*, 2009). This study is a part of large survey conducted during the epidemic of 2007. The survey assessed the outbreak in three aspects. The environmental factors which contributed to the outbreak and the morbidity pattern of the epidemic has been already reported. Two stage cluster sampling technique was used to select households within the specified districts. From each district 10 panchayaths (jurisdiction of Local Self Governments) were randomly selected. A cluster of 18 houses from each panchayath was selected for the study. Volunteers of *Kerala Sastra Sahitya Parishad* (KSSP) who were trained in administering the questionnaire collected the data. The case definition of chikungunya used here was an attack of joint pain affecting more than one joint with appearance of fever within a period ±2 days to the onset of joint pain. The details of the methodology have been reported elsewhere (Vijayakumar *et al*, 2010, 2011).

Out-of-pocket health expenditures (OOP health expenditure) were calculated as the direct health expenditure of treatment considering the money spent by the patient for physician consultations, investigations, drugs, transportation, food, escorts, and hospital stays. We also calculated indirect expenditure in terms of economic loss due to loss of workdays for the patient and the economic loss of the victim by keeping a caretaker who helped the patient at the time of the morbidity. Data on expenditures were collected in Indian rupees (INR) and converted to USD by the exchange rate as published by Reserve Bank of India, on July 31st 2007 (RBI, 2007). Total OOP direct health expenditure was compared with the monthly per-

capita income (MPCI) of the person to get an estimate of the economic impact of the illness on household budgets.

Catastrophic health expenditure (CHE) was defined in two ways. The total OOP direct health expenditure of a person in excess of her/his MPCI is the first criterion. Whether the total OOP direct health expenditure of the person is equal to or exceeding the international poverty line of USD32.4/month (USD1.08/day x 30 days) is the second criterion. According to World Bank, USD1.08/day is the minimum income required for normal subsistence, and an income of less than this level can be considered as poverty (Xu *et al*, 2003a,b).

Ethical considerations

The current study was undertaken with the permission of the local *panchayath* where the study was carried out. Informed consent of family heads was obtained before the start of data collection. Ethical clearance was obtained from the ethical board of KSSP (Ref no. –KSSP/EC/protocol/2007/13 dated 13/10/2007).

Statistical analysis

Means (SD-Standard deviation) or medians (IQR-Inter quartile range) were used to describe the exposure factors, which were quantitative in nature, while frequencies and proportions were used for categorical data. Non-parametric tests, like Mann-Whitney *U* test or Kruskal Wallis tests, were used to compare the OOP expenditure between groups. The data were entered into Microsoft Excel® and analyzed using SPSS® (version 16, IBM, Armonk, NY). A significance level of 95% and a power of 80% had been assumed for all statistical analyses. Logarithmic transformation was used to estimate the 95% confidence interval (CI) for skewed distributions.

RESULTS

Of the total 900 households, 43 records (4.8%) were defective and were not included in the analysis. Therefore, 3,623 people from 857 households formed our primary study base. The average family size was 4.23, which correspond to the average family size data for southern Kerala (Aravindan, 2006). There were 1,913 subjects (52.8%) who had suffered from chikungunya, according to the case definition used in this study, out of which information regarding the OOP health expenditure and work days lost was complete for 1,822 patients (95.2% of the total chikungunya patients). Information regarding these 1,822 chikungunya patients is shown in Table 1. The median age (IQR) of these subjects was 40 (27) years; 919 (50.4%) of these subjects were women.The mean MPCI in the chikungunya patients was USD81.4 (95% CI 49.5-91.5), which is apparently higher than the reported MPCI in Kerala of USD70.6. More than 43% (788) of the patients had a per-capita daily income less than the international poverty line. Nearly 60% (1,084) of the patients had an MPCI of less than that of the average Kerala per-capita income. Distribution of age and gender of the study group is shown in Table 1.The elderly (≥60 years) constituted 15.5%, while nearly 11% of the cases were children less than 15 years of age (Table 1).

The median (IQR) total OOP health expenditure in the study population was USD7.4 (16.7). Health expenditures in the different age groups and genders are displayed in Table 2. Although the OOP direct health expenditure was similar in both genders, it varies significantly in different categories of age (p=0.004). An increasing trend in OOP expenditure was observed as age progresses. About

Table 1
Age and gender distribution of the chikungunya patients.

Age category	Number of subjects in each gender (%)		
	Male	Female	Total
<15 yrs	118 (13.1)	80 (8.8)	198 (10.9)
15-59 yrs	656 (72.6)	686 (74.6)	1,342 (73.7)
≥60 yrs	129 (14.3)	153 (16.6)	282 (15.5)
Total	903 (100)	919 (100)	1,822 (100)

Table 2
Average total out-of-pocket health-expenditure in USD in different categories.

Categories	Expenditure	
	Mean	Median (IQR)
Gender		
Male	14.8	7.4 (16 7)
Female	16.5	7.4 (16.7)
Age group[a]		
<15 yrs	12.5	5.1 (12.4)
15-59 yrs	15.5	7.4 (16.4)
≥60 yrs	18.7	9.5 (21.3)
Hospitalization ≥1 day[b]		
Yes	35.6	20.2 (42.5)
No	11.1	6.4 (12.4)
Workdays lost ≥1 day[b]		
Yes	18.3	8.4 (18.6)
No	13.6	6.9 (14.1)
Total	15.6	7.4 (16.7)

[a]Difference in total OOP expenditure between age groups is significant (p=0.003) by Kruskal Wallis test.
[b]Difference in total OOP expenditure between different categories of health system is significant (p<0.001) by Mann-Whitney U test.

one-fifth of the patients (338, 18.6%) were hospitalized at least for one day, and 803 (44.1%) of the patients had a minimum loss of one workday due to the illness. OOP direct health expenditure was significantly higher (p<0.001) in those who were hospitalized and in those who had reported workdays lost as shown in Table 2. Hospitalization was significantly more in the above 60-year old age group (p<0.001), while no relation was noted with gender or income. Loss of workdays was more common among males, and the mean (SD) economic loss due to work days lost was USD29.4 (72.3) (Table 2).

OOP health expenditure did not show any significant association with increasing per-capita monthly income. The median OOP health expenditure was lowest in 3rd income quartile with USD6.7 and was highest in the first income quartile with USD7.9. A breakdown of total OOP health expenditure (Table 3) showed that medicines take up the major share (47.4%). Costs for transportation (17.2%), consultation (16.6%) and diagnosis (9.9%) also constituted a major portion of the total OOP health expenditure.

The percentage of patients who approached various health facilities and the OOP expenditure in health are shown in Table 4. The percentage of patients who attended government facilities (45.5%) and private facilities (44.4%) were almost equal. The proportion of patients who approached tertiary care hospitals were low, in both government and private sectors. OOP health expenditure was high in pri-

Table 3
Breakdown of average OOP health expenditure in USD.

Break down of OOP expenditures	Total OOP expenditure	
	Mean (% of total cost)	Median (IQR)
Doctors fees	2.6 (16.6)	0 (2.5)
Medicine	7.5 (47.4)	1.2 (7.4)
Investigation charges	1.6 (9.9)	0 (0)
Transportation	2.7 (17.2)	1.5 (3.7)
Food	1.1 (7)	0 (0)
Others	0.3 (2)	0 (0)
Total	15.6 (100)	7.4 (16.7)

Table 4
Distribution of study subjects and median (IQR) total OOP expenditure in USD based on types of health facility and health system.

	Factor	Number (%)	Total OOP expenditure	
			Mean	Median (IQR)
Health facility approached[a]	Government tertiary	45 (2.5)	27.8	17.3 (16.1)
	Government other	784 (43)	9.9	4.3 (9.6)
	Private super specialty	42 (2.3)	52.9	27.2 (39.3)
	Private other	767 (42.1)	18.4	10.6 (20.2)
	Combinations of health facilities	184 (10.1)	17.2	9.9 (12.3)
Health system utilized[a]	Modern medicine	1,670 (91.7)	16.1	7.4 (16.4)
	Ayurvedic medicine	31 (1.7)	11.5	8.7 (5)
	Homeopathic medicine	42 (2.3)	6.2	1.5 (7.6)
	Combinations of health systems	79 (4.3)	12.4	4.5 (24.7)

[a]Difference in total OOP health expenditure between different categories of health facility and health system are significant (p<0. 001) by Kruskal Wallis test.

vate sector facilities, especially in tertiary care hospitals. Differences in OOP expenditure between different health facilities were statistically significant (p<0.001).

The percentage of patients availing services from different health systems and the OOP expenditure in health are shown in Table 4. More than 91% of the patients visited modern medicine physicians,while 2.3% had visited a homeopathic physician. Median OOP expenditure was virtually similar between modern medicine and Ayurvedic medicine but was comparatively lower in homeopathic medicine (p<0.001).

The OOP health expenditure wasmore than the MPCI of the study subjects in 29.7% of the chikungunya cases. Catastrophic health expenditure as calculated using the different criteria is as follows. About one-fourth of the study subjects (454, 24.9%) had OOP exceeding their

monthly income. For more than three hundred (308, 16.9%) persons, the OOP was more than double their monthly income, and for 144 (7.9%) individuals, it exceeded five times the monthly income. The OOP crossed the limit of international poverty line for 216 (11.9%) individuals.

DISCUSSION

The occurrence of OOP catastrophic health expenditure due to epidemic outbreaks would challenge the household economy and thus the economic situation of the society. The higher the OOP health expenditure, the lesser would be household welfare in terms of health care and living standards (Wagstaff and Doorslaer, 2003; Xu *et al*, 2003a,b; Aravindan, 2006). This is especially devastating to those people who are living on daily wages, and who have less economic securities and reserves. OOP health expenditure has been considered an important cause of poverty (Kawabata *et al*, 2002).

With a mean OOP expense of USD7.4 per patient, the economic burden sustained by the outbreak in a heavily affected district is estimated to be USD13 million, more than 60 *crore* INR. (It was already reported that the prevalence of chikungunya in the same study population was as high as 57%.) The out-of-pocket medical expenses incurred by the participants of the current study is less than one-fifth the reported figures from Andhra Pradesh, India (Seyler *et al*, 2010), but the latter took all direct and indirect costs into account. The figures we found were comparable to a study reported from Tamil Nadu, India(Nandha and Krishnamoorthy, 2009). The observations should be discussed in the context of the absolute and relative severity of the disease burden, socio-economic factors, and the extent of public funding for each study setting. Our results indicated that there was no gender difference in OOP expenditure on health, but there was an increasing age-wise trend in expenditures. This probably reflects the more severe and prolonged course of illness in elderly subjects.

Money spent on medications formed the major share of expenditure, followed by investigation and consultation costs. These findings are consistent with similar studies conducted from other parts of India (Nandha and Krishnamoorthy, 2009; Seyler *et al*, 2010). However, these findings are in contrast with a study in Orissa, India where the expenditure for investigations was predominant (Gopalan and Das, 2009). We found that nearly 50% of the patients had utilized government health facilities, unlike previous studies in Kerala during inter-epidemic period, which indicated that the contribution of government system to be less than one-third (Aravindan, 2006). The increased utilization of government facility during this outbreak may be one of the factors that limited the OOP health expenditure in the community. A favorable trend towards utilization of modern medicine (Aravindan, 2006) was also noted reflecting the fact that chikungunya was a newly emerging problem in 2007.

Nearly 30% of the subjects had CHE when MPCI of the subjects was taken as the cutoff for CHE. In addition to the direct OOP health expenditures, patients also had to forego wages due to loss of workdays. Usually in resource-poor economies, any illness will lead to high and regressive cost burdens on households. Increased use of public sector institutions during epidemic might have protected many of them from experiencing CHE. As there were many affected members in

a single family, the economic impact of the disease on the household could be cataclysmic. OOP health expenditure incurred was high, irrespective of the level of income, there by implying the severity of the disease and the motivations of the people to seek health care. The prolonged nature of the disease resulted in large number of health care visits, profound health care expenditure, and loss of workdays and wages. While recovery from chikungunya is the expected outcome, convalescence can extend up to a year or more (Kennedy *et al*, 1980). Of the total expenses, 47.4% were for procuring drugs. This area needs attention from the disaster management program. Building a credible and effective public health system can reduce CHE. This is especially important in a country where there is little financial protection, and risk pooling mechanisms are lacking for the affected to face unforeseen health care needs such as disease outbreaks. A reemerging disease such as chikungunya was certainly an unforeseen event, and the households would likely not have sufficient financial resources at their disposal.

Public health spending should focus more on people living on meager MPCI with less financial reserves to avoid regressive payments. Governments should attempt to ensure wide spread financial protection against communicable disease by covering cost of care along with loss of productivity.

One of the strengths of this study is that it is one of the largest studies done in India on economic burden of chikungunya in terms of the sample size. We converted the figures in terms of USD for international comparisons. Both state specific and international cut-off points were used to calculate the CHE for the families.

Limitations of the study include the allotment of the study subjects was based on a clinical case definition. Criterion validity of the tool was not assessed in the study population. The sampling technique adopted here was cluster sampling, and the socioeconomic levels of the localities from where the clusters were identified might have influenced the study.

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