INCIDENCE AND CORRELATES OF CATASTROPHIC HEALTH EXPENDITURE AMONG TRIBAL HOUSEHOLDS IN KERALA

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Introduction

The state of Kerala has received international acclaim for its achievement of better health indicators which are comparable with most advanced economies of the world. Kerala model of "good health at low cost" is characterised by superior health and demographic indicators with comparatively low investments. The traditions of the government support for health development, high level of education especially female education, greater health consciousness were the important contributory factors for the advancement of health care in the state. However, there has been growing conviction that the health care sector of the state is at crossroads. The state has the highest per capita out of pocket health expenditure compared with other states of the country. The cost of treatment has emerged as one of the major reason for the indebtedness of the households belonging to marginalised communities in the state. In such a scenario, this paper makes an attempt to trace out the incidence, intensity and correlates of catastrophic health care payments among the tribal households of the state by focussing on eight prominent tribal communities who are the most disadvantaged among the outlier communities in the state. Such an analysis is of pivotal importance because the contributory factors that led to Kerala's health miracle have played only a limited role in the case of scheduled tribes of the state.

Methodology and Data Source

The study utilises both primary and secondary data. Primary data was collected through a sample survey among selected scheduled tribe households from three tribal concentrated districts of Kerala, namely Wayanad, Idukki and Palakkad. Wayanad (31.24%), Idukki (11.51%) and Palakkad (10.10%) accounts for over fifty percent of total tribal population in the state. There are 36 tribal communities in Kerala in which 12 constitutes around 90 percent of their population. The study was conducted among eight such non-primitive communities, namely Paniyan, Adiyan, Kuruman, Kurichiyan, Uraly Kuruman, Mala Arayan, Muthuvan and Irular. Wayanad was chosen for studying five communities (Paniya, Adiyan, Kuruman, Kurichiyan and Uraly Kuruman), Idukki was chosen for two communities (Mala Arayan and Muthuvan) and Palakkad

was chosen for the study of one tribal community (Irular). A Multistage stratified random sampling with the aid of structured interview schedule was undertaken for gathering information from the selected households. The sample size was estimated in such a way as to ensure at least one percent representation of the total household of the eight tribal communities under study. Thus, the sample size of the study is calculated as 596 tribal households. The reports of Directorate of Health Services, Government of Kerala, SRS bulletin and Census records of the country were the major sources of secondary data.

For the calculation of the prevalence and incidence of catastrophic health expenditure, the study used the methodological framework of Minimum Standard Approach (Wagstaff et al., 2001; Doorslaer et al., 2006). Along with the descriptive statistics, the Kruskal Wallis *H* test is used to estimate the differences in the median out of pocket health expenditure among the tribal communities. For the inter-community comparison, the non-parametric method of Mann-Whitney *U* test is used and Pearson's Chi Square test is utilised to analyse the degree of association between categorical variables. The study also employed a binary logistic regression model to predict the correlates of catastrophic health expenditure.

Living Conditions of Tribal Communities

The scheduled tribe population of Kerala has better demographic and health indicators compared to their counterparts in the other states and that of national average (Table 1).

Table 1: Demographic and Health indicators of Scheduled Tribe (2011)

	India	**Kerala**
Percentage to Total Population	8.6	1.45
Decadal Growth Rate	23.7	33.1
Child Population to Total Population	16	11.2
Literacy Rate	58.96	75.81
Female Literacy	49.35	71.1
Male Literacy	68.53	80.76
Sex Ratio (Rural)	991	1031
Sex Ratio (Urban)	980	1070
Sex Ratio (Total)	991	1035
Infant Mortality Rate (Rural)	85	60

Infant Mortality Rate (Urban)	61	44
Infant Mortality Rate (Total)	84	60

Source: Population Census (2011)

The sample population of the study were 2594 with 1284 males and 1310 females. 81.38 percent (N=485) of the households are male headed. The source of income of the tribal households does have an influence on the affordability of health care. Table 2 brings out that a major proportion of the community works as agricultural labourers for their livelihood followed by non-agricultural work (daily wage labour or coolie). However, this general pattern is changed in the case of Mala Arayan community whose main source of livelihood is government/semi government jobs.

Table 2: Sources of Livelihood of Scheduled Tribe (in percentages)

Main Source of income	Paniyan	Adiyan	Kuruman	Kurichiyan	Uraly Kuruman	Mala Arayan	Muthuvan	Irular	ST (combined)
None	1	0	0	2	0	5	4	0	1.67
Land and related	3	7	27	17	23	30	11	18	14
Forest related	0	0	0	0	8	0	7	0	1
Non agricultural labour	37	14	23	17	8	0	14	39	23.7
Employment Guarantee Scheme	4	0	7	2	8	0	14	14	5.33
Govt/semi govt job	0	7	10	5	0	35	4	7	7.67
Agricultural Labour	54	71	33	51	38	18	43	18	42.3
Animal Husbandry	0	0	0	2	15	0	0	4	1.33
Small Vendor	0	0	0	0	0	3	0	0	0.33
Private Service	1	0	0	2	0	8	4	0	2
Others	1	0	0	0	0	3	0	0	0.67

| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Source: Primary survey

Land is a key productive asset in the case of tribal communities and the landholdings of the household can be used to trace out their economic status. The landholdings of the household are measured in cents (100 cents = 1 acre of land). The descriptive statistics and the estimated Lorenz curve shows that there are high inequalities in household landholdings with the mean landholdings being 41.89 cents (95% CI =31.87-51.83) with high variance. At the same time, average landholding of paniya is only 4.6 cents (95% CI =4.34-4.87).

Table 3: Descriptive Statistics of Landholdings among Tribal Households

Descriptive Statistics		Paniyan	Adiyan	Kuruman	Kurichiyan	Uraly Kuruman	Mala Arayan	Muthuvan	Irular	ST (combined)
Mean		4.60	51.00	32.87	44.56	23.08	104.09	50.54	95.57	41.89
95% CI	Lower Bound	4.34	12.52	19.66	32.23	2.79	45.52	32.81	48.27	31.87
	Upper Bound	4.87	89.48	46.06	56.89	43.36	162.67	68.26	142.88	51.93
Std. Deviation		1.38	66.64	35.34	39.08	33.56	183.17	3002.2	121.99	88.26
Skewness		4.80	1.54	1.78	1.15	1.75	3.66	.632	1.37	6.01
Range		12.00	195.00	150.00	155.00	100.00	1000.00	13000.00	400.00	1000
Minimum		3.00	5.00	0.00	5.00	0.00	0.00	2000.00	0.00	0.00
Maximum		15.00	200.00	150.00	160	100.00	1000.00	15000.00	400.00	1000

Source: Primary survey
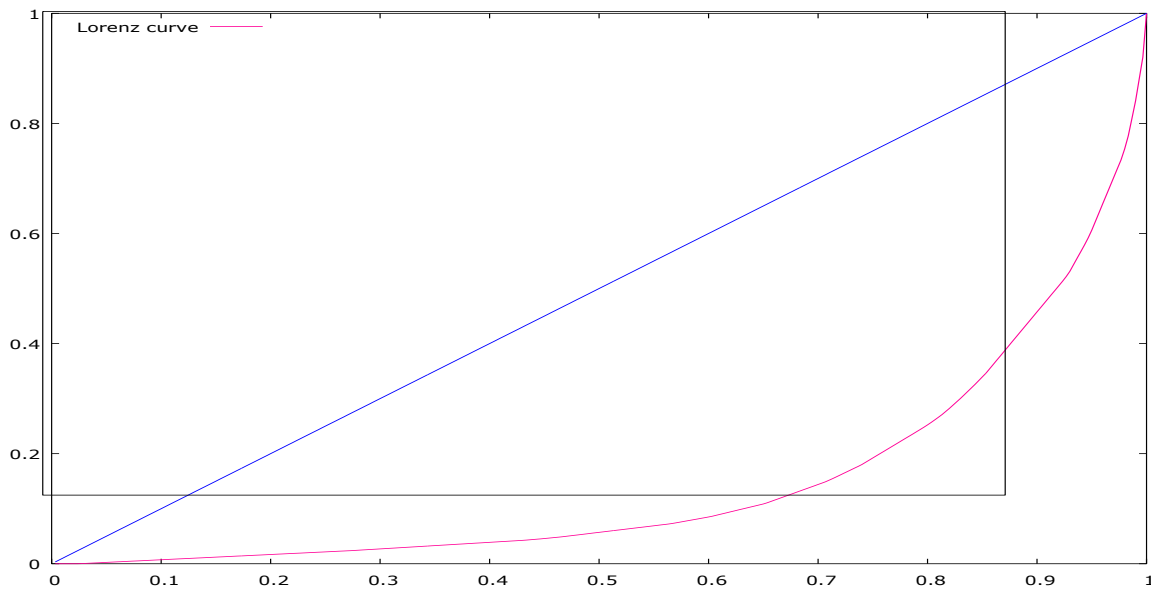
Figure 1: Lorenz Curve of land holding

(Sample Gini coefficient = 0.705671; Estimate of population value = 0.708031)

The analysis of monthly income of the households also indicates high degree of inter-tribal inequality. The average monthly income is the lowest for Uraly Kuruma while it is highest for Mala Arayan households. It is evident that Mala Arayan community who are major beneficiaries of the reservation policy of the central and state government in education and government jobs were able to render it into higher income (Table 4)

Table 4: Descriptive Statistics of Monthly Income of Tribal Households

Sub caste	Mean	95% CI		Standard Deviation	Skewness	Range
		Lower Bound	Upper Bound			
Paniyan	7135.38	6345.23	7925.53	4102.80	0.81	19400
Adiyan	8107.14	5707.28	10507.01	4156.45	0.32	13000
Kuruman	11876.67	8804.96	14948.37	8226.19	2.14	36000
Kurichiyan	7890.24	6587.63	9192.86	4126.91	0.49	17000
Uraly Kuruman	4430.77	2626.74	6234.79	2985.35	1.32	12000
Mala Arayan	17500.00	14594.00	20405.99	9086.48	0.36	38000
Muthuvan	6571.43	5407.29	7735.56	3002.20	0.63	13000
Irular	7907.14	5627.42	10186.86	5879.21	2.16	28000

ST (combined)						
	9042.17	8287.89	9796.43	6638.59	1.87	40000

Source: Primary survey

Health Status of Scheduled Tribes

The analysis of the health status of the scheduled tribes shows that 79 per cent of the households did experienced one or more type of disease during the reference period of past 30 days (Table 5). It is highest in the case of Uraly Kuruman community and lowest among Muthuvan households. Similarly, Uraly Kuruma household reported highest incidence of acute and chronic episodes during the reference period. It can also be observed that the presence of chronic episodes is high among the economically well-off community of Mala Arayan. The presence of physically disadvantaged persons is negligible among the tribal households.

Table 5: Health Profile of Tribal Households

Morbidity Profile	Paniyan	Adiyan	Kuruman	Kurichiyan	Uraly Kuruma	Mala Arayan	Muthuvan	Irular	ST (combined)
Presence of chronic episodes (%)	35	21	37	24	61	60	46	32	38
Presence of acute episodes (%)	11	21	17	21	23	20	0	17	15
Presence of physically/mentally challenged member (%)	4	7	3	2	0	5	0	3	3
Ailment during the last 30 days (%)	85	79	77	73	92	80	57	82	79

Source: Primary survey

The morbidity prevalence rate or rate of ailment is often cited as an important indicator of the health status and sometimes it is referred as an indicator of health consciousness (Verghese 2009). The prevalence of morbidity has been defined as the number of reported disease

prevailing in a population during the reference period to the total population exposed to the risk of that disease (Navaneetham et al., 2009). Thirty days prior to the date of survey has been used as the reference period for computing the morbidity prevalence rate. The computed rate confirms that Uraly Kuruman community are the most vulnerable group to ailment while Muthuvan is least vulnerable (Table 6)

Table 6: Morbidity Prevalence Rate

Sub caste	Population	Number of Ailment	Morbidity Prevalence Rate
Paniyan	912	201	220.39
Adiyan	119	36	302.52
Kuruman	243	75	308.64
Kurichiyan	336	83	247.02
Uraly Kuruman	92	40	434.78
Mala Arayan	360	80	222.22
Muthuvan	272	53	194.85
Irular	260	83	319.23
Scheduled Tribe (Combined)	2594	651	250.96

Source: Primary survey

The reported ailment with sub caste break up is presented in Table 7. It reveals that among all tribal communities the highest percentage of reported ailment is fever of unknown origin followed by high/low blood pressure. The cases of sickle cell anaemia were reported among Adiyan, Paniyan, Kuruman and Muthuvan households.

Table 7: Type of Ailment in 30 Days Reference Period (in percentage)

Ailment	Paniyan	Adiyan	Kuruman	Kurichiyan	Uraly Kuruman	Mala Arayan	Muthuvan	Irular	ST (combined)
Fever of unknown Origin	35	43	33	20	23	25	25	36	30.33
Asthma and other respiratory diseases	8	14	0	5	8	5	0	18	7
Cardiovascular ailments	8	0	3	5	8	10	0	0	5.33
Blood Pressure	8	7	17	12	8	20	21	11	12.33
Skin Diseases	1	0	0	0	0	0	0	7	1
Ear/throat/eye ailments	4	0	0	0	0	0	0	0	1.33
Kidney/urinary system related	5	0	0	2	0	5	0	0	2.67
Cancer/tumor	0	0	0	2	0	3	0	4	1
TB	1	0	0	2	0	0	0	0	0.67
Chicken pox	0	0	0	0	0	5	0	0	0.67
Diseases of mouth/teeth/gum	0	0	3	2	23	0	0	0	1.67
Accident/injury/fractures	2	0	0	2	0	3	0	0	1.33
Diarrhoea/decentry	2	0	0	0	0	0	0	0	0.67
Gynaecological disorders	3	0	7	2	0	0	0	0	2
Sickle Cell Anaemia	1	7	3	0	0	0	4	0	1.33
Diabetics	6	7	3	10	0	3	4	0	4.67
Epilepsy	1	0	0	0	0	0	0	0	0.33
Anaemia	1	0	0	0	8	3	4	0	1.33
Mental disease	1	0	0	0	0	0	0	0	0.33
Cerebral parsy	0	0	0	2	8	0	0	4	1
Arthritics	0	0	7	7	0	0	0	4	2
Gastro enteric disease	0	0	3	0	0	0	0	0	0.33
Liver sirosis	0	0	0	0	8	0	0	0	0.33
No ailments	15	21	20	24	8	20	43	18	20.33

reported									
Total	100	100	100	100	100	100	100	100	100

Source: Primary survey

One major limitation of only drawing inferences from the morbidity rate is that, morbidity being a subjective concept is prone to reporting errors. To overcome this limitation and to supplement the analysis of health status of the tribal population, the annual hospitalisation rate was computed. Hospitalisation is considered as the non-fatal health outcome which is relatively free from the reporting bias or errors of perception of the respondents. The annual hospitalisation rate is defined as the number of persons who had been hospitalised during the year leading up to the survey per thousand population. The hospitalisation rate among the tribal communities is presented in the figure 2.
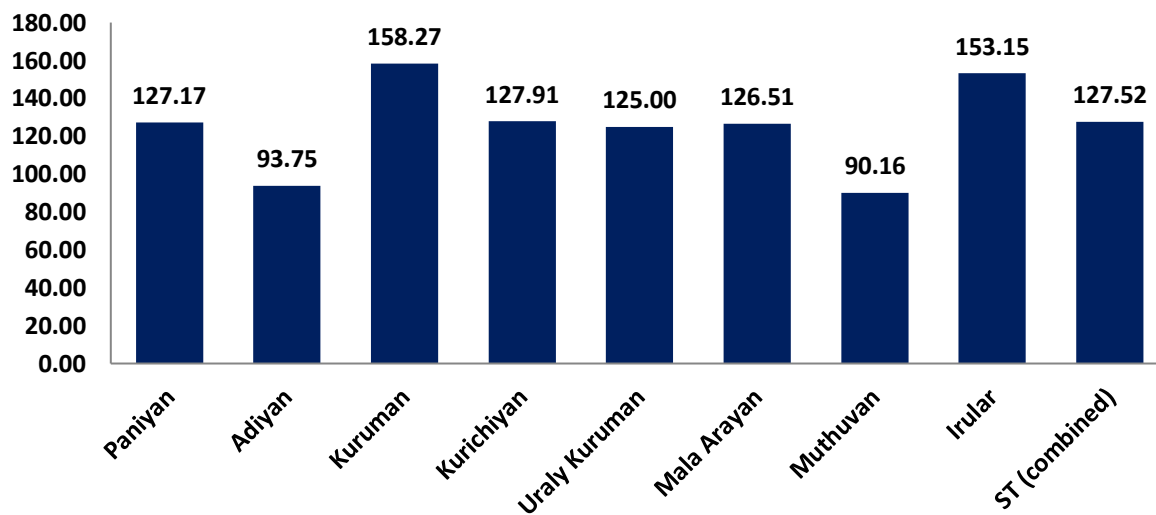

Figure 2: Hospitalisation Rate among Tribal Communities

The annual hospitalisation rate is 127.52 per thousand for tribal communities as a whole. The rate is highest for the Kuruman community and is lowest for the Muthuvan tribal community.

Extent of Out of Pocket Health Expenditure

Out of pocket expenditure by the households is the principal source of financing of health care among the developing countries. Even though the extent of out of pocket health expenditure is used as an indicator of access to health care facilities and utilisation, it is commonly acknowledged that large prevalence of out of pocket health expenditure is the most inequitable and regressive form of health care financing. It stems from the fact that high out of pocket health

expenditure can have adverse consequences on the living standards of the poor households and can push them into indebtedness and acute poverty. Figure 3 brings out the prevalence of out of pocket health care payments among the tribal households.
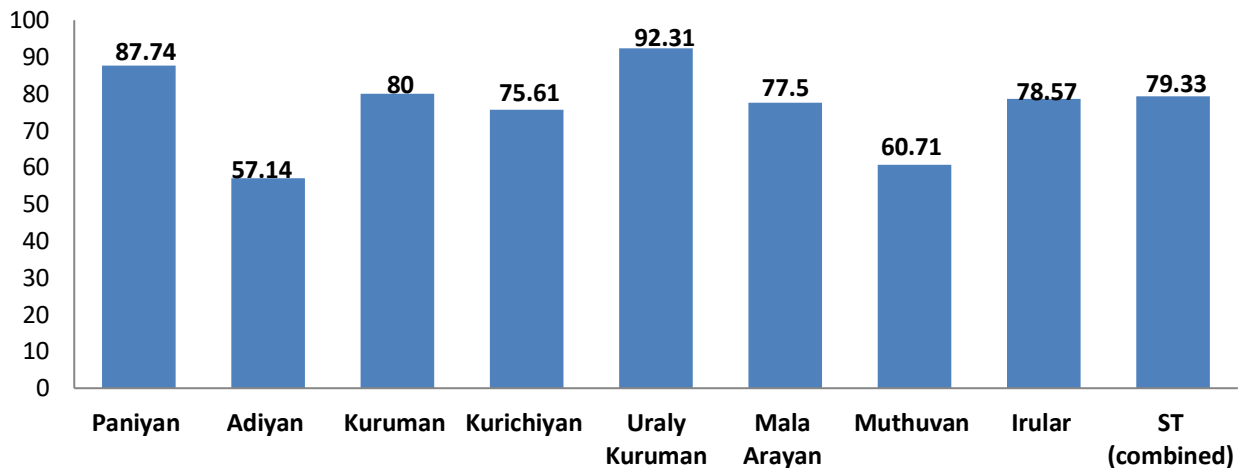
Figure 3: Prevalence of Out of pocket Health Expenditure among Tribal Communities

A significantly higher proportion of scheduled tribe households do incurred the out of pocket health expenditure during the reference period of one month leading up to the survey. The proportion is highest among the Uraly Kuruman community and they have recorded highest prevalence of morbidity as well. The prevalence is comparatively small among the backward tribal communities like Muthuvan and Adiyan. The descriptive statistics of out of pocket health expenditure are summarised in the Table 8.

Table 8: Descriptive Statistics of Out of Pocket Health Expenditure

Sub caste	Mean (in Rupees)	Standard Deviation	Skewness	95 per cent Confidence Interval for Mean	
				Lower Bound	Upper Bound
Paniyan	899.25	1256.16	2.83	657.32	1141.17
Adiyan	390.71	658.65	2.84	10.42	771.01
Kuruman	844.00	1072.50	1.64	443.52	1244.48
Kurichiyan	2105.49	5440.38	5.32	388.29	3822.68
Uraly Kuruman	746.15	657.48	1.47	348.84	1143.46
Mala Arayan	2108.75	5628.32	5.88	308.73	3908.77
Muthuvan	432.14	528.84	1.29	227.08	637.20
Irular	674.64	750.66	1.66	383.57	965.72
Scheduled Tribe (combined)	1124.92	3041.75	9.46	779.32	1470.52

Source: Primary survey

The mean health expenditure, including all the components, of tribal household is Rs 1124.The highest average out of pocket health expenditure is incurred by the Mala Arayan tribal community. Out of pocket health expenditure is high among the forward communities like Mala Arayan and Kurichiyan. The out of pocket health expenditure is lowest among the Adiyan tribal community and they spends only one fifth of the amount that Mala Arayan community spends for health care. There are obvious differences between the tribal communities with respect to the mean out of pocket expenditure and confidence interval for the mean is also large. Since there exist large differences between mean health expenditure and the distribution is positively skewed, the study used Kolmogorov- Smirnov and Shapiro-Wilk test to verify normality. The null hypothesis is H_0: the distribution is normal. The test results are summarised in the table 9.

Table 9: Normality Tests of Out of Pocket Health Expenditure

Test of Normality	Statistic	Degree of Freedom	P Value
Kolmogorov-Smirnov Test	0.223	596	0.000**
Shapiro-Wilk Test	0.759	596	0.000**

** Significant at 1 per cent level of significance

Both the test statistics are significant refuting the hypothesis that out of pocket health expenditure incurred by the tribal households is normally distributed. Thus, the study used the nonparametric method of Kruskal Wallis Test to check whether median health expenditures of tribal communities are equal.

Table 10: Kruskal Wallis Test on Out of Pocket Health Expenditure

Sub Caste	Median	Mean Rank
Paniyan	400	297.06
Adiyan	175	234.87
Kuruman	500	332.60
Kurichiyan	325	307.06
Uraly Kuruman	450	325.64
Mala Arayan	800	350.16
Muthuvan	100	233.91
Irular	300	270.02
Kruskal Wallis Test Statistic (Chi-Square)		25.927
Degree of freedom		7
P value		.001**

* Significant at 5 per cent level of significance

The results of Kruskal Wallis test are significant refuting the null hypothesis that median out of pocket health expenditures are equal. Thus, we can confirm that there is statistically significant difference in the out of pocket health expenditure between different tribal communities. But, the Kruskal Wallis test only indicates the existence of a difference in the median out of pocket health

expenditure. It does not provide insights into among which communities health expenditures differ from each other. To overcome this limitation, the study follows up with Mann Whitney *U* test of multiple comparisons between pairs of tribal communities. The results are summarised in the table 11.

Table 11: Man-Whitney *U* Test for Multiple Comparisons

Sub Caste		Man-Whitney U	Z	P value
Paniyan	Adiyan	446.50	-2.42	.150
	Kuruman	1475.00	-0.61	.545
	Kurichiyan	2109.50	-0.28	.784
	Uraly Kuruma	656.00	-0.28	.778
	Mala Arayan	1682.00	-1.93	0.054
	Muthuvan	1047.00	-2.40	.160
	Irular	1360.00	-0.68	.498
Adiyan	Kuruman	145.00	-1.66	.980
	Kurichiyan	181.00	-2.06	.390
	Uraly Kuruma	51.50	-1.94	0.054
	Mala Arayan	143.00	-2.74	0.006**
	Muthuvan	179.50	-0.46	.664
	Irular	136.50	-1.61	.108
Kuruman	Kurichiyan	553.50	-0.72	.473
	Uraly Kuruma	170.00	-0.65	.522
	Mala Arayan	471.00	-1.54	.124

	Muthuvan	333.00	-1.37	.170
	Irular	407.00	-0.20	.839
	Uraly Kuruma	266.50	0.00	1.000
	Mala Arayan	735.50	-0.80	.423
Kurichiyan	Muthuvan	393.00	-2.23	0.026*
	Irular	518.50	-0.68	.496
	Mala Arayan	207.00	-1.10	.271
Uraly Kuruma	Muthuvan	114.00	-1.93	0.054
	Irular	162.50	-0.55	.583
	Muthuvan	327.00	-2.94	0.003**
Mala Arayan	Irular	400.00	-2.01	0.045*
Muthuvan	Irular	308.00	-1.39	.162

** Significant at 1 per cent level of significance

* Significant at 5 per cent level of significance

The Mala Arayan community who have reported highest median expenditures differs significantly from three backward tribal communities namely Adiyan, Muthuvan and Irular in terms of out of pocket health expenditure. Further, from the table of multiple comparisons it can be inferred that the out of pocket health expenditure tribal community of Kurichiyan and Muthuvan are different from each other.

Incidence of Catastrophic Health Expenditure

For the analysis of the incidence of catastrophic health expenditure among the tribal communities the measures of financial catastrophe envisaged in the Minimum Standard Approach are utilised. The minimum standard approach essentially compares the out of pocket health expenditure to a certain threshold level of income. The approach requires that out of pocket health expenditure should not exceed the pre-specified threshold level of income. The threshold is defined in terms of proportionality of income. The premise is that household should not incur more than specified proportion of income on health care. If the ratio of out of pocket

health expenditure exceeds the specified threshold, health expenditure is considered as catastrophic. Thus, the minimum standard approach essentially focuses on the out of pocket health care payments that are catastrophic in the sense that it severely disrupts the living standards of the households.

One important measure of financial catastrophe is the catastrophic payment headcount (H_{cat}) which is the summary measure of the extent to which the households are exposed to the catastrophic health expenditure. The headcount is the proportion of households that have exceeded the threshold level of income. The catastrophic payment headcount is equal to

$$H_{cat} = \frac{1}{N} \sum_{i=1}^{N} E_i$$

Where N is the sample size, E is an indicator equal to one if $\frac{T_i}{X_i} > Z$ and zero otherwise. T_i is the out of pocket expenditure by the household i, X_i is the income of the household i and Z is the catastrophic threshold. The study have computed the catastrophic payment head count at four different thresholds, namely, five per cent, ten per cent, fifteen per cent and twenty per cent. But the measures of headcount only bring out the incidence of catastrophic payments. But it does not indicate the intensity of out of pocket health care payments on the tribal households. Thus, to gain further insights into the out of pocket health expenditure among the tribal communities, the catastrophic payment gap (G_{cat}) has been calculated that captures the height above which the households who are experiencing financial catastrophe make the payment. Thus, we measure the intensity or severity by defining the average gap or excess of catastrophic payments as

$$G_{cat} = \frac{1}{N} \sum_{i=1}^{N} O_i$$

Where O_i is the catastrophic overshoot, equal to $\frac{T_i}{X_{i-z_{cat}}}$ if $\frac{T_i}{X_i} > Z_{cat}$ and zero otherwise. The calculated catastrophic head count and payment gap of tribal communities are summarised in the table 12.

Table 12: Catastrophic Head Count and Payment Gap

Sub Caste		Catastrophic Threshold			
		5 per cent	**10 per cent**	**15 per cent**	**20 per cent**
Paniyan	Head Count	68.87	50.00	24.53	17.92
	Payment Gap	11.76	8.87	7.14	6.10
Adiyan	Head Count	38.46	30.76	23.07	15.38
	Payment Gap	4.38	2.95	1.61	0.71
Kuruman	Head Count	56.67	40.00	16.67	10.00
	Payment Gap	4.57	2.30	1.12	0.57
Kurichiyan	Head Count	63.41	53.65	36.58	31.71
	Payment Gap	32.52	29.79	27.86	26.18
Uraly Kuruma	Head Count	92.31	76.92	53.85	38.46
	Payment Gap	11.53	7.94	5.05	2.16
Mala Arayan	Head Count	45.00	35.00	27.50	22.50
	Payment Gap	12.43	10.43	8.93	7.67
Muthuvan	Head Count	46.43	35.71	21.43	14.29

	Payment Gap	5.37	3.38	1.86	1.07
Irular	Head Count	60.71	50.00	17.86	17.86
	Payment Gap	5.80	3.25	1.73	0.83
Scheduled Tribe (combined)	Head Count	60.33	46.33	26.00	20.00
	Payment Gap	12.46	9.93	8.26	7.12

Source: Primary survey

The measure of headcount reveals that the catastrophic impact of health care payments is pervasive among the tribal communities. It is noteworthy that even though forward communities like Mala Arayan and Kurichiyan incurs high amounts of out of pocket health expenditures, the burden of payment is largely felt by the vulnerable communities like Uraly Kuruma. At any given threshold, the incidence of financial catastrophe measured by the catastrophic headcount is the greatest among the one of the poorest households among the tribal communities in the state, namely Uraly Kuruma. The catastrophic payment is most prevalent among the community at all threshold levels. In fact, at the lower threshold value of five per cent, 92.31 per cent of the Uraly Kuruma households are spending in excess of the threshold. The high prevalence of morbidity among the Uraly Kuruma has resulted in the impoverishment of the community through out of pocket payments for health care. It can be noted that 46.33 per cent of tribal households spend more than ten per cent of their monthly income of health care and thus facing the burden of catastrophic payment. More than sixty per cent of the households incur more than five of their income on health care. The incidence of catastrophic headcount necessarily falls as the threshold level is raised from five per cent to twenty per cent. Yet, the changing of threshold level does not significantly affect Uraly Kuruma community that have the highest incidence of catastrophic health care payments. But there is noteworthy re-ranking of other communities at higher levels of threshold.

The calculated catastrophic payment gap captures the height above which the households who are experiencing financial catastrophe make the payment. Thus, it brings out the actual intensity of health care payments on the households. The payment gap at the commonly used threshold of ten per cent is 9.93 implying that, on an average, the tribal households spend 9.93 per cent

beyond the catastrophic threshold. The payment gap indicates that although the incidence of health care payment are felt by poorer communities, the intensity of payments invariably falls on the richer households of Kurichiyan and Mala Arayan, reflecting the higher amount of payments by these communities. Defining the threshold at twenty per cent, the Kurichiyan community has the highest payment gap or overshot, although it was only second highest incidence in terms of headcount, portraying very high intensity of catastrophic health care payment.

Correlates of Catastrophic Health Expenditure

Having explored the incidence and intensity of catastrophic health expenditure among the tribal communities, an attempt is being made in this section to analyse the major determinants or correlates of catastrophic health expenditure. From the policy perspective, it is important to understand the key determinants of catastrophic health expenditures to trace out the factors that endanger the financial protection received by the tribal households. To identify the correlates, the tool of logistic regression is used which have dependent variable with binary outcome. The logit model assumes that the probability distribution of the error term follows the logistic distribution function. The probability of the model is specified as:

$$P(Y) = \frac{1}{1 + e^{-(b_0 + b_1 X_{1i} + b_2 X_{2i} + \cdots + b_n X_{ni})}}$$

The dependent variable is constructed as a binary, with 1, if the household incurred catastrophic health expenditure and 0, otherwise. The threshold level of ten per cent is used for the construction of the dependent variable. The explanatory variables of the model are landholdings of the households, size of the household, mean age, number of elderly members in the household, literacy status of the head of the household, gender of the head, location of the household, presence of chronic ailments, presence of acute ailments, presence of disabled members, number of private outpatient visits and health insurance coverage. In the model, seven out of the twelve explanatory variables are categorical in nature. Thus, the nonparametric test of Pearson's Chi square is applied initially to check relationship between the dependent and explanatory variables. The Null hypothesis tested is H_0: variables are independent. The results of the tests are summarised in the table 13.

Table 13: Chi Square Test of Catastrophic Health Expenditure

Variable	Pearson Chi Square Statistic	Likelihood Ratio	P value
Gender of the head of the household	0.50	0.50	0.823
Habitat of the household	4.892	5.013	0.027*
Presence of chronic ailments	17.260	17.112	0.000**
Presence of acute ailments	21.692	20.778	0.000**
Presence of disabled members	8.674	9.755	0.013*
Health insurance coverage	5.642	5.606	0.018*
Literacy status of the head of the household	0.156	0.156	0.693

** Significant at 1 per cent level of significance

* Significant at 5 per cent level of significance

The results of the Chi square test of independence shows that there is no statistically significant relationship between catastrophic health expenditure and gender and literacy status of the head of the household. Thus, the two variables are omitted from the model of logistic regression. Table 14 summarises the results of the modified logistic regression model.

Table 14: Correlates of Catastrophic Health Expenditure - Logistic Regression Model

Variables	Coefficient	Standard Error	Z-Statistic	P Value
Constant	-2.356134	0.687835	-3.425437	0.0006**
Landholdings	-0.000889	0.001308	-0.679278	0.4970
Size of the household	0.021146	0.072120	0.293211	0.7694
Mean age	0.023562	0.013265	1.776323	0.0757
Number of elderly members	-0.348581	0.198732	-1.754020	0.0794
Habitat	0.871691	0.263467	3.308541	0.0009**
Presence of chronic ailments	0.543516	0.212445	2.558382	0.0105*
Presence of acute ailments	0.735199	0.304199	2.416838	0.0157*

Variables	Coefficient	Standard Error	Z-Statistic	P Value
Presence of disabled members	0.481935	0.365297	1.319297	0.1871
Number of private out-patient visit	0.747798	0.111266	6.720816	0.0000**
Health insurance coverage	-0.443828	0.198421	-2.236799	0.0253*

** Significant at 1 per cent level of significance
* Significant at 5 per cent level of significance

The value of likelihood ratio statistic (LR Statistic) is 114.0104 and P value is practically zero refuting the null hypothesis that all the coefficients are simultaneously zero. Thus, it can be said that all the ten variables included in the model of logistic regression are important determinants of catastrophic health expenditure. The model converges at the fourth iteration suggesting that multicollenearity is weak or absent. The goodness of fit of the model is verified with Hosmer-Lemeshow test and the statistic is 11.1534 with probability of 0.1932.

From the calculated coefficients, it can be inferred that, though landholding reduce the likelihood of catastrophic health expenditure, the result is not significant. Similarly, the size of the household, average age, number of elderly members and the presence of physically disadvantaged member do not have significant influence on the probability of catastrophic health expenditure. The habitat of the household has a significant influence on the catastrophic health expenditure. This indicates that tribal households' living outside the colonies has a greater probability of incurring the catastrophic health expenditures. The presence of members suffering from chronic and acute ailments significantly increases the probability of catastrophic health expenditure. The influence of private out-patient visit on the dependent variable is highly significant and households utilising the private providers for out-patient treatment has significantly higher probability of incurring catastrophic health expenditure. The enrolment in some form of health insurance system significantly reduces the likelihood of catastrophic health expenditure. Thus, from the estimated model we can assert that the location of the household, presence of chronic or acute ailments, utilisation of private out-patient treatment and enrolment in health insurance are the significant determinants of catastrophic health expenditures.

Conclusion

The paper has estimated the intensity and correlates of catastrophic health care expenditure among the tribal households who are the most deprived and disadvantaged among the marginalised communities in the state. The out of pocket health expenditure is widespread and absorbed large proportion of the household resources especially among the relatively poor tribal communities. The incidence of catastrophic health expenditure is severe and there are significant differences across tribal communities. It is generally higher among the low income communities like Uraly Kuruman as they rely more on out of pocket expenditure for financing of health care. The presence of chronic and/or acute episodes, landholdings of the households, presence of elderly members and the use of private health care facilities for outpatient treatment were found to be important correlates of catastrophic health expenditure. To conclude, it should be asserted that the large prevalence of financial catastrophe is not necessarily related to only disease; but it also indicates the poor functioning of financing of health care mechanism in the state. Despite, its creditable achievements in the macro health indicators, it is evident that the state of Kerala has failed to provide financial protection from large health care payments to its marginalised communities like scheduled tribes.

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