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Original Article

Perceptions of caretakers with different socioeconomic status about the harmful outcomes of fever in under-five children in Dodoma region, central Tanzania: A cross-sectional study

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ABSTRACT

Background: Socioeconomic status can affect health in childhood through many different pathways. Evidence on how households differ with regard to socioeconomic status and the degree to which this difference is associated with investment in child health is essential to the design of appropriate intervention strategies.
Aim: This study examines the impact of caretakers' socio-economic characteristics on perceptions about the harmful outcomes of fever among under-five children.
Material and methods: The study used a three-stage cluster sample of households with under-five children in Dodoma region, central Tanzania. Multilevel modelling approach was used to model the relationship between the outcome measure and caretakers' socioeconomic characteristics while controlling for other variables.
Results: A total of 329 under-five children with fever were studied of which 74.8% were perceived by their caretakers to have some chances for harmful effects of fever to occur when they experienced fever. Secondary school education or above of caretakers was significantly associated with decreased beliefs about the occurrence of harmful effects of fever.
Conclusion: Many caretakers are concerned about the occurrence of harmful effects of fever for their under-five children. Study findings suggest that promoting enrolment in secondary education or above and participation in the labour market particularly in non-farm activities of women would be valuable to the health of under-five children in central Tanzania.

1. Introduction

Fever continues to be one of the major public health problems in sub-Saharan Africa.[1] It is one of the most frequent reasons for caretakers of under-five children to visit health care facilities.[2] It is a frequently reported symptom in many childhood illnesses[3] including malaria, diarrhoea, pneumonia, measles, polio, and tuberculosis.[4] In Tanzania, fever remains a major cause of morbidity among under-five children. Results from the 2015–16 Tanzania Demographic and Health Survey and Malaria Indicator Survey show that 18 percent of under-five children had a fever in the two weeks preceding the survey.[5]

Caretakers often regard fever as detrimental.[6]As a result, parents get worried when their children experience an episode of fever.[7] Caretakers' apprehension about fever arises from concerns over the cause of fever, risk of hospitalization, and occurrence of potential harmful effects of fever in their children.[8] Brain damage, febrile convulsions, and death are among the frequently reported harmful effects of fever in children.[6] Evidence shows that generally, caretakers have a good biomedical understanding of febrile illnesses in terms of both types and symptoms.[9] Nonetheless, literature shows that fever phobia is still common among parents.[10] In this connection, the identification of factors that determine perceived consequences of an illness could increase our understanding of the actual pathways underlying the observed parental responses to situations of a health shock such as malaria

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symptoms among the under-five children. This is especially important in low-income countries where promoting access to and utilization of health services has long been one of the primary policy objectives.[11]

The relationship between socioeconomic status (SES) and health has been widely examined.[12] The focus of attention to socioeconomic factors in health-related research is in part due to their appropriateness to social policy about public health.[13] However, this relationship is complex in that there are many different pathways through which SES can affect health in childhood and that not all SES-related inequalities in health favour individuals of the higher SES strata.[14] Information regarding how households differ with regard to SES and the degree to which this difference is associated with the variables of interest, is essential to the design of appropriate intervention strategies.[15]

The three key indicators of SES are economic status (measured by income); social status (measured by education); and work status (measured by occupation).[16,17] Though interrelated, these three components of SES do not totally coincide[16] and thus, have different policy implications.[18]

This paper examines impact of caretakers' characteristics that are distributed along the socioeconomic hierarchy on perception about the likelihood of occurrence of harmful effects of fever in children under-five in Dodoma region, central Tanzania.

2. Materials and methods

2.1. Study design and site

This was a cross-sectional study carried out in Dodoma region, central Tanzania. The region features predominantly among the least in Mainland Tanzania in many domains of health as described in details in.[19]

2.2. Sampling procedure

The study unit was a household with a child under the age of five years. A three-stage sampling procedure was employed to sample the households. From the region, districts were randomly selected and from the districts, villages (in rural areas) or streets (in urban areas) were also randomly selected, and lastly from the villages or streets, the households were randomly selected. The selection of the *i*th district was done with probability proportional to size using the number of villages or streets in the district as the measure of size. This was achieved by cumulative total method.[20] Similarly, the villages or streets within the sampled districts were selected with probability proportional to size using the number of households in the respective village or street as the measure of size. In each sampled village or street, a complete listing of households with under-five children was done and simple random sampling scheme was used to select the representative households. Within the selected households, all under-five children of permanent members of the household were studied.

2.3. Study sample

The calculation of the sample size was based on several variables. These are the key indicator of the study, which was the likelihood that a case of malaria (proxied by fever) in under-five children was expected to be reported by the primary caretakers (mothers or guardians) in the sampled households. According to the 2007–08 Tanzania HIV/AIDS and Malaria Indicator Survey[21], about 19.5% of children under the age of five in Dodoma region were reported having experienced an illness with a fever in the past two weeks preceding the survey. Accordingly, to calculate the sample size, the value of the key indicator was taken to be 0.195. The probability of reporting a case of malaria in the study was estimated with a 5% margin of relative error at the 95% level of confidence. Other parameters (value) were sample design effect for the key indicator variable (1.385), average household size (4.5), non-response rate (9.9%), and an estimate of the percentage of the total population accounted for by the target population and for which the key indicator was based (0.18). The resulting estimated sample size for the study was 1073 households. The calculated sample size was rounded up to 1080 households with at least one child under the age of five. The sample was obtained from four (Dodoma Urban, Bahi, Kondoa, and Mpwapwa) out of the six districts of Dodoma region, which were officially recognised at the time of designing this study. In each selected district, 18 villages/streets were sampled resulting into 72 villages/streets. Moreover, in each selected village/street, a sample of 15 households was selected. Due to non-response, 1027 out of 1080 (95% response rate) households were successfully interviewed.

2.4. Data collection

Data were collected between October 2010 and January 2011. Face-to-face interviews were conducted by trained research assistants using a structured questionnaire adapted from Tanzania Demographic and Health Surveys, Living Standards Measurement Study, and Tanzania HIV/AIDS and Malaria Indicator Survey. The questionnaire was designed in English, but it was translated into Kiswahili (the language, which is commonly spoken in Tanzania) to facilitate intelligibility during the interviews, thereafter translated back into English in order to ensure that the original meanings of the various items of the questionnaire were maintained. The final version of the questionnaire was pre-tested and where necessary refined.

The questionnaire covered several aspects including age, sex, education and occupation of caretaker and that of heads of households, possession of household-owned assets, housing structure and materials, main source of power for cooking and lighting, household size, community characteristics including approximate distance (in kilometres) to the nearest health facility and marketplace, rural/urban location of household. Distances were measured by involving local leaders and other people in the respective communities who had knowledge about approximate distances from the household to the nearest health facility or marketplace. The child characteristics collected include age (in months), sex, and biological relationship with the head of household. Furthermore, information on illness and health seeking behaviours for each child were collected. Caretakers were asked whether the child under the age of five experienced an episode of fever at any time during the past four weeks preceding the day of the interview. In addition, caretakers were asked how they perceived the fever at the first onset during the past four weeks. That is, whether or not they interpreted the fever as indicative of any illness, perceived severity (with possible responses: severe, moderate or mild) of the fever. Because malaria can present in different forms in under-five children, besides fever, the study also collected information on whether or not the child experienced convulsion, diarrhoea, cough/flu and vomiting.

2.5. Research clearance and ethical considerations

The study was approved by the Department of Economics of the College of Social Sciences at the University of Dar es Salaam. The permission to carryout the research in the region was obtained from the Regional Administrative Secretary of Dodoma region, and from district executive directors (DEDs) of the four districts in which the study was conducted. DEDs informed lower level

administrative authorities about the study. At the individual level, each respondent who took part in the study gave oral informed consent.

2.6. Data management

Data were entered in the Statistical Package for the Social Sciences (SPSS) for Windows version 16.0 software. In order to verify the precision of data entry in SPSS, two generic data verification strategies were employed. First, 10% randomly selected questionnaires were thoroughly checked. Secondly, descriptive statistics and frequency distributions of each variable were estimated and checked.

2.7. Data analysis

2.7.1. Dependent variable

In this study, a sub-sample of the data in which caretakers reported an episode of fever among the under-five children was used to model the relationship between caretakers' socioeconomic characteristics and the dependent variable while controlling for other variables. We assessed perceptions about the occurrence of harmful outcomes of fever by first exploring caretakers' knowledge of likely harmful outcomes of fever among under-five children with febrile convulsions and death being frequently reported. Next, we asked caretakers this question: "Think of the time of onset of fever for the child at any time during the past four weeks. Would you say that there was a high chance, low chance, or no chance at all for the child to experience any of the harmful outcomes of fever, which you have mentioned?" As revealed, the response variable was polycotomous and ordered in nature. However, in order to facilitate implementation and interpretation of analysis results, the responses were collapsed to form a binary outcome.[22–25] Accordingly, the three response categories were recoded into a dichotomous dependent variable distinguishing between some chances (1) and no chance at all (0) of occurrence of harmful effects of fever.

2.7.2. Independent variables

The primary variables of interest in this paper are individual (caretaker) level socioeconomic characteristics. The study considered the three commonly used indicators of SES: social status, work status and economic status. Educational attainment was categorised into three major groups appropriate for Tanzania: no education, primary education, secondary education or above.[26] Occupational status was categorized as unemployed, working in agricultural activities, or in non-agricultural activities. Household economic status was used as a proxy of caretaker's income. Because of difficulty in accurately measuring household expenditure as a proxy for income, an asset-based approach was employed. To create the wealth index, the study employed the principal component analysis technique, cf.[15] and[27] on a set of correlated household durable assets and living conditions (housing structure and materials) items. Households were then divided into socioeconomic quintiles: poorest, second, middle, fourth and highest based on the factor scores. Since the social environment in which the individuals live may affect perception,[28] in this regard, we controlled in the analysis by contextual factors: place of residence (rural or urban), distance to the nearest health facility and market, perceived quality (fair or good) of main road and whether it was passable throughout the year. Age and sex of head of household, age of caretaker, age and sex of child, biological relationship of child to head of household, household size, number of under-five children in the household, marital status of caretaker, etc. were also considered important variables to moderate the SES-health beliefs relationship. Considering that lone parenting may have a negative effect on the management of an illness, we included in the analytical model a dummy variable representing presence or absence at home of both biological parents of the child. We also included as control variables, information on whether or not the child experienced convulsions, diarrhoea, cough/flu, or vomiting at any time during the past four weeks preceding the day of the interview. In order to account for both demand for health care services in the communities in which the children were from and complex sample design that the study adopted, we included in the model design-related information/variables. Specifically, size variables: number of households in the sampled villages or streets and number of households with under-five children in the sampled villages or streets within the selected districts were included.

2.7.3. Modelling strategy

This study adapted a multilevel modelling strategy. Children were nested within households and households nested within villages or streets while villages or streets were nested within districts. In this point of view, a household, as supported by[29] was believed to define a reasonably homogeneous social environment, which was shared by all of its members. Therefore, subjects (e.g., under-five children as in the presents study) within the same household or village were more likely to be similar with one another for example, in terms of exposure/living environment compared to children across households or villages. Such data structure is subject to intra-class correlations (ICC).[30,31] A number of studies including[32,33] have noted that analysis that ignores the ICC or suppose existence of independence of observations are inclined to underestimate the variance of the estimated regression coefficients. Underestimation of the variance of the estimated regression coefficients leads to overestimation of the significance of the effects of the explanatory variables.[34] Meanwhile, multilevel models are flexible since not all higher-level units are assumed to have the same number of level-1 units nested within.[35] However, with three or higher-level multilevel models, interpretation of the results is very difficult, especially when more variables at different levels and more random coefficients are considered.[36] Therefore, the analysis in this study fitted two-level multilevel models of the form given below.

2.8. Model specification

To assess the impact of caretakers' socioeconomic characteristics x while controlling for other variables z, a two-level multilevel random effect logistic regression model was fitted. That is,

$$y_{ij} = \alpha + x'_{ij}\beta + z'_{ij}\lambda + u_i$$

where y_{ij} represents caretaker's perceived likelihood of occurrence of harmful effects of fever for child i in village j; β and λ represent vectors of fixed effects for socioeconomic characteristics and control variables, respectively. The term u_i is a random effect variable with a mean of zero and constant variance and gives an estimate of the variance across villages. A larger value of u_i implies that the outcome is more dependent on the higher level units involved.[4]

To check for the suitability of the multilevel analysis, we first fitted the empty or intercept-only model of the form $y_{ij} = \kappa_{00} + u_{0j} + e_{ij}$. According to,[36] multilevel analysis is necessary only when ICC is found; otherwise, standard techniques may be used in the analysis.

2.9. Parameter estimation

Estimation of the parameters of the model was carried out in SAS version 9.2 (SAS Institute Inc., Cary, NC, USA) through the procedure *GLIMMIX*.[37] Descriptive statistics were first used to summarize the

data. For continuous variables, mean and standard errors (SEs) were calculated while for categorical variables, frequencies and percentages were calculated. The procedures *SURVEYMEANS* and *SURVEYFREQ* were used to account for sample design in computing the means together with their corresponding SEs and frequencies together with their corresponding percentages, respectively.

3. Results

3.1. Descriptive statistics

A total of 1390 under-five children were found from 1027 successfully interviewed households. Of the total children, 329 (23.7%) had fever at any time during the past four weeks preceding the date of the survey. However, the results in this paper focus on the 329 children who had fever. Table 1 presents descriptive statistics of variables distinguishing between children whose caretakers believed that the harmful effects of fever could occur and those whose caretakers did not. Out of the 329 children with fever, 246 (74.8%) were perceived by their caretakers (96.9% biological mothers) to have the possibility (low or high) to experience the harmful effects of fever and the remaining, 83 (25.2%) were perceived to have no chance at all.

The mean (SE) age of caretakers was 30.3 (0.2) years with a range of 16–60 years. Caretakers of the majority of children, 236 (71.7%) had completed primary education; of 76 (23.1%) of children had no education at all and of a small proportion of children, 17 (5.2%) had secondary education or above. The findings reveal further that caretakers of the majority of children, 240 (72.9%) were working in agricultural-related activities, of 64 (19.5%) of children were working in non-agricultural activities, and of 25 (7.6%) of children were unemployed. The results show that most of the children ($n = 241$, 73.3%) were from households in which the heads of households had completed primary education while children who were from households in which the heads of households had no education accounted for 20.7%. In terms of occupation, most children ($n = 267$, 81.2%) were from households in which the heads of households were engaged in agriculture and/or livestock keeping. Only 54 (16.4%) of the children with fever were from households in which the heads of households were engaged with non-agricultural activities.

Of the 246 children who were perceived to have some chances for the harmful effects of fever to occur, 11 (4.5%) were children of caretakers with secondary education or above. The corresponding number of children whose caretakers had no education was 53 (21.5%). Furthermore, the results show that children of caretakers who were engaged in agricultural activities were often reported to have the possibility of harmful effects of fever to occur (70.7%) than children of caretakers who were engaged in non-agricultural activities (19.9%). In terms of economic status, children from the poorest wealth group were frequently perceived to have the possibility (27.3%) for the harmful effects of fever to occur compared to children from the highest wealth category (8.3%) (Table 1).

3.2. Estimation results

Table 2 presents multivariate regression analysis results on the probability of reporting the occurrence of the harmful effects of fever. From the table, the intra-class correlation was about 0.17, which shows existence of moderately large between-village heterogeneity. The estimated variance of the random term ($\hat{\sigma}_u^2$) on the logit scale was 0.6571 and statistically significant ($\chi^2 = 5.97$, $p = 0.0073$) suggesting that caretakers' perception about the occurrence of the harmful effects of fever in under-five children was more dependent on the villages involved in the study. Therefore, the multilevel modelling approach was necessary to the data.

The estimate of the fixed-effect for model 1 was 1.2307 ($p < 0.001$); the corresponding probability of reporting some chances of occurrence of the harmful effects of fever on average been $\hat{p} = \exp(1.2307)/1 + \exp(1.2307) = 0.774$.

Model 2 was fitted with all variables. As seen in the results for model 3, there seems to be a statistically significant difference (at 0.1 level) in reporting of some chances for the harmful outcomes of fever to occur between caretakers with secondary or above education and those without education. The estimated coefficient for the variable secondary or above education of caretakers is −2.0364 ($p = 0.0637$). That is, the log-odds of reporting some chances for harmful outcomes of fever to occur among under-five children is −2.0364 times higher in caretakers with secondary or above education as compared to uneducated caretakers, adjusting for the other variables in the model. Moreover, there seems to be a statistically significant difference in perception about the occurrence of harmful outcomes of fever between children of heads of households who had secondary education or above and those of uneducated heads of households, adjusting for the other variables in the model. The estimated coefficient is 2.9799 ($p = 0.0358$), suggesting an increased probability of reporting of occurrence of some chances for harmful outcomes of fever among children from households in which the heads of households had secondary education or above than those without education. Occupation of heads of households also appears to be statistically significant at the 0.1 level, with children of heads of households in non-agricultural activities more likely to be perceived to have some chances for harmful outcomes of fever to occur, adjusted for all other variables in the model. The corresponding estimated coefficient is −3.2791 ($p = 0.0700$).

With regard to contextual variables, number of households with under-five children in the sampled village was statistically significant at the 0.1 level. The corresponding estimated coefficient is −0.0076 ($p = 0.0718$), suggesting decreased probability of perception of occurrence of the harmful outcomes of fever among children from villages with large number of under-five children, when adjusted for all other variables in the model. The estimated effect of perceived quality of road is 0.9980 ($p = 0.0470$), indicating an increased probability of perception of some chances for the harmful outcomes of fever to occur in areas where the quality of main roads were perceived to be fair or good than in areas with poor main roads, adjusted for all other variables in the model.

In terms of the control variables, there appears also to be statistically significant differences (at 0.1 level) in perception about the occurrence of harmful outcomes of fever between children whose both biological parents stay at home and those whose both parents are not at home ($p = 0.0612$). The variable perception that fever was a sign of an illness is statistically significant ($p = 0.0618$). The log-odds of reporting some chances for harmful outcomes of fever to occur is 0.7529 times higher among children whose fever was perceived as a sign of an illness against those whose fever was not considered as a sign of an illness. The log-odds of reporting some chances for harmful outcomes of fever to occur is −1.0629 ($p = 0.0257$) times higher among children whose fever was perceived as being severe as compared to those whose fever was perceived as mild, adjusting for all the other variables. There is also a statistically significant difference in perception about the occurrence of harmful outcomes of fever between children from male-headed households and those of female-headed households ($p = 0.0428$). The log-odds of reporting some chances for harmful outcomes of fever to occur is −3.4780 times higher among children from male-headed households as compared to children from female-headed households, adjusting for all the other variables in the model.

Table 1
Children whose caretakers believed that the harmful effects of fever could occur and those whose caretakers did not. Data are frequency (percentage) or mean (SE) for categorical and continuous variables, respectively, $n = 329$.

Characteristic	Perception that harmful effects of fever could occur		
	Some chances 246 (74.8)	No chance 83 (25.2)	All children, $n = 329$
Characteristics of child			
Age (in months):			
0–11	46 (18.7)	14 (16.0.9)	60 (18.2)
12–23	73 (29.7)	17 (20.5)	90 (27.4)
24–59	127 (51.6)	52 (62.7)	179 (54.4)
Sex (male)	130 (52.8)	44 (53.0)	174 (52.9)
Child had convulsion (yes)	9 (3.7)	3 (3.6)	12 (3.6)
Child had diarrhoea (yes)	112 (45.5)	30 (36.1)	142 (43.2)
Child had cough/flu (yes)	169 (68.7)	61 (73.5)	230 (69.9)
Child had vomiting (yes)	80 (32.5)	20 (24.1)	100 (30.4)
Relationship to head of household (non-biological)	18 (7.3)	8 (9.6)	26 (7.9)
Fever perceived as a sign of a disease (yes)	183 (74.4)	44 (53.0)	227 (69.0)
Perceived severity of fever for child:			
Mild	111 (45.1)	31 (37.3)	142 (43.2)
Moderate	93 (37.8)	26 (31.3)	119 (36.2)
Severe	42 (17.1)	26 (31.3)	68 (20.7)
Both biological parents stay at home (yes)	180 (73.2)	56 (67.5)	236 (71.7)
Biological mother stays at home (yes)	240 (97.6)	79 (95.2)	319 (97.0)
Number of under-five children in the household (2 −3)	51 (20.7)	21 (25.3)	72 (21.9)
Characteristics of caretaker			
Age (years), mean (SE)	30.3 (0.2)	30.3 (0.2)	30.3 (0.2)
Education:			
No education	53 (21.5)	23 (27.7)	76 (23.1)
Primary	182 (74.0)	56 (67.5)	236 (71.7)
Secondary and above	11 (4.5)	6 (7.2)	17 (5.2)
Occupation:			
Unemployed	23 (9.3)	2 (2.4)	25 (7.6)
Agricultural activities	174 (70.7)	66 (79.5)	240 (72.9)
Non-agricultural activities	49 (19.9)	15 (18.1)	64 (19.5)
Years in current place of residence (always)	135 (54.9)	39 (47.0)	174 (52.9)
Marital status (married)	187 (76.0)	60 (72.3)	247 (75.1)
Main source of information is health worker	190 (77.2)	67 (80.7)	257 (78.1)
Characteristics of head of household			
Sex (1 = male)	192 (78.0)	63 (76.0)	255 (77.5)
Age (years), mean (SE)	37.1 (1.6)	37.6 (1.6)	37.2 (1.6)
Education:			
No education	44 (17.9)	24 (28.9)	68 (20.7)
Primary	184 (74.8)	57 (68.7)	241 (73.3)
Secondary and above	18 (7.3)	2 (2.4)	20 (6.1)
Occupation:			
Unemployed	7 (2.8)	1 (1.2)	8 (2.4)
Agricultural activities	196 (79.7)	71 (85.5)	267 (81.2)
Non-agricultural activities	43 (17.5)	11 (13.3)	54 (16.4)
Characteristics of household			
Household size, mean (SE)	5.1 (0.3)	5.4 (0.7)	5.2 (0.3)
Economic status:			
Poorest	59 (24.0)	22 (26.5)	81 (24.6)
Second	65 (26.4)	27 (32.5)	92 (28.0)
Middle	48 (19.5)	15 (18.1)	63 (19.1)
Fourth	44 (17.9)	17 (20.4)	61 (18.5)
Highest	30 (12.2)	2 (2.4)	32 (9.7)
Community characteristics			
Place of residence (rural)	200 (81.3)	75 (90.4)	275 (83.6)
Village population size, mean (SE)	907.2 (67.8)	948.9 (55.0)	917.7 (51.6)
Number of households with under-five children in village, mean (SE)	341.7 (19.8)	385.5 (23.9)	352.5 (21.5)
District of residence:			
Dodoma Urban	43 (17.5)	6 (7.0.2)	49 (14.9)
Bahi	77 (31.3)	27 (32.5)	104 (31.6)
Kondoa	57 (23.2)	31 (37.3)	88 (26.7)
Mpwapwa	69 (28.0)	19 (22.9)	88 (26.7)
Distance to nearest health facility ($\geqslant$5 km)	174 (70.7)	65 (78.3)	239 (72.6)
Distance to nearest market (1 = $\geqslant$ 5 km)	151 (61.4)	58 (69.9)	209 (63.5)
Main road passable throughout the year (yes)	179 (72.8)	54 (65.1)	233 (70.8)
Perceived quality of main road (fair or good)	150 (61.0	42 (50.6)	192 (58.4)

4. Discussion

In this paper, 329 under-five children with fever in the past four weeks preceding the date of the survey were studied and the majority were perceived by their caretakers to have some chances for harmful outcomes of fever to occur. The findings of this study concur with those of[2] who found that 84.1% of mothers believed that fever had complications and that mostly (67.7%) believed that

Table 2
Multilevel logit models on perceived harmful effects of fever, $n = 329$.

Parameter	Model 1: empty or intercept-only model		Model 2: with all variables	
	Estimate (S.E)	*P*-value	Estimate (S.E)	*P*-value
Intercept	1.2307 (0.1865)	<0.0001	2.6841 (2.8008)	0.3416
0–11 months			Ref.	Ref.
12–23 months			-0.0505 (0.5438)	0.9263
24–59 months			-0.4680 (0.4770)	0.3293
Sex of child (male)			0.2558 (0.3464)	0.4635
Child had convulsion (yes)			0.2654 (0.9315)	0.7822
Child had diarrhoea (yes)			0.6149 (0.4129)	0.1425
Child had cough/flu (yes)			-0.0632 (0.4217)	0.8816
Child had vomiting (yes)			-0.0985 (0.4434)	0.8251
Both parents were at home (yes)			2.4121 (1.2569)	0.0612[a]
Relationship to head of household (non-biological)			1.5051 (1.2673)	0.2362
Mother stayed at home (yes)			0.4027 (1.4563)	0.7892
Age (years) of caretaker			-0.0327 (0.0436)	0.4544
Caretaker had no education			Ref.	Ref.
Caretaker had primary			0.1911 (0.4851)	0.6954
Caretaker had secondary or above education			-2.0364 (1.0728)	0.0637[a]
Caretaker was unemployed			Ref.	Ref.
Caretaker was engaged in agricultural activities			-1.5240 (1.2435)	0.2272
Caretaker was engaged in non-agricultural activities			-1.1074 (1.2137)	0.3667
Caretaker's years in current place (always)			0.3466 (0.3908)	0.3797
Marital status (married)			1.1197 (1.6622)	0.5042
Source of information in matters of health (health worker)			-0.1902 (0.4370)	0.6657
Fever perceived as a sign of a disease (yes)			0.7529 (0.3937)	0.0618[a]
Fever perceived as mild			Ref.	Ref.
Fever perceived as moderate			-0.2934 (0.4127)	0.4791
Fever perceived as severe			-1.0629 (0.4683)	0.0257[b]
Age of head of household (years)			0.0294 (0.0353)	0.4060
Sex of head of household (male)			-3.4780 (1.6624)	0.0428[b]
Head of household had no education			Ref.	Ref.
Head of household had primary education			0.5588 (0.4966)	0.2665
Head of household had secondary or above			2.9799 (1.3759)	0.0358[b]
Head of household was unemployed			Ref.	Ref.
Head of household was engaged in agricultural activities			-1.1001 (1.3817)	0.4376
Head of household was engaged in non-agricultural activities			-3.2791 (1.6889)	0.0700[a]
Household size			0.0046 (0.1220)	0.9704
Number of under-fives in household (2 −3)			-0.0367 (0.3968)	0.9269
Poorest			Ref.	Ref.
Second			-0.0371 (0.4851)	0.9393
Middle			0.5856 (0.5625)	0.3005
Fourth			0.0884 (0.6446)	0.8913
Highest			2.0505 (1.4628)	0.1643
Location (rural)			0.5288 (1.2361)	0.6703
Village population size			0.0018 (0.0013)	0.1841
Number of households with under-five children in village			-0.0076 (0.0041)	0.0718[a]
Distance to nearest health facility ($\geqslant$ 5 km)			0.3598 (0.4928)	0.4704
Distance to nearest marketplace ($\geqslant$ 5 km)			-0.4269 (0.5602)	0.4534
Dodoma Urban district			Ref.	Ref.
Bahi district			1.0841 (1.2758)	0.3987
Kondoa district			-0.0155 (1.2860)	0.9904
Mpwapwa district			1.2625 (1.2667)	0.3227
Main road passable all over the year (yes)			-0.2448 (0.4958)	0.6254
Perceived quality of main road (good)			0.9980 (0.4861)	0.0470[b]
σ_u^2	0.6571	0.0073[c]	1.1159	0.0032[c]

[a] Significant at <0.1 level.
[b] Significant at <0.05 level.
[c] Significant at <0.01 level.

fever could cause convulsion while 6% believed that fever could lead to death. In the same light, Walsh and Edwards,[38] reviewed literature on the management of childhood fever by parents and realized that many parents considered fever to be harmful and were exceptionally concerned about the perceived harmful outcomes of fever.

It has also been revealed in this study that secondary education or above of caretakers was associated with decreased beliefs that the harmful outcomes of fever could occur. Children of caretakers with no education were more likely to be perceived to have some chances for the harmful outcomes of fever to occur than children whose caretakers had secondary or above education. This may be partly attributed to increase in knowledge among the educated caretakers on how to efficiently deal with childhood fever when it occurs and partly due to high level of autonomy among the educated caretakers. The observed phenomenon seems to agree with the findings from other studies about the role of maternal education in health-related matters in children. For example, it has been shown elsewhere[2,39–41] that maternal education had a strong effect on child health, often resulting into better health outcomes through various pathways. For instance, in a study on mothers' perception of fever management in children, Alex-Hart and Frank-Briggs[2] noted that most of the educated mothers knew the causes of fever and the symptoms associated with fever. Semba

et al.[39] found that high level of maternal education was strongly associated with protective childcare practices including use of a local health post and receipt of childhood immunisations. In the same vein, Birdsall, Ross and Sabot[42] observed that educated mothers were more effective in using health care services not only for themselves, but also for their children.

When the findings in the present study are carefully evaluated one could conclude that highly educated mothers are more likely to act appropriately when fever appears in their children than their counterpart uneducated caretakers. Moreover, women's education has a strong association with their autonomy.[43,44] Women's autonomy, which includes control over resources and decision regarding healthcare for sick children,[45] may persuade them to report that their under-five children have less possibility for harmful outcomes of fever to occur.

In this study, it was also found that secondary education or above of heads of households was significantly associated with increased log-odds of belief about the occurrence of harmful outcomes of fever among children. This finding appears to be counter-intuitive in view of a strong linkage between education and household wealth, which has long been established in literature. Studies have observed that well educated individuals earn higher incomes to meet necessary goods and services for improving health status.[39,45] Walsh and Edwards[38] provide a literature review on management of childhood fever by parents, showing that when fever occurs, parents often take children's febrile temperature constantly, mostly hourly in order to monitor its severity, which was more practised by parents with higher socio-economic status. However, the variable of socio-economic status was not significant in our study.

Lack of a statistically significant effect of wealth status of households on perception about the occurrence of the harmful outcomes of fever could be due to many factors. It could be due to existence of strong relationships among most of the socioeconomic variables considered in the analysis. For example, with respect to the outcome measure of interest in the present study, education of caretaker and that of head of household could be highly linked. Semba et al.[39] noted that highly educated fathers often earn more money and marry women of similar levels of education. In the present study, sex of head of household appears to have a negative effect on the outcome measure, indicating that relative to male-headed households, children in female-headed households were associated with high probability for the harmful outcomes of fever to occur. This is not surprising as headship is often associated with household income control including decisions guiding income expenditure, often male-headed households being more affluent than female-headed households are.

Regarding perceived quality of the road, the findings from the present study showed that children in places where the quality of the main road was perceived as being fair or good were associated with increased probability of beliefs about the occurrence of the harmful outcomes of fever. This finding is also contrary to our prior expectation. Perhaps this may be because a large part of the sample in the present study was from rural areas where there is limited system of roads for a given area to permit easy access to social services. Because of this constraint, caretakers, despite being living in an environment where the quality of main road is perceived to be fair or good, may still consider their under-five children to be at a high risk of occurrence of the harmful outcomes of fever.

Interpretations of the results of the present study are subject to limitations. The first limitation is associated with the study design. Because of the cross-sectional nature of the study, it was not feasible to estimate causal effects, hence make casual inferences about the relationship between the dependent variable and socioeconomic status variables while controlling for other variables. As opposed to longitudinal studies, cross-sectional study designs do not capture information to reflect the dynamic or changing pattern of different factors that influence the outcome variables of interest. For example, caretakers' reported perceptions of potential harmful effects of fever may be positively or negatively affected by previous outcomes of the condition in their children. The second limitation is related to the measurement (reliance on caretakers' reports of past events) of fever and the outcome measure. In this situation, the reported responses are likely not to be free from elements of subjectivity.[11] The responses might be subject to recall bias,[46] which is likely to vary depending on many factors including level of education and socio-economic status.[47] The third limitation is that there are a small numbers of children in the "no chance" group relative to the "some chances" group for some variables particularly with respect to education, occupation, economic status of caretakers as well as education and occupation of head of household. Therefore, the effects of these variables have to be interpreted with caution.

5. Conclusion

When fever occurs in under-five children, many caretakers in Dodoma region are concerned about the likely harmful outcomes. Beliefs about the occurrence of harmful effects of fever in under-five children differ significantly by caretakers' level of education. Secondary education or above of caretakers is associated with decreased beliefs about the occurrence of harmful effects of fever in under-five children. The findings of the study suggest that empowering caretakers with the ability to deal with febrile illnesses would be beneficial to the health of under-five children in central Tanzania.

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