Child Disability and Siblings' Healthcare Expenditures in a Context of Child Fostering

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October 27, 2016

CSAE conference 2017

Abstract

Many studies have assessed the impact of disability on healthcare expenditures of the disabled child, but practically none has considered the externalities of a child's disability in terms of healthcare expenditures for their siblings. This study, conducted in Cameroon, therefore seeks to measure the impact of a child's disability on healthcare expenditures allocation between children of a household. The assessment is based on a two-part model and on data from the 2011 Demographic Health and Multiple Indicator Cluster Survey (DHS-MICS) conducted by Cameroon's National Statistics Institute (INS), with support from UNFPA, UNICEF, the World Bank and USAID. The disability module of the survey was administered to 17,864 children aged under 18 who constitute the sample studied. The results showed that that a disability significantly increases the monthly healthcare expenditures of the disabled child by XAF 204. This effect does not vary significantly according to the fosterage status of the child. Living with a disabled child has no impact on health care spendings of a child. However, having a disabled sibling reduces the health care expenditures allocated to a child by

XAF 102. The disability of a child has therefore wider effect that could influence the health of siblings.

Keywords: Cameroon; disability; healthcare expenditures; child; fostered child; two-part model; development

Introduction

The direct cost of illness refers to the resources spent on prevention, diagnosis and treatment. Healthcare expenditure accounts for the bulk of this cost. Disability as a functional limitation, may generate considerable additional healthcare expenditures, both for the disability itself and for concomitant diseases. This argument makes sense when "good health" is considered as a consumption commodity, as suggested by Grossman [19]. That theoretical intuition has prompted empirical verification, mainly in developed countries [14, 25, 13, 31, 10, 35], where healthcare systems differ considerably from those in developing countries (in Cameroon as in many African developing countries the health insurance coverage is around 1% [28]).

Conversely, disabled people might not have higher healthcare expenditures than others. This could be envisaged if we consider that health could be demanded as an investment commodity as in Grossman's pure investment model of health [19] and by later developments, such as Becker and Tomes' investment model when children's endowments differ [3]. Indeed, if we consider disability as a reduction in a child's endowment, and healthcare spending as an investment in human capital, then, according to Becker and Tomes [3], the parent may invest more in children with better initial endowments at the expense of less well-endowed children. The preference model of Behrman et al. [6] could also help to understand the strategy of parents to reinforce the differences by allocating more resources to well-endowed non-disabled children or to reduce the differences by allocating more resources to the less-endowed disabled children.

Some studies, such as that by Zan and Scharff [35], have found that some disabilities have no impact on the healthcare expenditures of the children concerned. Parish et al. [29] found lower healthcare expenditures for disabled children in single-parent families. However, none of these studies have considered that it could be due to healthcare expenditures choices that parents could have made between disabled children and their siblings.

This study therefore, seeks to assess how childhood disabilities might affect out–of –pocket healthcare expenditures allocations between siblings. In other words, it tests the hypothesis of "rivalry" between disabled and non-disabled siblings in terms of healthcare expenditures by assessing simultaneously the effect of disability on healthcare expenditures of the disabled child and the impact of living with a disabled child on healthcare expenditures of other children.

This study makes a contribution at several levels. Firstly, it acknowledges that healthcare expenditures on the children in a household may be interdependent and therefore assesses for the first time how disability modifies the healthcare expenditures of the disabled child and his/her siblings. Secondly, the analysis takes the local social context into account, and differentiates between fostered and non-fostered children living in the household. In Cameroon, as in many African countries, it is common for parents to foster children out to other households. Since the carer' behaviour with respect to child could differ according to the relationship with the child, it is important to also address this heterogeneity. Thirdly, although the measurement of the burden of living with a disabled child for the rest of the family has important policy implications, very few measurements have been done in developing countries. This study therefore seeks to fill in that information gap.

The rest of the paper is organised as follows: section 1 is a detailed literature review, section 2 describes the methodology used, and section 3 presents and discusses the results.

1 Literature review

1.1 Review of the theoretical literature

The starting point for understanding the impact of disability on healthcare expenditures is probably the human capital model of the cost of illness. According to this model, any health problem is likely to generate various costs for the individual concerned, his/her family and/or society, including a direct cost consisting of the additional healthcare expenditures generated by the ill health. The disability of a child may have various causes and may also lead to concomitant health problems, such as pain, pressure ulcers, obesity and depression. Disabled children are therefore more likely to be in a poor state of health than other children are.

If we reason according to Grossman's model [19] which considers good health as pure consumption, as a consumption commodity that enters into individuals' preference function (and poor health as a source of disutility), we assume that the welfare of children enters into their parents' utility function. The parents will therefore respond to the disutility generated by the disability by increasing their demand for "good health". It will lead to an increasing of healthcare expenditures for the disabled child. That increase in healthcare expenditures on the disabled child could reduce the share of the resources available for the other children in the household [1] including healthcare expenditures. Alternatively, it is possible that the parents' constant contact with the healthcare system to meet the medical needs of the disabled child would generate positive externalities for the other children in the household; healthcare expenditures on the siblings of disabled children would thus be higher than on children who do not have a disabled sibling.

From an altogether different perspective, we could consider health as an investment, as does Grossman [19], and reason within the Becker and Tomes' framework of the investment model when children's endowments differ [3]. That model explains how parents' expenditures on healthcare may vary in accordance with the endowments of their children. Becker and Tomes highlight differences between endowments and preferences among children. They assume that parents have neutral preferences between their children, in terms of the marginal utility of an improvement in the quality of each child would be the same if the children had the same endowments.

If the respective costs of adding to the quality (or improving health) of each child were equal, the parents would invest more in the disabled (less well endowed) children in order to compensate for quality even if the initial endowments of the children were different. However, in the case of disability, a difference in cost can stem from a need for specialist medical care or the high cost of transport for the most severely disabled children. According to Becker and Tomes, it could then exist two opposite effects: the "wealth" effect which leads to compensation of poorer endowed children and the "price" effect which induces parents to reinforce well-endowed children.

The Becker and Tomes' model shows that "price" effect dominate for human capital investments and that the "wealth" effect dominate for investments in non-human capital. Therefore, the parents would tend to invest more in human capital of the better-endowed child (non-disabled) and compensate by investing more in non-human capital (through intergenerational transfers for example) of less-endowed (disabled). However, as stated by the authors, parents, mostly the poorer ones, usually give only small amounts of non-human capital to their children. "They would, however, still tend to invest more human capital in better-endowed children if they anticipated that these children would "care" sufficiently about their siblings to transfer voluntarily enough resources to their siblings" [3] in the future.

The preference model is a wider framework to analyse parental allocations of resources among their children [6]. In fact, contrary to the investment model, this model allow preferences or aversion for inequality to play a crucial role in allocation of resources. In the case of strict aversion for inequalities, parents will adopt a compensation strategy by investing more in children with worse endowments. In case of no inequality aversion, if the earning function is such as children with better endowment have higher (lower) earning, then parents adopt a reinforcing (compensation) strategy. They will therefore invest more (less) in the well-endowed child at the expense of the less-endowed child.

1.2 Empirical review

1.2.1 Child disability and healthcare expenditures: what is known

Numerous studies analysing the relationship between child disability and healthcare expenditures have focused on the disabled child. On this vein, some have found very clear evidence of a correlation between disability and higher healthcare expenditures.

Using American data, Newacheck et al. [27] found that mean healthcare expenditures on disabled children is much higher than on non-disabled children ($2,669 versus $676). Sharpe and Baker [34] show that financial issues in families that have a child with autism were positively associated with use of medical interventions, having high out–of –pocket or unreimbursed medical or therapy expenses, and having lower incomes. Using more objective variables to assess the financial problems, Kuhlthau et al. [21] found that 40% of these families experienced financial-related burden. Focusing on poor families, Lukemeyer et al. [22] showed that only 38% of these families incurred non-child-care expenditures as a result of their child's disability. Among those who did have expenses, medical out–of –pocket medical expenses were the most common (23%), but only 6% of families incurred medical costs exceeding $100 per month.

A less clear relationship between disability and increasing health care expenses was found by Busch and Barry [10]. They showed that, in the United States, a child's mental health disorder does not represent a significant financial burden for children covered by private health insurance. Zan and Scharff [35] found conditions such as epilepsy, migraine, asthma, ADHD/ADD, allergies and ear infections have a positive financial cost. They also found that some types of disability, such as speech impairment and mental retardation/Down syndrome, had no impact on the out-of-pocket medical costs of the children concerned. However, the authors did not provide an explanation for this and did not extend their analysis to the other members of the household, probably because the data used were only collected for one child in each household. Parish et al. [29] found that average monthly spending on disabled children in single parent families ($179) was lower than average monthly spending on non-disabled children in single parent families ($250) where there is no disabled child. The authors attribute this to the fact that single-parent families use low-cost care. However, as in the previous study, their data only provide information about one child selected randomly per household, which does not make it possible to extend the analysis beyond that child.

Only Altman et al. [1] have attempted to assess the impact of the disability of a family member on other family members' healthcare expenditures. They found that having a disabled child had no impact on the number of medical visits and the amount of healthcare expenditures on non-disabled siblings. However, their study did not examine the healthcare expenditures of the disabled individual, so provides only a partial picture of the issue and does not capture interactions. Moreover, their study is also based on US data.

1.2.2 Evidence of an inter-relationship between siblings in terms of investment in human capital

An abundant economics literature has nevertheless highlighted differentiated investment allocations between siblings based on their initial endowments. Berhman et al. [7], who examined differences in general endowments by comparing identical and non-identical twins, show that allocations of schooling by parents tend to reinforce differences in initial endowments. Morduch [26], Garg and Morduch [18], Pitt et al. [30] and Berhman [4], analyse the allocation of resources from the perspective of gender. Morduch shows that in Tanzania, a child's human capital accumulation is positively correlated with the number of sisters. Garg and Morduch [18] show that in Ghana children who have only sisters will have health indicators that are 25%-40% better than children who have only brothers. While Berhman [4] shows that there is a boy preference in nutrients allocation during lean season in India. He obtained a similar result concerning birth order [5]. In a study conducted in Ethiopia, Ayalew [2] shows that the parents, through their allocations of health inputs, compensate for children's different initial health endowments.

By using the term endowments, most of these studies do not refer directly to disability. Fletcher and Wolfe [16], however, show that the presence of a child with behavioural problems in a household influences investments in the educational capital of the other children, to which they attribute the lack of an education differential between children with certain mental health disabilities and healthy children. The present study proposes to extend the existing literature by assessing the impact of disability on healthcare expenditures on both the disabled child and on his/her siblings.

2 Methodology

2.1 Study data

The data used for this research comes from the 2011 Demographic Health and Multiple Indicator Cluster Survey (DHS-MICS) conducted by Cameroon's National Statistics Institute (INS), with support from UNFPA, UNICEF, the World Bank and USAID. The survey disability modules were administered to half of the households: 17,864 children aged under 18, from 5,237 households were identified and constitute the sample used in this article.

The household head (HH) of children selected for the healthcare expenditures module were asked to self-report diseases, chronic conditions or injuries experienced in the 30 days prior to the survey. A total of 91.7% reported not having been ill. Data on healthcare expenditures was collected from individuals who reported having been ill in the month before the survey. Of that group, 12.9% reported not having used healthcare or having benefited from free healthcare. In other words, 92.8% of the children in the sample had zero healthcare expenditures.

The healthcare expenditures taken into account in this study comprises spending on self-medication, consultations, tests, drugs, hospitalisation, transport to medical services and hospitalisation. The health expense are not specific to disability but are general healthcare expenditures, which may include expenditures linked directly or indirectly to disability.

The disability measure used in this study comes from the disability module of DHS-MICS. In this module, for all the individuals in the selected households, HHs were asked whether they had any disabilities, such as missing limbs or extremities, deformation, serious vision, hearing and/or speech impairments, and mental health disorders. They were then asked if the disability was partial or total. However, in order to estimate healthcare expenditures, since few individuals had positive healthcare expenditures and therefore the small numbers of disabled children, no distinction by severity of disability was made. Thus the *disabled* variable takes the value 1 if the child is disabled and 0 if not.

Because the relationship with the child could modify the behaviour of parents [8], in this research, a distinction is made between fostered and non-fostered children. There are different definitions of child fosterage in the literature. Castle considers fosterage on a cultural view and defined a fostered child as a child "recognized as living under nonmaternal care" [12]. Bledsoe et al. [8] define a foster child as a child who lives away from his/her mother. The idea is that, as the father usually participates only indirectly to child care, it is the mother (or the women in charge) of the child who will notice the health care needs of child and report them to the breadwinner if she is not able to solve them. Not living with his/her mother could then modify the amount of health expenditures allocated to a child and blur the effect of disability on allocation of healthcare expenditure if this is not taken in account. This study defines fostered (or foster), as a child who does not live with his/her mother.

Table 1 shows that average monthly healthcare spending is XAF 958, with a very large standard deviation (XAF 8,404). Healthcare expenditures are thus highly skewed. Some 73% of the children in the sample are non-fostered children.

2.2 Method

The healthcare expenditure data presents several specific features requiring particular treatment. Firstly, (i) the number of individuals i with zero health expenditure $Y_i = 0$ is very high, so cannot be ignored. Secondly, (ii) the observations are always positive $Y_i \geq 0$. And thirdly (iii) the empirical distribution of non-zero observation are positively skewed [24]. The debate over the appropriate model for this type of data has long fuelled the health economics literature [15, 20, 32, 33, 23, 17]. Based on the criteria for choosing a model suggested by Madden [23], Manning and Mullahy [24] and Buntin and Zaslavsky [9] a series of tests have been run. The test of the mean squared error (MSE) helps for the choice between Heckman model and two-part model. The Modified Park Test (MPT), the calculation of the kurtosis coefficient of the error and the Box-Cox test determine the model to use at the second part of the two-part model, his family (or variance function) and its link function (or mean function). Based upon these tests, presented in Appendix, this study uses a two-part model. The first stage models the probability of having positive healthcare expenditure $Pr(Y_i > 0|X_i)$ using a logistic model. The second stage uses a generalised linear model (GLM) with gamma family and log link to estimate predicted expenditure conditional on non-zero expenditure $E(Y_i|Y_i > 0, X_i)$. In this case, the unconditional spending is obtained as follows:

$$E(Y_i|X_i) = Pr(Y_i > 0|X_i) * E(Y_i|Y_i > 0, X_i) \quad (1)$$

Y_i represents the healthcare expenditure on individual i and X_i the independent variables. The estimated equation, inspired by equation 1, takes the following form:

$$E(Y_i|D_i, D_{s_i}, F_i, x_i) = Pr(Y_i > 0|D_i, D_{s_i}, F_i, x_i) * E(Y|Y_i > 0, D_i, D_{s_i}, F_i, x_i) \quad (2)$$

Where D_i the disability status of individual i , D_{s_i} indicates the presence of another child in this child's family who has a disability, and x_i all the control variables. D_i allows to estimate the effect of disability of i on his healthcare expenditure. D_{s_i} is used to capture the effect of having a sibling with a disability on healthcare expenditure of i as used by Fletcher and Wolfe [16] in the case of education. F_i indicates if the child i a fostered child. Then to capture the heterogeneity according to the fosterage status of the child the equation 3 is estimates:

$$E(Y_i|D_i, D_{s_i}, F_i, x_i) = Pr(Y_i > 0|D_i, D_{s_i}, F_i, D_i{*}F_i, x_i){*}E(Y|Y_i > 0, D_i, D_{s_i}, F_i, D_i{*}F_i, x_i) \quad (3)$$

It is important to note that the variable *disabled sibling* D_{s_i} is common to almost all children of the same household. In order to factor in intra-group correlations that may exist between children of the same family, the results presented will use clusters robust standard errors at household level [11]. Where the "true" siblings are considered, meaning children of the same mother, the result presented will use cluster robust standard errors at siblings level.

The control variables used in this study are those usually used in the literature as determinants of health care expenditures [35]. Due to the absence of information about insurance coverage of children this variable is not introduced (this variable is less pertinent in a developing country context, since the coverage rate is almost null [28].) We have also introduced a variable indicating the type of health facility used, for it could sharply modify the amount of health expenditures. Generally, the same variables are used for the two equations of the two-part model [35] [23] except if there is a good reason to explain differences. In this study we have included in the second part of the estimation the severity of illness and the type of health facility because these variables have been collected only for children having been ill.

3 Results

Table 1 presents the description of disabled and non-disabled children. It shows that disabled children have more often than the others positive healthcare expenditures (11.5% vs 7.1%) and that the amount of these expenses is significantly higher (XAF 2993 vs 908). The percentage of fostered children is higher among disabled children (32% vs 27%). Additionally, disabled children have severe illness more often than others, are older, live in lower size households and with more educated HHs than their non-disabled peers.

Table 2 presents the two-part model of healthcare expenditures of children. The logistic regression in the first stage examines the probability of having positive healthcare expenditures, the GLM in the second stage estimates the impact of our variables on healthcare expenditures conditional on positive healthcare expenditures. The first set of columns gives the results for all individuals as specified in equation 2. It shows that disability significantly increases the probability for a child to have positive healthcare expenditures and has a positive but not significant impact on the amount of healthcare expenditures conditional on positive healthcare expenditures. However, living with a disabled child has no significant impact both on the probability of positive healthcare expenditures and on the amount of these healthcare expenditures. The second set of columns present results where an interaction variable is introduced in order to assess whether this effect depends on whether or not the child is a foster child as specified in equation 3. The disability of non-fostered children increase significantly only the probability of having positive spending, while compared to these latter, the disability of fostered children increase the amount of expenditures

The unconditional marginal effects presented in the second columns set of the Table 2 show that many factors specific to the HH are also likely to influence the amount of healthcare expenditures on a child. This is especially true for the educational level of the HH. Compared with a child living in a household where the HH has no education, an additional XAF 146 is spent on average for a child when the HH has secondary or higher education, and an additional XAF 64 when the HH has primary education. This could translate the greater importance given to health by educated HH. Healthcare expenditures on children increases significantly with the household's economic well-being. We thus observe an increase in healthcare spending of XAF 198 on a child living in a household in the most affluent economic quintile compared with a child living in a household in the poorest quintile. The type of health facilities chosen and the severity of illness are also important determinants of the amount of healthcare expenses.

Other characteristics specific to the children also have a significant impact on healthcare expenditures. Firstly, the age of the child. Every additional year reduces the amount of healthcare expenditures on the child by XAF 15, reflecting the low morbidity among older children. Being a boy does not have a significant impact on healthcare expenditures. Thus, as in the study by Ayalew [2] in Ethiopia, this study highlights an absence of parental preference for boys in terms of investment in health capital. Lastly, the fosterage status of the child is a determinant factor in healthcare expenditures. All other things being equal, on average, XAF 116 less is spent for the foster children compare to non-foster children. This seems to confirm Bledsoe et al. [8], who find intra-household discrimination regarding foster children's access to healthcare.

These results show that a disability of a non-foster child significantly increases healthcare expenditures of that child (by XAF 204). The effect of disability for fostered children is not significantly different from the effect observed for their non-fostered peers. However, the variable disabled sibling indicates that, for a given child, living in a household where there is a disabled child does not affect his/her healthcare expenditures.

Nevertheless, the impact measured here is rough, because the disabled child living in the household may be or not a fostered child. If the disabled child is a foster child, the disability might not have any impact on the allocation of healthcare resources of non-disabled children, since their healthcare expenditure is not financed by the same source or because mothers already have some "natural" preferences for their biological children. To refine the analysis, we would therefore need to analyse the impact of a child's disability on healthcare expenditures of his/her "true" siblings. Since the survey does not provide any information about the siblings of fostered children, this analysis is conducted only on non-fostered children.

Table 3 shows the possible impact of a child's disability on healthcare expenditures of his/her siblings simultaneously to its impact on health care spending of the disabled child. It indicates that having a disabled sibling does have a significant impact on a child's healthcare expenditures. Having a disabled sibling reduces the health care allocated to a child by XAF 102. The Disability therefore creates a "sibling rivalry" in terms of healthcare expenditures within families. As Ayalew [2], these results show that parents adopt a compensation attitude. They spend less for health care expenditure of the better endowed non-disabled children living with disabled sibling and inversely, they spend much more for the disabled children.

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Conclusion

The aim of this study was to measure the impact of a child's disability on out–of –pocket healthcare expenditures of all children in the household. The overall result obtained is that disability significantly increases healthcare expenditures of the disabled child, compared with non-disabled children. This effect does not vary significantly according to the fosterage status of the child. Living with a disabled child does not modify health care expenditures of a child compared to a child not living with a disabled child. However, when we focus on true siblings, meaning children of the same mother, we realise that there is a "rivalry" between disabled and non-disabled sibling. Indeed, having a disabled sibling reduces the monthly health expenses allocated to a child by XAF 102.

This study nevertheless has some limitations. Firstly, it would have been interesting to know about other household expenditures because healthcare is far from being the only source of additional expenditure generated by the disability of a child. Moreover, given that households are not making equal spending adjustments on healthcare, it would have been interesting to assess the impact of the increase in healthcare expenditures on other household items of expenditure. Lastly, information about household income would have made it possible to evaluate the relative burden of child disability on family economic well-being.

However, the present study contributes to the literature in several ways. It measures, for the first time, the impact of the disability of a child on his/her healthcare expenditures and on his/her siblings' healthcare expenditures. This was made possible by the database used, which contains information about all the children living in the household. Next, the analyses were performed taking in account fosterage status of the child. This highlights the importance of considering true siblings rather than children living in the same household when analysing spending allocation between children. Lastly, this is the first study of its kind in an African developing country. It therefore offers an excellent base for formulating various economic policy recommendations for these countries.

This study suggests that the disability of a child beyond to create a financial pressure to the household by increasing the health care expenditures of the disabled children, reduces health expenditures allocated the siblings. This negative spillover effect for siblings could have long term consequences for their health. These results therefore underline the necessity that policy planners mobilise resources in order to help the families to face the health care needs engendered by the disability of a child.

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Appendices

3.1 Selection test between Heckman model and two-part model

The results of the empirical tests of the mean squared error (MSE) presented in Table 4 indicate that the two-part model (2PM) is superior to Heckman's model.

3.2 Model selection test for the second part of the 2PM

The calculation of the kurtosis coefficient of the error at the level of the logarithm gives $2.93 < 3$ so use GLM in the second stage is recommended. The Box-Cox test shown in Table 5 indicates that $\theta = 0.047$; therefore the log link represents the best link between healthcare expenditures and the explanatory variables.

The use of a regression by GLM requires a prior specification of the mean and variance functions. In the case of a log (link) mean function, as in this study, $E((Y|X) = exp(X\beta) = \mu(X\beta)$. In this case, the variance of Y conditional on X takes the form:

$$Var(Y|X) = k(\mu(X\beta))^{\lambda} \tag{4}$$

where λ is a non-negative finite number and $k > 0$. If $\lambda = 0$, we have a usual non-negative least squares estimator (NNLS Gaussian family). If $\lambda = 1$ we have a Poisson type structure. If, however, $\lambda = 2$, we have a gamma variance function. Cases where $\lambda = 3$ and $\lambda = 4$, more rarely observed, point to inverse-Gaussian and negative binomial families of distributions respectively. The Modified Park Test proposed by Manning and Mullahy [24] consists of two main stages. First, a GLM estimation to predict $\widehat{Y_i} = exp(X_i\hat{\beta})$. Second, a regression of the following equation by GLM:

$$(Y_i - \widehat{Y_i}) = \lambda_0 + \lambda_1 ln(\widehat{Y_i}) + \upsilon_i \tag{5}$$

The estimation of the coefficient λ_1 indicates the GLM family that must be adopted according to the values indicated above. The Modified Park Test in Table 6 indicates that $\lambda_1 = 1.95 \approx 2$; therefore, the GLM family selected will be the gamma family.

Table 1: Means and standard deviations of the variables by disabled status

	Overall		Disabled		Non-disabled		P-value
	Mean	SD	Mean	SD	Mean	SD	
Healthcare expenditure	957.599	8404.192	2992.649	1.7e+04	907.884	8061.585	0.000
Healthcare expenditure >0	0.072	0.258	0.115	0.319	0.071	0.257	0.001
Disabled	0.024	0.153					
Disabled sibling	0.081	0.273					
Fostered Child	0.274	0.446	0.322	0.468	0.273	0.445	0.026
Severity of illness∓							0.001
Mild	0.313	0.464	0.143	0.354	0.320	0.467	
Moderate	0.415	0.493	0.367	0.487	0.417	0.493	
Severe	0.271	0.445	0.490	0.505	0.263	0.440	
Age	7.689	4.988	9.850	4.397	7.636	4.990	0.000
Boy	0.502	0.500	0.528	0.500	0.501	0.500	0.267
Health facility ∓							0.203
Public	0.363	0.481	0.449	0.503	0.360	0.480	
Private	0.186	0.389	0.224	0.422	0.184	0.388	
Other	0.451	0.498	0.327	0.474	0.456	0.498	
Educational level of HH							0.085
No education	0.261	0.439	0.218	0.414	0.263	0.440	
Primary	0.396	0.489	0.437	0.497	0.395	0.489	
Secondary or higher	0.343	0.475	0.345	0.476	0.342	0.475	
Place of residence)							0.260
Regional capital	0.192	0.394	0.162	0.369	0.193	0.395	
Other town	0.229	0.420	0.230	0.421	0.229	0.420	
Rural area	0.579	0.494	0.608	0.489	0.579	0.494	
Household size	8.142	4.537	7.725	3.686	8.152	4.555	0.028
Economic well-being							0.217
Poorest	0.206	0.405	0.197	0.398	0.207	0.405	
Poor	0.238	0.426	0.277	0.448	0.237	0.425	
Average	0.217	0.412	0.216	0.412	0.217	0.412	
Affluent	0.183	0.387	0.185	0.389	0.183	0.387	
Plus Riche	0.156	0.363	0.124	0.330	0.157	0.363	
Observations	17864		426		17438		

Note: Author's calculations based on data from the 2011 DHS-MICS. ∓ Reference sample: children with healthcare expenditure greater than zero. SD: standard deviations. P-value from Chi2 and means difference test

Table 2: Two-part model of healthcare expenditure

	Overall				Unconditional ME		Overall				Unconditional ME	
	logit		glm		—		logit		glm		—	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Disabled	0.745***	(0.156)	0.231	(0.198)	298.145**	(119.044)	0.783***	(0.179)	-0.002	(0.221)	204.289*	(109.291)
Disabled sibling	0.061	(0.119)	-0.054	(0.175)	-0.015	(46.061)	0.060	(0.119)	-0.078	(0.176)	-5.688	(45.122)
Fostered Child	-0.304***	(0.087)	-0.313***	(0.095)	-110.631***	(21.545)	-0.297***	(0.089)	-0.355***	(0.098)	-116.221***	(21.926)
Disability*Fostered Child							-0.155	(0.365)	0.822**	(0.411)	154.667	(118.750)
Age	-0.079***	(0.007)	0.004	(0.009)	-14.826***	(2.498)	-0.079***	(0.007)	0.004	(0.009)	-14.863***	(2.487)
Boy	-0.066	(0.059)	0.013	(0.083)	-10.197	(22.208)	-0.066	(0.059)	0.013	(0.083)	-10.064	(22.024)
Educational level of HH (No education)												
Primary education	0.272**	(0.106)	0.149	(0.137)	63.712**	(26.078)	0.272**	(0.106)	0.150	(0.136)	64.380**	(26.252)
Secondary or higher ed.	0.535***	(0.113)	0.280**	(0.133)	149.334***	(30.740)	0.535***	(0.113)	0.263**	(0.133)	145.564***	(30.601)
Place of residence (Rural)												
Provincial capital	-0.002	(0.124)	0.220*	(0.125)	52.880	(40.422)	-0.002	(0.124)	0.216*	(0.125)	51.889	(40.270)
Other town	-0.019	(0.107)	-0.098	(0.111)	-23.594	(30.155	-0.019	(0.107)	-0.101	(0.110)	-24.087	(30.014)
Household size	-0.064***	(0.014)	0.008	(0.011)	-11.130***	(3.762)	-0.064***	(0.014)	0.008	(0.011)	-11.069***	(3.751)
Economic well-being (poorest)												
Poor	0.014	(0.122)	0.040	(0.188)	7.743	(32.151)	0.014	(0.122)	0.039	(0.187)	7.698	(32.088)
Middle	0.095	(0.136)	0.176	(0.163)	43.065	(32.244)	0.095	(0.136)	0.161	(0.163)	40.290	(32.041)
Fourth	0.416***	(0.154)	0.272	(0.178)	129.907***	(42.732)	0.416***	(0.154)	0.270	(0.179)	129.547***	(42.802)
Richest	0.419**	(0.164)	0.484**	(0.195)	195.454***	(54.778)	0.419**	(0.164)	0.490**	(0.196)	197.693***	(55.099)
Severity of illness (Mild)												
Moderate illness			0.475***	(0.096)	106.432***	(23.926)			0.473***	(0.095)	105.972***	(23.781)
Serious illness			1.139***	(0.109)	372.355***	(51.219)			1.131***	(0.109)	367.440***	(50.610)
Health facility (Public)												
Private			-0.039	(0.116)	-32.111	(95.359)			-0.051	(0.116)	-42.029	(94.872)
Other			-1.731***	(0.094)	-694.753***	(69.167)			-1.738***	(0.094)	-700.206***	(69.497)
Constant	-1.954***	(0.151)	8.770***	(0.189)			-1.955***	(0.151)	8.799***	(0.188)		
Observations	17864		1286		17864		17864		1286		17864	

Note: Author's calculations based on data from the 2011 DHS-MICS. Coef.: coefficient, SE: cluster robust standard error, ME: marginal effect. * significant at 10%, ** significant at 5%, *** significant at 1%. The variables between parentheses are the reference values.

Table 3: Two-part model of healthcare expenditure of non-fostered children

	Overall				Unconditional ME	
	logit		glm		—	
	Coef.	SE	Coef.	SE	Coef.	SE
Disabled	0.788***	(0.179)	0.008	(0.216)	245.846*	(128.261)
Disabled true sibling	0.091	(0.150)	-0.548***	(0.153)	-101.853***	(36.218)
Age	-0.081***	(0.008)	0.009	(0.010)	-16.680***	(3.309)
Boy	-0.057	(0.067)	-0.005	(0.093)	-14.593	(29.474)
Educational level of HH (No education)						
Primary education	0.331***	(0.108)	0.155	(0.151)	84.169***	(32.129)
Secondary or higher ed.	0.615***	(0.119)	0.265*	(0.152)	184.192***	(38.892)
Place of residence (Rural)						
Provincial capital	-0.060	(0.128)	0.198	(0.143)	41.716	(52.018)
Other town	-0.017	(0.115)	-0.161	(0.128)	-42.822	(40.267
Household size	-0.057***	(0.011)	0.002	(0.015)	-12.852***	(4.816)
Economic well-being (poorest)						
Poor	0.006	(0.125)	-0.051	(0.210)	-7.798	(40.438)
Middle	0.062	(0.138)	0.198	(0.180)	50.120	(41.807)
Fourth	0.372**	(0.156)	0.245	(0.199)	135.190**	(53.789)
Richest	0.489***	(0.170)	0.467**	(0.219)	253.024***	(74.330)
Severity of illness (Mild)						
Moderate illness			0.553***	(0.107)	148.555***	(33.197)
Serious illness			1.161***	(0.122)	441.562***	(67.050)
Health facility (Public)						
Private			-0.096	(0.134)	-90.397	(124.515)
Other			-1.752***	(0.106)	-820.265***	(91.991)
Constant	-2.040***	(0.156)	8.854***	(0.209)		
Observations	12970		1043		12970	

Note: Author's calculations based on data from the 2011 DHS-MICS. Coef.: coefficient, SE: cluster robust standard error, ME: marginal effect. * significant at 10%, ** significant at 5%, *** significant at 1%. The variables between parentheses are the reference values.

Table 4: Empirical test of the mean squared error

Variable of interest	Ho: Heckman true model			Ho: 2PM true model		
	MSE (Heckman)	MSE (2PM)	Choice	MSE (Heckman)	MSE (2PM)	Choice
Disability						
Disability	131.332	18.695	2PM	131.354	0.050	2PM

Note: Author's calculations based on data from the 2011 DHS-MICS.

Table 5: Box-Cox Test

Healthcare expenditure	Coef.	SD	P-value	confidence interval 95%
θ	0.047	0,015	0.000	0.017 ; 0.077
Observations	1286			

Note: Author's calculations based on data from the 2011 DHS-MICS. Coef.: coefficient, SD: standard deviation

Table 6: Modified Park Test

$(Y_i - \widehat{Y_i})$	Coef.	SD	P-value	confidence interval 95
$ln(\widehat{Y_i})$	1.905	0.250	0.000	1.415;2.395
Constant	1.946	2.267	0.391	-2.497;6.389
Observations			1,286	

Note: Author's calculations based on data from the 2011 DHS-MICS. Coef.: coefficient, SD: standard deviation