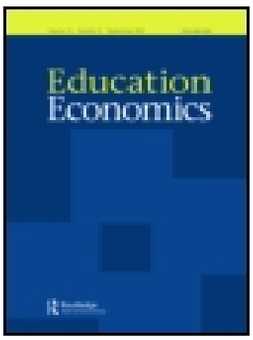

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Human capital accumulation of children in Cameroon: does disability really matter?

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ABSTRACT

Although most of the world's disabled people live in developing countries, little is known about the consequences of disability in this part of the world. Using the DHS-MICS 2011 data of Cameroon, this paper contributes to the literature by providing new robust estimates of the effect of child disability on education in a developing country context. It controls for unobserved heterogeneity within the households by using a 'true' sibling fixed effect model and also accounts for the severity of disability. The results show that moderate and severe disabilities reduce the probability that a child attends school and diminish school progress.

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Disability; education; child; sibling fixed-effects model; human capital

1. Introduction

In both developed and developing countries, education is associated with a higher probability of gaining a decent and better paid job (Unicef 2013). Any obstacle to education therefore reduces individuals' future productivity (Simo Fotso, Zamo Akono, and Tsafack Nanfosso 2016) and incurs a future cost. This is why education for all, especially universal primary education, features high among all development strategies, and the elimination of inequalities in education is one way of achieving it (ONU 2014).

There are various types of inequality in education: by gender, ethnicity, urban ratio, income, disability, etc. Even if the inequalities relating to disability are less frequently addressed in the literature, they have been shown to have greater impact than most other forms of inequality. Currie and Stabile (2007) show for two developed countries (Canada and US) that the education deficit due to disability is greater than that due to income or mother's education. Filmer (2008), working on thirteen developing countries, concludes that this deficit is often greater than that due to gender, urbanisation and economic status. The educational gap due to disability is therefore just as great as, if not greater than, all other forms of inequality.

And yet there are many policies and laws dealing with the education of people with disabilities. Internationally, as early as 1948, the Declaration of Human Rights recognised the right of education for all, the Convention on the Rights of the Child reiterated this right for children, and the Convention on the Rights of Persons with Disabilities promotes their right to education. In Cameroon, the general legal framework for education is laid down by the 1998 Law on Educational Guidance, which is supposed to guarantee access to education without discrimination. In 2000, primary education was made free of charge for every children.[1] The education of people with disabilities is covered by the 2010

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law, whose Article 29 states that the State contributes to the education and initial vocational training expenses of poor pupils and students with disabilities.

However, both global and national figures continue to reveal the huge educational disadvantages suffered by people with disabilities (OMS 2011). The situation in Cameroon is no better. The data from the 2005 Population and Housing Census show a net primary school enrolment rate of 75.5% for children with no form of disability, compared with only 69.9% for those with disabilities (Mbouyap and Ahanda 2010).[2] A differential also appears in level of instruction at all stages in the education system. Only 13.8% of people aged 6 and above with disabilities have reached the first cycle of secondary school, compared with 18% for the population as a whole.

This suggests that their disability would be the major detrimental factor in the deficit of human capital that children face. However, matters are not that simple. Economic theory reveals much more complex relationships between child health and education. Some authors, using life-cycle theoretical models, have concluded that disability has a possible influence on education (Case, Fertig, and Paxson 2005; Currie and Stabile 2006; Fletcher and Lehrer 2009; Jackson 2009; Filmer 2008; Cutler and Lleras-Muney 2012).

Other authors mention observable and unobservable third factors that may influence both disability and the level of educational attainment. Some empirical studies, controlling for some of these unobservables have shown that disability has no effect on children's education in some countries (Filmer 2008; Oreopoulos et al. 2008; De Ridder et al. 2013).

In the face of these theoretical and empirical disagreements and the virtual absence of robust evidence from developing countries in general and in Cameroon in particular, this study aims to assess the effect of a child's disability on their accumulation of human capital in Cameroon. Using the 2011 Demographic Health and Multiple Indicator Cluster Survey (DHS-MICS) data, the contribution of this study is of four kinds.

First, this study goes further than existing studies investigating the disability-education nexus in developing countries, by taking in account the household heterogeneity and using a 'true' sibling fixed-effects model instead of a household fixed effect model only. In fact, in developing countries many households include, in addition of children of the head of household (HH), other foster children (Simo 2017). In this context, using household fixed-effects model, in place of 'true' sibling fixed-effects model, can fail to account for unobserved genetic abilities and/or the heterogeneous investment between household head's biological children and the other children. Second, for the first time in a developing region, the effect is evaluated according the severity of disability. Third, the effect of disability is evaluated on both school attendance and school achievement, using a new indicator of school progress allowing to include all the children in school age. Fourth, a fairly recent database is used, hence our results are informative for suggesting current policy recommendations.

The rest of this paper has three sections. Section 1 is a detailed review of the theoretical and empirical literature on the relationship between disability and education. Section 2 presents the methodology used in this study. Section 3 proposes an analysis of the statistical and econometric results obtained.

2. Review of the literature

2.1. Theoretical links between child disability and education

In economic theory there are two possible links between health and education (Cutler and Lleras-Muney 2008). First, Poor health may cause lower educational attainment. Second, some third factors may affect both the health and education of an individual.

2.1.1. Child's disability a determining factor in educational attainment

Poor health, particularly during an individual's first years of life, is likely to negatively affect their accumulation of human capital. This conclusion is implied by certain life-cycle models

(Case, Fertig, and Paxson 2005). Although these models reveal the effect of childhood health on adult future health, they also show clearly that this is due, among other things, to an effect of health on educational attainment. How this operates in the case of a disability may be explained by two channels.

First, health may affect education via the illness it causes and/or the anticipations of lifespan it changes (Cutler and Lleras-Muney 2012). A child's disability may reduce their physical and/or cognitive capabilities. The child may also have other satellite illnesses and thus attend school less, learn less when they are there, leading to poor school results and ultimately lower educational attainment.

Second, in addition to the morbidity effect of a child's disability on their school results which may be called 'direct', an 'indirect' effect may also be observed. The disability may alter the 'subjective' or 'objective' return expected from education. The 'subjective' expected return is the internal or external return of education as modelled by their parents" beliefs about what a child with disabilities can accomplish at school or in the labour market. The 'objective' expected return is the parents' objective reasoning about the profitability of their child's education, given the state of the labour market. If the labour market displays strong discrimination against people with disabilities (Baldwin and Choe 2014) or if the type or severity of the child's disability is such that they are unlikely to obtain a job, the 'objective' expected return will be low.[3] If, as Becker (1962) claims, the expected return on investment in human capital is the main determining factor in the amount of that investment, then one would expect the parents of children with disabilities to reduce the investment made in their education, particularly if household resources are strained. Ultimately, the child's disability will lead to a reduction in educational attainment.

2.1.2. Third factors affecting both the education and the disability of the child

A set of third factors or family antecedents may also simultaneously affect a child's disability status and school attainment. These factors may be either observable or unobservable. The observable factors include household income, parents' educational attainment or social status. A rich parent can invest more in both the education and health of their child (Case, Fertig, and Paxson 2005; Cutler and Lleras-Muney 2008). A poor parent is more likely to have children with disabilities, because they invest less in their offspring's health, and to have less-educated children, because they invest less in their education.

The unobservable factors that may affect both health and educational attainment in a child include notably their genetic features or endowments (Cutler and Lleras-Muney 2008). A child's genetic inheritance may thus be responsible for certain mental or physical illnesses and also poor school results. Other unobservable factors in the family environment may also affect both education and disability status. For example, a noisy, dangerous or unlit family environment may underlie certain forms of disability and also be unfavourable for accumulating educational capital. Parents' preferences for investing in human capital could also affect simultaneously disability status and education outcomes.

2.2. Empirical literature linking child disability and educational capital

2.2.1. Empirical literature in developed countries

Following the pioneering work of researchers such as Barker (1995), showing that weight at birth is one determining factor in certain chronic diseases in Britain, a number of authors have taken that indicator and related it to individual school results. Although it is not in itself a disability, low birth weight, like other health indicators at birth, is associated with a high rate of disability and may therefore be considered to be a condition marker (Stabile and Allin 2012).

Black, Devereux, and Salvanes (2007) use a twin fixed-effects model to compare twins in the same family and thus allow for the unobservable heterogeneity between households. They find that in Norway a 10% increase in birth weight increases the probability of completing secondary school by just under 1%. However, their estimation technique requires them to confine themselves to twins, which raises the issue of the external validity of their results. The twin population differs in

many ways from that of other children, throwing doubt on the generalisation of results to the population as a whole. Oreopoulos et al. (2008) in Canada use both a sibling fixed-effects model and a twin fixed-effects model to assess the effect of certain health indicators at birth such as weight, Apgar score and length of pregnancy.[4] They find that whereas most of these indicators have no effect on the scores obtained in language tests at Grade 12, they do have a significant negative effect on the probability of entering Grade 12 at age 17.

Fletcher and Lehrer (2009) combine a sibling fixed-effects model and a 'genetic lottery'. The idea is that a child's health until they become an adult is affected by the behaviour (choices) of their parents. It should therefore be treated endogenously. The authors use variations in genetic markers between children and their interactions as an instrument of health, due to the simple genetic lottery that occurs at a child's conception. They find that mental disorders have a negative effect on the number of years' schooling completed. However, even if this approach solves the endogeneity problem that remains after using family fixed effects (because even for children in the same family there are differing characteristics), there are rarely if ever a exogenous genetic markers able to explain a broad health condition such as disability. As a result of this limitation and the lack of information about the genetic lottery in most databases, this method cannot easily be generalised.

Smith (2009) works on chronic diseases both severe (such as cancer, heart and lung disease and stroke) and moderate (high blood pressure, arthritis, diabetes). Although simple regression shows a significant negative effect of chronic disease, the inclusion of unobservables via family fixed effects causes the effect to disappear. De Ridder et al. (2013) analyse the risk of college dropout among adolescents presenting certain health problems. They use a sibling fixed-effects logistic model or conditional logistic to allow for unobservable heterogeneities at family level. They find a high risk of dropout for young people with high psychological distress and problems with concentration. However, once sibling fixed effects are controlled for, the effect is no longer significant for psychological distress. Their study may suffer from selection bias, since only young people attending school were included in the base sample, potentially excluding those who had already dropped out.

Alongside these studies of general health problems, others have been devoted to child deficiencies, by far the most on mental disability or behavioural disorders. Currie and Stabile (2006) examine the effects of Attention Deficit Hyperactivity Disorder (ADHD) on the level of children's human capital in Canada and the US, showing that the effects of this behavioural disorder are more marked than those of physical conditions. Currie and Stabile (2007) find a similar result including, in addition to ADHD, anxiety/depression, conduct disorder and other behaviour problems. Fletcher and Wolfe (2008) extend Currie and Stabile's (2006) study to older children so as to see the effect of these disorders on long-term educational results in the US. They find that, when they include family unobservables, ADHD has no effect on long-term education indicators such as the number of years' schooling or the probability of going on to higher education. To explain what is a counter-intuitive result, they show that living with a child suffering from this disorder negatively affects the other children, leading to a reduction in observed differences between children.

2.2.2. Weak evidences in developing countries

Although there are many studies in developing countries evaluating the effect of nutrition problems and tropical diseases (Bobonis, Miguel, and Puri-Sharma 2006; Clarke et al. 2008; Field, Robles, and Torero 2009), there are virtually none on the effect of disability. While study population for Mitra, Posarac, and Vick (2011) and Mitra, Posarac, and Vick (2013) is adults, they show that disability is associated with a low number of years' schooling in Ghana, Malawi, Mauritius, Zambia, Zimbabwe, Bangladesh, Lao PDR, Pakistan, Philippines, Brazil, Mexico and Paraguay, but not in Burkina Faso, Kenya and the Dominican Republic. Disability is also associated with a low probability of completing primary school in all these except Burkina Faso. However, because of the format of the survey, designed to question only one person per household, the authors are not able to establish a causal link and this result can only be seen as a correlation.

Filmer (2008) analyses the interactions between children's disability, education and poverty in developing countries and one emerging one. He finds that, although in most of these countries children with disabilities do not always live in poor households, their education is negatively affected by their disability. He shows that, except for Chad, disability has a negative effect on the probability of currently attending or having attended school. Although he controls for family unobsevables (such as parents' preferences for investing in children's education and health, and family environment) through household fixed effects model, it could remain some unobservables heterogeneity in households especially in an African context. In fact, many families in the developing countries include children from different parents. Comparing these children does not control for genetic unobservables. Moreover, parents' unobserved heterogeneous preference in investment could remain and bias the estimates.

Our article is an extension of this article applied on more recent data and Cameroon context. We go further by using a 'true' sibling fixed-effects model to correct for genetic unobservables heterogeneity in households. The estimates are also controlling for the disability severity.

3. Data and variables measurements

The Demographic Health and Multiple Indicators Cluster Survey (DHS-MICS) was used for the statistical and econometric processing. It was held from January to April 2011 by the INS with support from UNFP, UNICEF, World Bank and USAID. It is representative of the entire Cameroon population and was intended to collect information on demographic and health indicators using three questionnaires: women, men, and household.

Within the household questionnaire, various modules were used with all or some households. The disability module was administered to a random sample of half the households. This is the subsample used for all the following analyses. In addition to demographic information such as age, gender and relationship with head of household, the DHS-MICS survey collected information on current and past school attendance and educational level for the current and previous school year for household children from 3 to 24.

Given that the survey is a transversal one and does not provide the exact date at which each disability began, the effect of child disability on school results can be measured as such only for the population defined as children.[5] Our child definition is from age 6 to age 17. Although information on school attendance was collected from the age of 3, before 6 most children are in pre-primary; their enrolment rate is relatively low. School attendance in Cameroon is only compulsory from primary school on.

The general sample used in this study thus comprises children aged 6–17 for whom the education information is not missing.[6] Since DHS-MICS collected information about all the children in each household, it is possible to produce analyses at household level. For these analyses via household fixed effects, only the sub-set of individuals living in household with at least two children of differing disability status (i.e. at least one child with a disability and one without) (Filmer 2008) is used: the household sample. Analyses are also made with a restricted sample on only biological siblings. It means the head of household's biological children, where at least one has at least one disability and one has none: the Sibling sample.[7]

This restriction of study sample can cause a problem of selection bias and then question the external validity of results. In fact families with disabled children can differ from those without any disabled children. A number of verifications in order to ensure that the selection bias is moderate are discussed in Section 5.1 below.

The DHS-MICS survey makes it possible to identify deficiencies such as the lack of a body part or 'extremity', deformation of a limb, serious problems with sight, with hearing, with speech and behavioural disorders as described in Table A1. For example in the case of the lack of a body part or 'extremity' the following questions are used:

Is there a person in your household who is missing a body part, for example, a hand, arm, foot or leg? Is there a person in your household who is missing an extremity, such as a fingertip, toe, nose or ear?

If the respondent says 'yes' the name of the person affected is requested and further information about the disability are collected. In addition, the following question is also used 'Does [NAME] have bodily extremities that are numb?' for this category of disability. Table A1 shows that children who have a missing part or 'extremity', deformation, visual, hearing, speech and mental deficiency represent 8.1%, 25.9%, 17.9%, 32.9%, 19.9% and 12.7% of disabled children respectively.[8] The degree of severity of deficiency is then checked by a question about whether or not it is partial. This provided a disability categorical variable of value 1 if the child has no disability, 2 if their disability is moderate and 3 if the disability is severe.

There are a number of measures of education used in the literature (Mani, Hoddinott, and Strauss 2013). Some measure access to schooling, others educational attainment. In order to capture access to schooling, this analysis uses the *attends school* and *ever attended school* variables. These are short-term measurements of education. The *attends school* has value 1 if the child currently attends (or is enrolled at) a school and otherwise 0, *ever attended school* takes the value 0 if the child has never attended school and 1 otherwise. Educational attainment is a long-term measurement because it is supposed to summarise the child's career from school entry to the survey date. To measure it, the number of completed years' schooling at the time of the survey could be used.

However, this variable is better suited to adult populations (Patrinos and Psacharopoulos 1997). Since the sample used for this study comprises children of school age who have therefore not completed their educational careers, the measurement is right-censored (Mani, Hoddinott, and Strauss 2013), so another school attainment measurement is necessary.

Some authors consequently use the relative number of years' schooling or school progress (Mani, Hoddinott, and Strauss 2013). This is the ratio of number of completed years of education to the number of potential years of education. The latter figure is the number of years of education the person would have completed if they had started their schooling at the normal age and then completed one further year of education each year. In the literature, the variable is expressed as follows:

$$School\ progress = \frac{Years'\ schooling}{Age - E} \tag{1}$$

Where *Years' schooling* is the number of actually completed school years and E the usual school entry age in the country concerned. In Cameroon, E is 6 (Unesco-BIE 2010). Equation (1) may pose a problem with very young children, namely those aged 6. For them the *School progress* variable is infinite since the denominator is zero. For that reason, we built another school progress variable which allows including children of 6 in this study, what the previous variable does not allow.

It is expressed as follow:

$$School\ progress = \frac{Years'\ schooling + 1}{Age - E + 1} \tag{2}$$

School progress or the relative number of years' education provides information on both whether a child entered school late and if there have been results failures along the way. Where $School\ progress < 1$, the child has had a bad school progression meaning he has entered school late or has repeated at least one grade. If $School\ progress \geq 1$, it means that the child has a normal or advantageous school progression meaning he entered school at the right time or earlier and had never repeated any class. It is important to notice this indicator values the years of education according to the child's age, for example one year of education for a child of 8 is better valued than for a child of 9.

4. Method

In order to evaluate the effect of a child's disability on their school results, the estimated equation will first be of the following form:

$$Y_i = \alpha + \beta D_i + \lambda X_i + \epsilon_i \tag{3}$$

Where Y_i is the human capital of individual i, D his/her disability status and X_i all individual and family control variables. β and λ are the parameters to be estimated. As in many studies (Currie and Stabile 2006; Black, Devereux, and Salvanes 2007; Filmer 2008; Fletcher and Wolfe 2008; Oreopoulos et al. 2008), Equation (3) is estimated with a linear model both for the continuous variables (Ordinary Least Squares [OLS]) and the binary variables (via a linear probability model). This is done to directly interpret the results. Cluster-robust variances are calculated.

However, as pointed out above, the child's disability status and school results may be influenced by third factors such as family environment, parents' preferences for investing in human capital and certain genetic traits. As a result of these unobservable elements, coefficient β obtained in Equation (3) is tainted by endogeneity bias.

To correct for this bias, one may compare children living in the same household. This may be done by using, like Filmer (2008), a household fixed-effects model. The household fixed-effects model corrects the estimates for the unobservables shared by children in the same household independently of their biological relationship with the head of household. It supposes that there is no parents' preferences difference between their own child and a foster child, which is not always true as shown by Bledsoe, Ewbank, and Isiugo-Abanihe (1988) and Case, Paxson, and Ableidinger (2004). Moreover, there may be genetic unobservables that affect both education and a child's disability status. An attempt to control for these unobservables is made by considering only children who have the same parents through a sibling fixed-effects model (Currie and Stabile 2006; Fletcher and Wolfe 2008; De Ridder et al. 2013). By comparing the biological children of the head of household rather than all the children in the database irrespective of origin, the sibling fixed-effects model controls for all the observable, and unobservable, elements shared by siblings.

So the equation is:

$$Y_{is} = \alpha + \beta D_{is} + \lambda Z_{is} + \mu_s + \epsilon_{is} \tag{4}$$

With Z identical to X, except that it excludes the control variables shared by siblings. Subscript s represents the Sibling. So Y_{is} is the school attainment of individual i in Sibling s. μ_s represents the sibling fixed-effects; it relates to the family-specific unobservables. And ϵ_{is} is the error term.

5. Results

5.1. Description of the samples

Table 1 describes in detail the study samples. Column 1 describes the general sample of children for whom human capital variables are not missing. Columns 2 and 3 describe the samples in which there are at least two children with differing disability status. These samples are used for the fixed-effects models. Overall, disability affects some 3.1% of children aged 6–17 in Cameroon (moderate and severe disabilities affect 2.6% and 0.5% respectively). This prevalence is identical to that found by Filmer (2008) in Mongolia but slightly above that obtained in other African countries such as Burundi, Zambia and South Africa (approximately 1.3%) from 1995 to 2003. This probably reflects the ability of the 2011 DHS-MICS to better record certain types of disability. The disability prevalence figures obtained for the other two samples are much higher, which is quite understandable because these samples only include children in households with at least one disabled child.

Table 1 shows that overall the samples selected for fixed effects are fairly close to the general sample and there is not much evidence of differences in observables. Moreover, the Table A2 assessing whether living with at lest one disabled child in the household affects a child educational

Table 1. Variables means and Standard deviations.

	General sample		Household sample		Sibling sample	
	Mean	SD	Mean	SD	Mean	SD
Attends school	0.820	0.384	0.803	0.398	0.804	0.397
Ever attended school	0.867	0.339	0.853	0.354	0.848	0.360
School progress	0.838	0.460	0.791	0.473	0.796	0.478
Child disability						
None	0.969	0.174	0.702	0.458	0.679	0.467
Moderate disability	0.026	0.159	0.253	0.435	0.277	0.448
Severe disability	0.005	0.071	0.045	0.208	0.044	0.206
Child illness						
None	0.942	0.234	0.927	0.261	0.918	0.274
Slight illness	0.020	0.139	0.020	0.140	0.026	0.160
Moderate illness	0.024	0.152	0.027	0.163	0.026	0.160
Serious illness	0.015	0.121	0.026	0.160	0.029	0.169
Age	10.858	3.401	10.970	3.343	10.725	3.292
Age2	129.464	77.318	131.503	76.236	125.845	74.254
Boy	0.502	0.500	0.535	0.499	0.552	0.498
Biological child HH	0.648	0.478	0.693	0.461		
Education HH						
None	0.274	0.446	0.221	0.415	0.223	0.416
Primary education	0.390	0.488	0.433	0.496	0.439	0.497
Secondary or higher ed.	0.336	0.472	0.346	0.476	0.339	0.474
Age HH	48.603	14.018	49.177	12.357	47.655	10.480
Disability HH	0.108	0.310	0.188	0.391	0.177	0.382
Domicile						
Provincial capital	0.189	0.391	0.161	0.368	0.165	0.372
Other town	0.241	0.428	0.223	0.417	0.198	0.399
Rural area	0.570	0.495	0.616	0.487	0.637	0.481
Household size	8.201	4.564	9.102	3.832	8.895	3.598
Econ. well-being						
Poorest	0.203	0.402	0.220	0.415	0.270	0.444
Second quintile	0.233	0.422	0.262	0.440	0.247	0.432
Middle	0.216	0.412	0.220	0.415	0.200	0.400
Fourth	0.187	0.390	0.165	0.371	0.180	0.385
Richest	0.161	0.368	0.133	0.339	0.103	0.304
Constant						
Observations	11,105		995		611	

Notes: Author from 2011DHS-MICS data. The school attendance is known for 11,106, 995 and 613 observations respectively. Ever attended school is known for 11,106, 995 and 611 observations respectively. SD: standard deviations.

outcomes shows that there is not significant difference between children living with disabled kids and those living with only healthy children in the household. Even if this result does not fully ruled out the issue of selection bias it shows that the control group used in the fixed-effects analyses has educational results quite similar to the group who has been excluded because not living in a household with disabled children.

Table 2 shows the means of human capital variables by child's disability status. Whatever the educational variable, there is a considerable differential in human capital between children with and

Table 2. Level of human capital by disability status and gender.

	No disability (1)	Moderate disability (2)	Δ Mean (1)-(2)	Severe disability (3)	Δ Mean (1)-(3)	Girl (4)	Boy (5)	Δ Mean (4)-(5)
Attends school	0.825	0.772	0.053	0.281	0.544	0.789	0.852	−0.063
	(0.380)	(0.421)	[0.020]	(0.453)	[0.000]	(0.408)	(0.355)	[0.000]
Ever attended school	0.870	0.834	0.036	0.474	0.396	0.846	0.888	−0.042
	(0.336)	(0.372)	[0.075]	(0.504)	[0.000]	(0.361)	(0.315)	[0.000]
School progress	0.842	0.752	0.090	0.474	0.368	0.837	0.839	−0.003
	(0.459)	(0.465)	[0.000]	(0.339)	[0.000]	(0.472)	(0.447)	[0.381]
Observations	10,758	290		57		5524	5582	

Author from 2011DHS-MICS data. Standard deviations are in parentheses. Δ Mean is the difference between means or proportions of the columns indicated. *P*-values of the Two-sample test of proportions and means are in hooks.

without disabilities. The more severe the disability the wider the gap. For example, the school attendance rate is 82% for children with no disability, 77% for those with a moderate disability and 28% for those with a severe disability. Similarly, the school progression of children with a severe disability is only 0.47 compared with 0.75 of those with a moderate disability and 0.84 of those with none. The *P*-values of the two-sample test of proportions and means show that all these differences are statistically significant.

In addition, there is significant educational gap between girls and boys except in terms of school progression. However, if this gap is quite similar to the one observed between non-disabled and moderate disabled it is far inferior to the difference existing between non-disabled and severely disabled children. These descriptive findings suggest that there would be a causal relationship between having a disability and having poor educational capital. This hypothesis requires, however, more detailed econometric investigations.

5.2. Evidence of correlation between disability and education

Table 3 shows the OLS estimated regression of education on disability for all children (i.e. single-children, children living in families with more than one child with identical disability status and children living in families with children with varying disability status). It suggests that children with disabilities have lower school attendance than others. Compared with a child with no disability, a child with a moderate disability has a risk of attending school that is 7 percentage points (pp) lower. The difference is even more marked for children with severe disabilities where the difference may reach 56 pp. Similarly, moderate disability is associated with a lower risk (by roughly 6 pp) of ever attended school

Table 3. Correlation between disability and education: OLS for all children.

	Attends school		Ever attended school		School progress	
	Coef.	SE	Coef.	SE	Coef.	SE
Child disability (None)						
Moderate disability	−0.070**	(0.022)	−0.064**	(0.020)	−0.063**	(0.023)
Severe disability	−0.557***	(0.059)	−0.426***	(0.063)	−0.335***	(0.044)
Child illness (None)						
Slight illness	0.024	(0.023)	0.035*	(0.018)	0.002	(0.024)
Moderate illness	0.020	(0.020)	0.027	(0.017)	0.017	(0.020)
Serious illness	−0.035	(0.028)	0.003	(0.025)	−0.019	(0.038)
Age	0.142***	(0.008)	0.132***	(0.007)	−0.260***	(0.010)
Age2	−0.007***	(0.000)	−0.005***	(0.000)	0.009***	(0.000)
Boy	0.061***	(0.007)	0.042***	(0.006)	0.009	(0.007)
Biological child HH	0.011	(0.008)	−0.011	(0.007)	0.000	(0.009)
Education HH (None)						
Primary education	0.177***	(0.015)	0.159***	(0.013)	0.130***	(0.012)
Secondary or higher ed.	0.227***	(0.015)	0.182***	(0.014)	0.213***	(0.014)
Age HH	0.003***	(0.000)	0.002***	(0.000)	0.003***	(0.000)
Disability HH	0.011	(0.014)	0.012	(0.014)	0.000	(0.014)
Domicile (Rural area)						
Provincial capital	−0.043**	(0.014)	−0.010	(0.012)	−0.027	(0.016)
Other town	−0.013	(0.011)	−0.010	(0.010)	−0.029*	(0.014)
Household size	−0.005***	(0.001)	−0.003***	(0.001)	−0.007***	(0.001)
Econ. well-being (Poorest)						
Second quintile	0.165***	(0.018)	0.148***	(0.017)	0.142***	(0.014)
Middle	0.214***	(0.018)	0.175***	(0.016)	0.232***	(0.016)
Fourth	0.259***	(0.019)	0.205***	(0.017)	0.345***	(0.018)
Richest	0.286***	(0.020)	0.214***	(0.018)	0.451***	(0.021)
Constant	−0.299***	(0.048)	−0.233***	(0.045)	2.048***	(0.057)
Test coef. moderate dis=severe disability	[0.000]		[0.000]		[0.000]	
R^2	0.206		0.211		0.351	
Observations	11106		11106		11105	

Author from 2011DHS-MICS data. Coef.: coefficient, SE: standard errors clustered at the household level. *Significant at $p<0.05$, **Significant at $p<0.01$, ***Significant at $p<0.001$. Variables in parentheses are reference categories. *P*-values of the post-estimation test on whether the coefficient on moderate disability is significantly equal to severe disability are in hooks.

and a lower child's school progress. Severe disability is associated with a reduction of 43 pp in ever attended school risk and in even lower school progress. Post-estimation test on coefficient gives evidence that the coefficient of moderate disability is significantly different from the one of severe disability.

To have a clearer idea of the extent to which these variations may be due to disability, it is of interest to compare them with those arising from other common sources of differences in human capital. In order to do so, we calculated the sheaf coefficients presented in the Table A3. The sheaf coefficients post-estimations treat two or more variables as if they were one. They help comparing the relative strength of the influence of several blocks of variables or categorical variables (Buis 2010). On contrary of Filmer (2008) and Currie and Stabile (2007), this shows that the gaps due to disability are weaker than those due to gender or parent's educational attainment and economic well-being. These variables do have substantial effect on child's educational outcomes.

Concerning the demographic variables, Table 3 shows that being a boy increases the probability of attending and ever attended school, by 6 pp and 4 pp respectively. This variable has no significant effect on school progression, suggesting that gender educational inequalities are mostly located at the school attendance level in Cameroon. Child's age increases significantly his/her probability of being at school, while it reduces his/her school progression.

Household head's better education is associated with higher children educational outcomes, whatever is the school variable considered. For example, compared to a child whom the household head has no education, a child whom household head has completed primary education will have a probability of attending school and ever attended school higher by 22 pp and 18 pp respectively. He/she will also have a better school progression. Having an older household head is associated with a better school outcomes, while there is no association between the household head's disability status and child's school achievement.

The place of residence does not affect identically all the educational variables. For a child living in a provincial capital, the probability of currently attending school is 4 pp lower compare to a child of a rural area. No significant effect is observed for the other school outcomes. Likewise living in the other towns affects negatively a child's school progression only.

The household size is negatively associated with school attendance and progress. This result could translate the negative effect of the financial pressure related to household size on children educational investment. The school outcomes are positively and significantly associated with the socio-economic well-being of the household. For children belonging to the highest quintile, the school current attendance and ever attendance is higher by 28 pp and 21 pp respectively compare to those living in the lowest quintile. They also have a higher school progress (0.44).

Overall, the results for the probability that a person has ever attended school suggest that the lower current school attendance of disabled children could be due to their barrier at the entrance as shown by Filmer (2008). But school progress information show that they experience barriers once at school. However, because of the risks of endogeneity, the above results can only be interpreted as correlations. To determine more causal effects, we used fixed effects estimation.

5.3. Biases correction and evidence of causal effect of disability on education

Table 4 gives the results of the OLS estimates and the household fixed-effects model applied on the household sample. Overall, the OLS estimates are fairly close to those obtained in Table 3 with the wider sample. This suggests that previous results are robust to the sample size reduction.

In terms of school attendance, the disability coefficients obtained from the household fixed-effects model are fairly close to those obtained by OLS and are still just as significant. This suggests that the school attendance differential obtained previously was not due to unobservable factors common to households but indeed to the disability. Moderate and severe disabilities reduce children's school attendance by 9 pp and 57 pp respectively.

Table 4. OLS and household fixed-effects model.

	Attends school				Ever attended school				School progress			
	OLS		FE		OLS		FE		OLS		FE	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Child disability (None)												
Moderate disability	−0.090***	(0.025)	−0.091***	(0.024)	−0.080***	(0.022)	−0.082***	(0.022)	−0.074*	(0.030)	−0.073**	(0.027)
Severe disability	−0.573***	(0.067)	−0.600***	(0.068)	−0.410***	(0.075)	−0.452***	(0.082)	−0.345***	(0.054)	−0.365***	(0.069)
Child illness (None)												
Slight illness	−0.024	(0.112)	0.116	(0.069)	0.003	(0.068)	0.077	(0.061)	0.013	(0.085)	0.017	(0.094)
Moderate illness	0.104	(0.053)	0.024	(0.049)	0.080	(0.044)	0.018	(0.050)	0.123	(0.066)	0.022	(0.067)
Serious illness	0.059	(0.051)	−0.024	(0.067)	0.097*	(0.041)	0.043	(0.047)	0.095	(0.163)	−0.009	(0.074)
Age	0.120***	(0.025)	0.133***	(0.024)	0.100***	(0.023)	0.118***	(0.022)	−0.300***	(0.033)	−0.276***	(0.031)
Age2	−0.005***	(0.001)	−0.006***	(0.001)	−0.004***	(0.001)	−0.005***	(0.001)	0.011***	(0.001)	0.010***	(0.001)
Boy	0.097***	(0.021)	0.081***	(0.023)	0.064**	(0.019)	0.045*	(0.020)	0.092***	(0.023)	0.072**	(0.025)
Biological child HH	0.022	(0.029)	0.082*	(0.038)	0.020	(0.025)	0.047	(0.032)	0.043	(0.029)	0.078*	(0.036)
Education HH (None)												
Primary education	0.136*	(0.053)			0.099*	(0.048)			0.084*	(0.038)		
Secondary or higher ed.	0.225***	(0.050)			0.173***	(0.047)			0.260***	(0.045)		
Age HH	0.001	(0.001)			0.001	(0.001)			0.004**	(0.001)		
Disability HH	0.024	(0.037)			0.054	(0.034)			−0.004	(0.036)		
Domicile (Rural area)												
Provincial capital	−0.053	(0.055)			−0.034	(0.045)			−0.058	(0.052)		
Other town	−0.020	(0.039)			−0.021	(0.034)			−0.035	(0.052)		
Household size	−0.004	(0.004)			−0.002	(0.004)			−0.006	(0.004)		
Econ. well-being (Poorest)												
Second quintile	0.199***	(0.056)			0.196***	(0.054)			0.156***	(0.035)		
Middle	0.220***	(0.060)			0.218***	(0.055)			0.236***	(0.047)		
Fourth	0.234***	(0.062)			0.229***	(0.059)			0.322***	(0.059)		
Richest	0.269***	(0.068)			0.251***	(0.063)			0.436***	(0.078)		
Constant	−0.123	(0.177)	0.097	(0.135)	−0.090	(0.157)	0.143	(0.124)	2.129***	(0.198)	2.462***	(0.180)
R^2	0.244		0.220		0.228		0.183		0.424		0.343	
Observations	995		995		995		995		995		995	

Author from 2011DHS-MICS data. Coef.: coefficient, SE: standard errors clustered at the household level. *Significant at $p<0.05$, **Significant at $p<0.01$, ***Significant at $p<0.001$. Variables in parentheses are reference categories.

The household fixed-effects models show that a child with a moderate disability and a child with a severe disability have a probability of ever attended school of 8 pp and 45 pp respectively lower than a child with none. Having a moderate disability or a severe disability reduces a child's school progress compared to having no disability.

The effect of severe and moderate disability on school participation and progress slightly increases when household unobservables are included and remains highly significant. This means that household-specific unobservables tend to under-estimate the effect of disability.

However, as discussed above, a further possible source of endogeneity bias are some genetic unobservable, and investment differential which can exist within the household because fostering practices are frequent in Cameroon. The estimates controlling for these unobservables through 'true' sibling fixed-effects are given in Table 5.

The effects of disability on school ever attendance (reduction of 8 pp and 44 pp for moderate and severe disability respectively) and school progression (reduction of 0.07 and 0.37 for moderate and severe disability respectively) obtained here are a quite similar to the previous ones. We observed only a slight difference concerning school attendance. In fact, concerning the probability of attending school, moderate disability is found to cause a reduction of 12 pp when we account for the other potential sources of unobserved heterogeneity. Likewise, severe disability caused a reduction of 52 pp.

Accounting for the genetic and investment unobserved heterogeneity inside a household using 'true' sibling fixed-effects model does not change drastically the results. It could mean that genetic unobservables inside the household do not play a big role in child school achievement and that there is not a huge preference difference between biological and fostered children.

6. Conclusion

The aim of this study was to evaluate the effect of child disability on the accumulation of human capital in Cameroon. The effect was measured taking into account the possibility of family-specific unobservables likely to affect both education and disability status, such as heredity, family environment and unobserved parents' preferences concerning human capital related to bond of filiation with the child.

The analysis of this paper is in a developing country context characterised by the lack or weakness of social support for disabled people. The specificity of this context make the results of the relatively abundant literature in developed countries (Currie and Stabile 2006, 2007; Fletcher and Wolfe 2008) hardly extendable and highlight the necessity of such a study specific to the region. Moreover the paper focuses on Cameroon which has not been included as part of the sample of the rare studies analysing the school achievement of disabled people in that region of the world (Filmer 2008; Mitra, Posarac, and Vick 2011, 2013).

The paper proposes an extended number of outcome variables. In addition to school current attendance and ever attendance used by the previous studies assessing the effect of child disability on education in an African context such as Filmer (2008), this paper used a measure of school progress proposed by Mani, Hoddinott, and Strauss (2013) and extended it in order to account for very young children.

The study adds also to the literature by distinguishing the effect of moderate and severe disability on school outcomes. In addition to the household fixed effect used by Filmer (2008), the paper accounted for the African context where child fostering is very common, by using also a 'true' sibling fixed-effects model.

The findings shows that a moderate disability reduces by 12 pp a child's probability of attending school and for a severe disability this figure may be as high as 52 pp. Moderate and severe disabilities reduce by 8 pp and 44 pp the probability that a child has ever attended school respectively. Most of the difficulty for children with disabilities is rather access to schooling. However, both the moderate and severe disabilities reduce a child's school progress. This suggests that disability creates a major

Table 5. OLS and sibling fixed-effects model.

	Attends school				Ever attended school				School progress			
	OLS		FE		OLS		FE		OLS		FE	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Child disability (None)												
Moderate disability	−0.104***	(0.030)	−0.120***	(0.029)	−0.078**	(0.027)	−0.084**	(0.027)	−0.068	(0.037)	−0.070*	(0.031)
Severe disability	−0.506***	(0.089)	−0.523***	(0.104)	−0.382***	(0.088)	−0.440***	(0.099)	−0.334***	(0.068)	−0.368***	(0.094)
Child illness (None)												
Slight illness	−0.079	(0.127)	0.092	(0.069)	−0.040	(0.079)	0.028	(0.060)	0.012	(0.103)	0.042	(0.131)
Moderate illness	0.134***	(0.038)	0.136**	(0.048)	0.104**	(0.032)	0.092*	(0.038)	0.168	(0.087)	0.093	(0.095)
Serious illness	0.025	(0.068)	−0.085	(0.081)	0.103*	(0.051)	0.066	(0.062)	0.158	(0.217)	−0.018	(0.107)
Age	0.125***	(0.030)	0.117***	(0.029)	0.123***	(0.029)	0.119***	(0.028)	−0.302***	(0.042)	−0.281***	(0.039)
Age2	−0.005***	(0.001)	−0.005***	(0.001)	−0.005***	(0.001)	−0.005***	(0.001)	0.011***	(0.002)	0.010***	(0.002)
Boy	0.111***	(0.028)	0.087**	(0.030)	0.079**	(0.025)	0.055*	(0.025)	0.066*	(0.030)	0.041	(0.035)
Education HH (None)												
Primary education	0.078	(0.070)			0.088	(0.062)			0.063	(0.045)		
Secondary or higher ed.	0.204**	(0.066)			0.189***	(0.056)			0.277***	(0.061)		
Age HH	0.001	(0.002)			0.003	(0.002)			0.003	(0.002)		
Disability HH	−0.028	(0.052)			0.011	(0.046)			−0.027	(0.042)		
Domicile (Rural area)												
Provincial capital	−0.126	(0.072)			−0.091	(0.061)			−0.065	(0.055)		
Other town	−0.050	(0.053)			−0.022	(0.048)			−0.039	(0.061)		
Household size	−0.012	(0.007)			−0.005	(0.006)			−0.003	(0.006)		
Econ. well-being (Poorest)												
Second quintile	0.210**	(0.064)			0.216***	(0.058)			0.162***	(0.045)		
Middle	0.237**	(0.073)			0.206**	(0.069)			0.243***	(0.058)		
Fourth	0.243**	(0.075)			0.210**	(0.065)			0.306***	(0.068)		
Richest	0.280***	(0.083)			0.235***	(0.070)			0.483***	(0.081)		
Constant	−0.075	(0.218)	0.199	(0.158)	−0.215	(0.205)	0.151	(0.160)	2.223***	(0.246)	2.553***	(0.224)
R^2	0.256		0.210		0.247		0.198		0.453		0.351	
Observations	613		613		611		611		611		611	

Author from 2011DHS-MICS data. Coef.: coefficient, SE: standard errors clustered at the household level. *Significant at $p<0.05$, **Significant at $p<0.01$, ***Significant at $p<0.001$. Variables in parentheses are reference categories.

future indirect cost, by impairing children's accumulation of human capital, and making it harder for them to integrate into the labour market and/or reducing their adult earnings. However, the gap created by disability seems not to be greater than the other usual sources of education deficits contrary to what some previous studies found (Currie and Stabile 2007; Filmer 2008).

The effect of the child's moderate disability on current school attendance and ever attendance found in this study is close to the one found by Filmer (2008) in Mozambique. But this effect appeared to be lower than the results obtained for the other countries of Filmer's sample (except India). This is probably explained by the fact that the author did not make a distinction between moderate and severe disability. In fact, the effect of severe disability on school attendance shown here is higher than the effect obtained using a global measure of disability in almost all the countries of Filmer's sample. Similarly to Mitra, Posarac, and Vick (2011) results based on adults in developing countries, this study found that disability hinder children's school progress, even though the extent of the effect is hardly comparable since the measure of school progress and the targeted population are not the same.

This study does, however, have limitations. Although we have controlled for the surrounding and genetic unobservables in the household, we cannot exclude unobservable factors specific to each child. In addition, the econometric specification based on fixed-effects necessarily reduced the observation sample. Though the overall sample and the one kept in the model are very similar, a selection bias could not be totally excluded. In spite of their limitations, the findings provide matter for a number of recommendations for economic policy.

First, they show that the educational differential between people with and without disabilities is not due to third factors, as suggested by economic theory, but is indeed due to the disability. Adopting policies to reduce childhood disabilities is therefore also a way of eliminating an obstacle to universal education. Second, improvements need to be made both to the supply of education, by guaranteeing access to schools and specialist schools, and to the demand, by informing parents about the opportunities that education offers a child with a disability, so as to raise the level of school attendance. As UNICEF puts it, the fact that parents believe that a child with a disability is unable to study at school is probably the main reason for the lower school enrolment (Unicef-Armenie 2012). Third, public authorities should improve and ensure the adequacy of tools used to provide education so that children with disabilities can achieve better school results. Finally, this work suggests implementing more research on the economic consequences of child disability in developing countries to fully understand the origins of the observed human capital penalty.

Notes

1. In practice, other expenses, such as uniform, transport, school exams and textbooks, and subscriptions to parent-teacher associations remain to be paid by parents.
2. Except where otherwise stated, all the figures in this paragraph come from the same source.
3. Note that the 'subjective' and 'objective' expected returns may be linked, since the state of the labour market may alter beliefs about the capabilities of children with disabilities.
4. The Apgar score is a summary of five vital signs noted by health staff at birth. They are heart rate, respiration, muscle tone, reflex and colour. Each is scored from 0 (poor) to 10 (excellent).
5. The 1989 Convention on the Rights of the Child defined a child as 'every human being below the age of eighteen years unless under the law applicable to the child, majority is attained earlier' (ONU 1989, 2056).
6. The information on current school attendance, ever school attendance and number of years' schooling is missing for only 0.34%, 0.34% and 0.35% of children respectively.
7. The choice of grouping children by their descendance from the head of household rather than from father or mother was guided by the desire to keep as many children as possible in the sample. Generally speaking, 44.19% and 35.77% of children do not live in the same household as their father or mother respectively, and cannot be grouped as siblings on that basis. However, in all households there is a head of household (who may be a woman or a man) and this person is generally one of the children's parents.
8. Although the questions used are not those of the Washington Group on Disability Statistics (WG), they produce overall results as to the prevalence of disability that are fairly close to those obtained with the WG questionnaire in Senegal in 2013.

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