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Standard of Living and Disability in Cambodia

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ABSTRACT *Little is known about the extra costs faced by households with disabled members in low resource settings and the impact of these costs on living standards. In this paper we estimate the direct cost associated with disability for households in Cambodia. Using the Standard of Living approach, the direct cost associated with having a member with disabilities is estimated to be 19 per cent of monthly household consumption expenditure. Accounting for the direct cost of disability doubles the poverty rate amongst households with disabled members from 18 per cent to 37 per cent, and increases the poverty gap from 3 to 8 per cent. A comparison of the direct cost associated with disability and income support received from government and family sources reveals that only 7 per cent of the costs of disability are met. Our findings suggest that, in the absence of increased coverage of public income support, households with disabled members will continue to experience a lower standard of living compared to households without disability in Cambodia.*

1. Introduction

Disability and economic disadvantage tend to go hand in hand. In countries of varying levels of development, persons with disabilities typically achieve a lower level of education and are less likely to be employed than their peers without disability (Filmer, 2008; Mitra, 2018; Mizunoya & Mitra, 2013; World Health Organization, 2011).¹ As a consequence, persons with disabilities and the households in which they live are over-represented amongst the poor (Mitra, 2018; Mitra, Posarac, & Vick, 2013; World Health Organization, 2011).² While the indirect costs of disability that occur through reduced earnings capacity and employment are well documented (Lamichhane, 2015; Mizunoya & Mitra, 2013; World Health Organization, 2011), more recent attention has turned to understanding the direct cost that disability imposes on individuals and the households in which they live. The direct cost is incurred through expenditure on disability related items such as assistive devices or medication, as well as additional expenditure on items not specifically related to disability such as transport or dietary requirements. These additional expenditures imply that a household with a disabled member requires more resources in order to attain the same standard of living as an otherwise similar household (Sen, 2004). As a consequence, knowledge of the direct cost of disability is critical to understanding the relationship between disability and poverty, and to the development of policies that ensure an adequate standard of living for persons with disabilities and the households in which they reside.

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Quantifying the additional costs faced by households with disabled members is of particular policy relevance in low- and middle-income countries because millennium development goals, and the sustainable development goals that have succeeded them, specifically target poverty reduction.³ In addition, the UN Convention on the Rights of Persons with Disabilities (CRPD) requires signatories to protect the right of persons with disabilities to have an adequate standard of living for themselves and their families, including adequate food, clothing, and housing, as well as to safeguard access by families to social protection assistance with disability related expenses (Article 28, Aguilar, 2017; United Nations, 2008). In order to assess the extent to which the development goal targets for poverty reduction and obligations under the CRPD to ensure an adequate standard of living are being met, accurate measures of the direct cost associated with disability are needed.⁴

Despite its importance, especially for low- and middle-income countries, there remains a significant gap in understanding the direct cost of disability. In a survey of the literature, Mitra, Palmer, Kim, Mont, and Groce (2017) identify a total of 20 studies on the direct cost of disability covering 10 predominantly high-income countries. These studies show that the direct cost of disability can be non-trivial and have been estimated to be between 11 and 55 per cent of household income in high income countries, and between 9 and 20 per cent of household income for the low- to middle-income countries of Bosnia, Vietnam, and China. Mitra and co-authors suggest that an important reason for the direct cost of disability being smaller in low- to middle-income countries is a lack of availability, access, and affordability of disability services. If this is the case, then the direct cost of disability in low-income countries cannot be inferred from the estimated costs in high- or even middle-income countries. While access to disability services and associated costs may be expected to be lower in very poor settings, the impact of these costs on poverty may be greater due to low overall living standards. It is in this context that we seek to make a contribution by providing the first estimates of the direct costs of disability and their impact on poverty in a low resource setting.

We estimate the direct cost of disability in Cambodia, one of the poorest countries in southeast Asia. We do so using the ‘Standard of Living’ (SOL) approach. This approach is based on the concept of compensating variation, and estimates the additional resources required for a household with a disabled member to reach the same standard of living as an otherwise similar household without a disabled member.⁵ We implement the SOL approach using information collected in the Cambodian Socio-Economic Survey (CSES) over the period 2009–2014. The estimated direct cost of disability is then used to calculate measures of poverty (specifically, the poverty head count and the poverty gap) adjusted for the cost of disability. We also compare the estimated direct cost of disability to the level of support received from government, non-government and family sources. Few papers are able to compare the cost of disability to the level of support received (Mitra et al., 2017). Those that attempt to do so are limited to considering support received from government transfers only (Loyalka, Liu, Chen, & Zheng, 2014; Morciano, Hancock, & Pudney, 2015; Zaidi & Burchardt, 2005). As the CSES collects information on remittance transfers to households in addition to government and non-government transfers, we are able to compare direct disability costs with the amount of support received from formal and informal sources. This is a notable contribution since information on the extent to which households can self-insure against the costs associated with disability can inform the design of disability benefits. This is particularly relevant in low resource settings where formal government income support is not widely available and informal supports represent an important source of welfare.

2. Disability in the context of Cambodia

For much of the last 50 years, Cambodia’s history has been one of civil conflict and instability. The most intense period of conflict occurred between 1975 and 1979, during the reign of the Khmer Rouge. During this period an estimated two million people died of starvation, forced labour, untreated disease, torture, and execution (Dy, 2007).⁶ However, political instability and violence continued long after the fall of the Khmer Rouge, and well into the 1990s. While much of the fighting after 1980 was

confined to provinces that bordered with Thailand, the ongoing civil conflict impacted on the nation's ability to rebuild the basic economic and public infrastructure that was destroyed during the time of the Khmer Rouge.

Today, Cambodia remains one of the poorest countries in southeast Asia with a GDP per capita of approximately 1100 USD (National Institute of Statistics, Directorate General For Health, & ICF International, 2015). In recent decades the country has achieved strong economic growth and poverty has decreased to approximately 20 per cent of the population. However, large disparities in living standards exist between urban and rural areas. Child malnutrition remains high with an estimated one third of children in Cambodia stunted. The vast majority of the population does not have health insurance (84% of women and 87% of men) and the first health care provider of choice for most Cambodians is private pharmacies. Health facilities are concentrated in urban areas whereas the population is predominately located in rural locations. Poor road infrastructure makes access to health services both difficult and expensive for persons with disabilities (Nossal Institute for Global Health, et al., 2017). In addition, many health services are reported to be physically inaccessible to persons with mobility disabilities because they lack entry ramps, lifts, and other equipment such as adjustable beds. The physical rehabilitation needs of Cambodian's are served at Physical Rehabilitation Centres (PRCs). These centres were established by international non-government organisations to provide physical rehabilitation services to individuals disabled by war, landmines, and polio. Over the past 10 years, responsibility for management and resourcing of the PRCs has been transitioning to the government, which now funds approximately 30 per cent of these centres (Nossal Institute for Global Health, et al., 2017). Nonetheless, physical rehabilitation services are in limited supply, with only 11 centres serving the needs of the population with disabilities in Cambodia.

The conflict experienced by Cambodia is likely to have increased the level of disability in the population in the short- to medium-term through the population's contact with violence, and indirectly through the effects of malnutrition, poor sanitation, and a lack of health services (Ugalde, Richards, & Zwi, 1999). On-going effects of the country's history of civil and regional conflict on disability are experienced through exposure to unexploded ordnance and land mines (Cambodian Mine Action Centre, 2014; Merrouche, 2011).⁷ However, the long-term impact on the prevalence of disability is ambiguous since the death of an estimated one-quarter of the population and low fertility in the 1970s led to changes in the demographic profile of the country (de-Walque, 2005, 2006). Almost half (43%) of Cambodia's population is below the age of 20 years and just 6 per cent are 65 years of age or older. To the extent that disability is correlated with age, the youthfulness of Cambodia's population puts downward pressure on current disability rates.

Recent estimates of the national prevalence of disability in Cambodia range from around 1 to 4 per cent of the population (National Institute of Statistics and Ministry of Planning, 2009, 2015; National Institute of Statistics, et al., 2015). The estimates are low but are consistent with disability prevalence estimates from other low resource countries (Mitra & Sambamoorthi, 2014). Over and above the demographic effects discussed above, a potential explanation for low estimates of the prevalence of disability in Cambodia lies in the way disability is measured. The 2008 Census of Cambodia estimates the prevalence of disability to be 1.4 per cent of the all age population using a medical impairment definition of disability (National Institute of Statistics and Ministry of Planning, 2009). This definition views disability in terms of disease or impairment and a measure based on this definition tends to under-report disability (Palmer & Harley, 2012). Subsequent national surveys measure disability on the basis of degree of difficulty in functioning, consistent with the International Classification of Functioning, Disability and Health developed by the World Health Organisation (World Health Organization, 2001). Using this approach, the 2014 Cambodian Socio-Economic Survey estimates the prevalence of disability to be approximately 4 per cent of the all age population (National Institute of Statistics and Ministry of Planning, 2015). In the same year, using an international standardised measure of disability (Washington Group Short Set of Questions on Disability), the Cambodia Demographic Health Survey estimated the prevalence of disability to be 2.1 per cent of the population aged five years and older (National Institute of Statistics, et al., 2015).⁸

Little is currently known about the living standards of persons with disabilities (and the households in which they reside) in Cambodia. To our knowledge there exists no nationally representative research on the association between disability and poverty. The Royal Government of Cambodia has taken several steps to improve the economic position of persons with disabilities. In October 2007, the government signed the CRPD which was ratified in December 2012. In July 2009, it introduced an inaugural national disability law (*Law on the Protection and the Promotion of the Rights of Persons with Disabilities*) which aims, among other things, to develop policies to provide livelihood assistance for persons with disabilities (Kingdom of Cambodia, 2009). A sub-decree was passed in June 2011 which entitles persons with severe disabilities living in conditions of poverty to a monthly disability pension of approximately 5 USD (20,000 Riel) (Kingdom of Cambodia, 2011). To strengthen the implementation of the national disability law and associated sub-decrees, a national disability strategic plan was developed for the period 2014–2018. A key goal of the national plan is to ensure that the poor are provided with assistance from the State with disability-related expenses. A contribution of this research is that in estimating the cost of disability to Cambodian households, it provides crucial information to assist policy-makers in achieving this goal.

3. Conceptual framework

There are three main approaches used to estimate the direct cost of disability (Mitra et al., 2017; Stapleton, Protik, & Stone, 2008). The first is the goods and services *used* approach. It estimates the costs of disability as the difference in actual expenditures on consumption of persons with and without disabilities.⁹ The problem with this approach is that surveys that collect information on household expenditure typically do not include disability specific expenditure items such as personal assistance, adaptations to vehicles and housing, and special dietary requirements. Furthermore, and relevant in the context of countries such as Cambodia, the goods and services used method is sensitive to budgetary and other constraints relating to the availability and accessibility of disability goods and services. For these reasons, the method is likely to under-estimate the costs of disability.

A second approach to estimating the direct costs of disability is the goods and services *required* approach. Under this framework people with disabilities are asked to estimate the costs of items required to reach a reasonable standard of living or perform particular activities that individuals are not performing due to their disability. The method is based on stated rather than revealed preferences. A weakness of this approach is that it requires disabled individuals to know not only the types of goods and services that could improve their standard of living but also the costs of these goods and services. In the absence of this knowledge, this method is likely to produce an under-estimate of the direct cost of disability, and the downward bias may be greater in low resource settings such as Cambodia.

A third approach, and the one that we follow, is the *expenditure equivalence* or Standard Of Living (SOL) approach to estimating the direct cost of disability. Based on the concept of compensating variation, the SOL approach indirectly measures the direct costs of disability as the additional resources required to achieve the same standard of living as an otherwise similar household (along controlled for dimensions) without disability. The advantage of this method over those above is that it does not depend upon disability specific expenditure measurements or subjective estimates of needs. Instead, it relies upon measures of income and living standards (derived from items unrelated to disability).

The SOL approach has been used to estimate the direct cost of disability in the UK by Zaidi and Burchardt (2005), Cullinan, Gannon, and O'Shea (2013), and Morciano et al. (2015). These studies focus on older persons with disability, as disability and hence government financial support for the disabled in the UK is concentrated in older age groups. Overall, these papers suggest that the average direct cost of disability ranges from 11–55 per cent of household income. In the context of China, Loyalka et al. (2014) use the SOL approach to estimate a direct cost of disability in the range of 8–20 per cent of household income for rural households with two and three adult members respectively. Braithwaite and Mont (2009) and Mont and Nguyen (2011), also using the SOL approach, estimate

the direct cost of disability in Vietnam to be 9–12 per cent of household income. No previous study has examined the direct cost of disability in a low resource country setting such as Cambodia.

The SOL approach is generally implemented using a parametric regression model in which the outcome of interest is the standard of living of household j living in province s at time t (SOL_{jst}), which is modelled as a function of household resources (Y_j), an indicator for the presence of a disabled household member (D_j), a vector of variables capturing observed household heterogeneity (X_{jtk}), a set of indicators for the province in which the household resides (P_s), and unobserved heterogeneity (ε_{jst}).

$$SOL_{jst} = \alpha.Y_j + \beta.D_j + \delta'_k.X_{jtk} + \gamma'.P_s + \varepsilon_{jst} \quad (1)$$

The household's standard of living is measured using an index of household assets and housing characteristics. Given the low resource setting, we use household consumption expenditure to measure household resources (Deaton, 1997). Observed household heterogeneity that we control for includes: household size, number of children, number of elderly persons, rural location, year and month of survey, and characteristics of the household head (refer Table A1 for a detailed description of variables).

The direct cost of disability as defined in the compensating variation framework is the additional resources required for households with disabled members to achieve the same standard of living as an otherwise similar household (as measured by characteristics that we control for) without disabled members. On the basis of the model for household standard of living given by Equation (1), the direct cost associated with having disabled household members (C), is given by:

$$C = -\frac{\beta}{\alpha} \quad (2)$$

While the SOL method used in this study to estimate the direct cost of disability offers several advantages over other direct disability cost estimation methods, it is not without its limitations. Chief among these is the sensitivity of results to the choice of the functional form relating household resources to household standard of living, the sensitivity of results to the variables and method used to construct the living standards measure, and the likely correlation between disability and unobserved heterogeneity in households' standard of living (Hancock, Morciano, & Pudney, 2013; Zaidi & Burchardt, 2005). It is also important to recognise that the SOL method estimates the direct cost of disability based upon the specific context, which includes availability and access to health care goods and services.

We address the issue of choice of functional form by fitting specifications in which the household resource variable enters the model for household standard of living with differing functional forms (linear, quadratic, square root, and logged). Results are shown in Supplementary Materials Table 1. The Akaike information criterion (AIC) is used to compare the parametric models. On this basis, the natural log of household consumption expenditure is preferred. This functional form implies that a household's standard of living increases with consumption expenditure at a diminishing rate. In this preferred specification, the cost of disability, C , given in Equation (2) approximately corresponds to the proportionate increase in household consumption expenditure required to achieve the same standard of living as an otherwise similar family with no disabled members. The sensitivity of our results to the choice of variables and method used to construct the household standard of living measure is investigated in Section 5.2.

4. Data

4.1. The Cambodian socio-economic survey

This study draws on information collected in the Cambodian Socio-Economic Survey (CSES) over the period 2009–2014. The CSES is a cross-sectional survey that provides nationally representative

information on consumption, assets, and wealth of surveyed households as well as demographic characteristics, health status, and health care utilisation on all individuals residing within surveyed households.¹⁰ Each wave of the CSES is representative at the national level, and all follow the same stratified sampling design. Sample sizes are around 3,000 households for the 2010, 2011, 2012, and 2013 waves, and around 12,000 households in the 2009 and 2014 waves. Pooling the six independent cross-sections for the years 2009–2014 yields a total of 38,103 households which are used in our analysis.

4.2. Disability

Disability is reported in the CSES using questions on functioning difficulties, defined as difficulties experienced with basic functions, such as seeing and hearing, which may limit participation in unaccommodating environments (Mitra, 2018).¹¹ The CSES asks each household respondent to answer the following two questions for each household member: ‘Does ..[NAME].. have any of the following? [Enter the three most important] 1. Difficulty seeing; 2. Difficulty hearing; 3. Difficulty speaking; 4. Difficulty moving; 5. Difficulties in feeling or sensing; 6. Psychological or behavioural difficulties; 7. Learning difficulties; 8. Fits; 9. Other (specify); 10. Don’t know.’, and ‘Is the difficulty: 1 = Mild; 2 = Moderate; 3 = Severe.’

Our primary measure of disability (measured at the individual level) is constructed as an indicator that is equal to 1 if the individual is reported by the household respondent to have at least one functioning difficulty, and the first (most important) difficulty is reported to be moderate or severe. The average prevalence of disability based on this measure over the six waves of data is 3.2 per cent.

Our measure excludes from the category of disabled those whose most important functioning difficulty is reported to be mild. We do this because three-quarters of those whose most important functioning difficulty is mild report a seeing difficulty, typically corrected by wearing glasses, as their most important difficulty. While no international standard definition of disability exists, seeing difficulties that can be corrected by glasses are generally not included in definitions of disability. For example, the United Nation’s Washington Group on Disability Statistics exclude from the definition of functioning difficulties seeing difficulties that are corrected when wearing glasses.¹² In order to ensure consistency of our measure of disability with those used by previous studies, we exclude individuals whose most important difficulty is mild from our measure of disability. In a low resource setting, however, mild seeing difficulties that could be corrected by glasses may still impact on individuals functioning because there is poor access to glasses and vision screening (Mitra, 2018; Mont, 2007). Therefore, in order to explore the sensitivity of our results to excluding those reporting as their most important functioning difficulty, a mild difficulty, we also construct an alternative disability indicator that is equal to one for individuals who are reported to have at least one functioning difficulty, where the most important difficulty is either mild, moderate, or severe.¹³

Figure 1 graphs the distribution of disability at the household level. Figure 1(a) shows that, over the period of 2009–2014, 13.3 per cent of Cambodian households report having one or more members with a disability, with 11.2 per cent of households in the pooled sample having one member with a disability (84% of households with any disabled members). Figure 1(b) shows that of households with a single disabled member, 1.4 per cent are contributed by households with a disabled household member who is less than 20 years old, 5.2 per cent are contributed by households with an adult disabled member aged 20–59, and 4.6 per cent have an elderly disabled member aged 60 years or older.

4.3. Standard of living

We measure the household’s standard of living using an asset index (Anton, Brana, & Bustillo, 2011; Loyalka et al., 2014; Mont & Nguyen, 2011; Zaidi & Burchardt, 2005). The CSES collects information on a broad class of assets, which allows us to differentiate living standards across households. Following the approach recommended by Cambodia’s National Institute of Statistics et al. (2015) for measuring assets, we include in our asset index household level information on

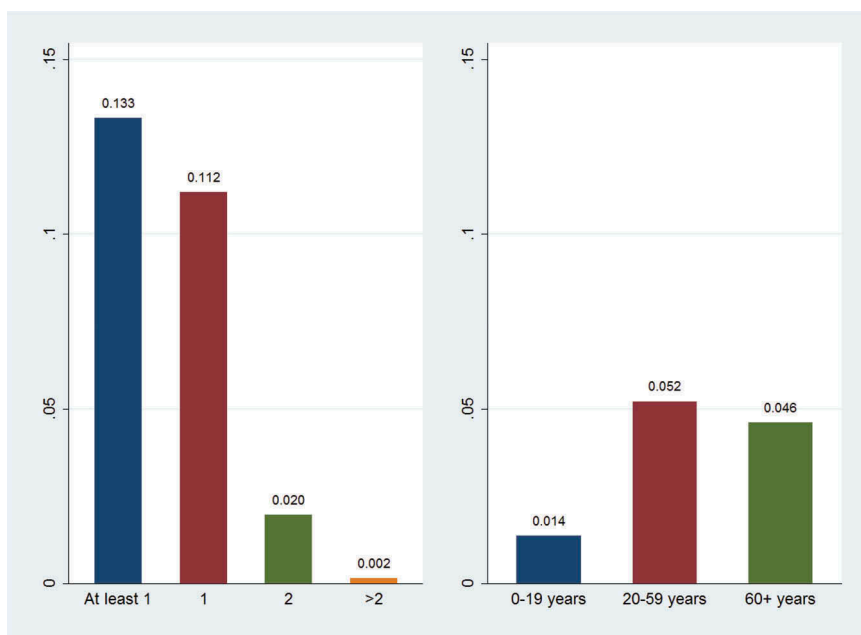


Figure 1. Disability prevalence at household level, by number of members with disabilities (a) and age category of member with disabilities in households with one disabled member (b).

Source: Cambodia Socio-Economic Survey 2009–2014.

ownership of durable assets (radio, television, mobile phone, fan, wardrobe, DVD/CD player, bicycle, and motorcycle) and housing characteristics (number of rooms for sleeping, type of floor and roof materials, source of lighting, source of water supply, sanitation).¹⁴ The index is constructed using weights derived from principal components analysis. This method is commonly used in the construction of proxies for long-run economic status or living standards (Filmer & Pritchett, 2001; Vyas & Kumaranayake, 2006). Information on the variables used to construct the asset index, including descriptive statistics, are reported in Table A2. The table also reports the eigenvector (scoring factors) corresponding the first principal component, which serves as weights for construction of the assets index. A histogram showing the distribution of the household asset index scores, which we use to measure the household's standard of living, is shown in Figure A1. The distribution exhibits sufficient range to distinguish between socio-economic groups with a skew reflecting the choice of variables sensitive to the lower-income distribution.

4.4. Household resources

In countries, such as Cambodia, where most workers are self-employed or agricultural workers, it is difficult for both practical and conceptual reasons to measure household income (Deaton, 1997). For this reason, we use total household consumption expenditure to measure household resources (Deaton, 1997). Our construction of the consumption expenditure variable follows the approach recommended in Cambodia's national poverty line guidelines (Ministry of Planning, 2013). The variable comprises a collection of food and non-food expenditure items as well as house rent, repair, and utility expenditures incurred in cash or in kind including own labour. Food and housing items are reported in the CSES for the last month prior to survey whereas non-food items differ in recall period (monthly, six-monthly, and annually), and we converted them to monthly values. All expenditure items were converted to monthly 2009 Cambodian Riel prices by deflating the nominal values using the Cambodian Consumer Price Index.

4.5. Independent variables

The CSES contains rich information on household and community level characteristics that we use as controls in our analysis. Table 1 presents descriptive statistics for these control variables for households with and without disabled members. Households with at least one disabled member are slightly larger in size with fewer children and more elderly members compared to households without disabled members. They are poorer as measured by household consumption expenditure and the asset index, and are more likely to be located in rural areas. Households with disabled members are

Table 1. Summary statistics at household level

	Households without disability	Households with disability	Difference in means
Household size	4.547 (0.017)	4.928 (0.040)	-0.381*** (0.040)
Number of children in household (< 10 years age)	0.934 (0.011)	0.756 (0.018)	0.178*** (0.018)
Number of elderly in household (> 59 years age)	0.287 (0.005)	0.752 (0.015)	-0.465*** (0.015)
Total consumption expenditure (USD)	250.175 (2.992)	236.177 (3.651)	13.998*** (3.576)
Poverty head count	0.137 (0.005)	0.181 (0.008)	-0.044*** (0.008)
Poverty gap ratio	0.025 (0.001)	0.036 (0.002)	-0.011*** (0.002)
Asset index	0.094 (0.066)	-0.490 (0.062)	0.584*** (0.056)
<i>Location</i>			
Rural	0.787 (0.012)	0.860 (0.010)	-0.073*** (0.008)
Urban	0.213 (0.012)	0.140 (0.010)	0.073*** (0.008)
<i>Household head characteristics</i>			
Age	45.339 (0.132)	54.290 (0.286)	-8.951*** (0.286)
Male	0.793 (0.004)	0.739 (0.009)	0.054*** (0.009)
Married	0.798 (0.003)	0.735 (0.008)	0.063*** (0.008)
Highest level of education completed			
None	0.198 (0.005)	0.293 (0.010)	-0.095*** (0.009)
Less than primary	0.381 (0.005)	0.407 (0.010)	-0.026*** (0.009)
Primary	0.234 (0.004)	0.193 (0.008)	0.041*** (0.008)
Lower secondary	0.118 (0.003)	0.079 (0.005)	0.038*** (0.006)
Upper secondary and above	0.069 (0.003)	0.028 (0.003)	0.042*** (0.004)
Observations	33,256	4847	38,103

Notes: A household with disability is defined as having at least one member with a moderate or severe functioning difficulty. All estimates are weighted for the survey design and standard errors are in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Cambodia Socio-Economic Survey 2009–2014.

more likely to be headed by persons that are older and in higher proportion female, unmarried, and uneducated than households without disabled members.

5. Results

5.1. Baseline estimates

Table 2 presents the results from estimating the model for households' standard of living as a function of household consumption expenditure and the presence of disabled members. The first three columns of the table use the full sample and report on specifications that differ in the way that disability is accounted for at the household level. The first specification does so by including an indicator equal to one if one or more household members are disabled (defined as reporting a functioning difficulty that is moderate or severe). The second specification replaces the disability indicator with two mutually exclusive indicators for one, and more than one disabled household member. The third column includes three mutually exclusive indicators for the household having less than 20 years of age, 20–59 years of age, and 60 years or older. The sample over which this last model is estimated excludes the 749 (out of 38,103) households that have more than one disabled member. The final two columns report on estimates that use the same specification as column 1, but are estimated over rural (column 4) and urban (column 5) sub-samples separately. All estimations were weighted for the survey design and robust standard errors are reported in parentheses.

As can be seen from the results presented in **Table 2**, having one or more disabled household members is associated with a lower household standard of living, all else being equal. The coefficient estimate for column 1's specification indicates that having at least one member with a disability is associated with the household's index of standard of living that is 0.27 lower than an otherwise similar household (in terms of controlled for covariates). The point estimates in column 2 suggest that the reduction in the household's index of standard of living associated with having one disabled member is 0.25 compared to a reduction of 0.37 for households with more than one disabled member. While we are unable to reject the null hypothesis that the effect on household's standard of living is the same for one or more than one disabled household member at standard levels of significance ($p\text{-value} = 0.15$), this likely reflects a lack of precision due to the small number of households with more than one disabled member. The results for the specification allowing for differential effects on household standard of living by age of the disabled household member are reported in column 3 of **Table 2**. The point estimates in column 3 suggest that the reduction in household living standards associated with a disabled member aged less than 20 is greater than the reduction for households with disabled members aged 20 or older. However, the null hypothesis that the impact of disability is equal for the three age groups cannot be rejected at standard levels of significance ($p\text{-value} = 0.62$).

In column 4 and 5 we explore the extent to which the impact on living standards of having household members with disabilities differs by rural versus urban location. To do so, we re-estimate the specifications reported in column 1 for the rural and urban sub-samples separately. Noting that 80 per cent of households in our sample live in rural locations, it is not surprising that the results for the rural sub-sample are similar to those reported for the full sample. The point estimates for the urban sample are larger but also noisier than those based on the rural sample as a result of the much smaller sample size over which estimation is carried out. Comparing estimates of the coefficient on the indicator for at least one disabled household member (specification 1) across the two sub-samples suggests a larger reduction in the index of standard of living for households in an urban location (-0.35) compared to a household in a rural location (-0.25). However, the coefficient estimates are not statistically different ($p\text{-value} = 0.17$).

As a final point, the results in **Table 2** show that the log of household consumption expenditure is positively and significantly associated with households' standard of living for all specifications, with a 10 per cent increase in consumption expenditure associated with a 0.14 rise in the standard of living

Table 2. Baseline estimates of the model for household standard of living

	Households with disability		Number of disabled members		Age of disabled members		Rural households with disability		Urban households with disability	
	Coefficient	St. Error	Coefficient	St. Error	Coefficient	St. Error	Coefficient	St. Error	Coefficient	St. Error
Log of household consumption expenditure	1.426***	(0.037)	1.426***	(0.037)	1.430***	(0.037)	1.400***	(0.044)	1.426***	(0.061)
Household with ≥ 1 disabled member	-0.265***	(0.036)					-0.246***	(0.041)	-0.354***	(0.070)
Cost of disability	0.186***	(0.022)					0.177***	(0.025)	0.241***	(0.035)
Household with 1 disabled member			-0.248***	(0.037)						
Cost of disability			0.174***	(0.024)						
Household with > 1 disabled member			-0.367***	(0.082)						
Cost of disability			0.257***	(0.055)						
Household with disabled member aged < 20 years					-0.310***	(0.079)				
Cost of disability					0.217***	(0.058)				
Household with disabled member aged 20–59 years					-0.222***	(0.050)				
Cost of disability					0.154***	(0.030)				
Household with disabled member aged > 59 years					-0.264***	(0.054)				
Cost of disability					0.182***	(0.040)				
Observations	38,103		38,103		37,354		26,599		11,504	
R-squared	0.641		0.641		0.643		0.403		0.556	

Notes: Disability is defined as having a moderate or severe functioning difficulty and is accounted for differently at the household level. The first specification (column) includes an indicator variable equal to one if the household contains at least one disabled member; the second specification includes two indicator variables for households with one and more than one disabled member; the third specification includes three indicator variables for households with one disabled member aged less than 20 years, 20–59 years, and 60 years or older. All regressions control for household size, number of children, number of elderly, rural/urban location, province, year and month of survey, and the following characteristics of the household head: age, gender, marital status, and education level. All estimations are weighted for the survey design and robust standard errors are in parenthesis. Standard errors for disability costs are bootstrapped at 100 repetitions. ***p < 0.01 , **p < 0.05 , *p < 0.1 .

Source: Cambodia Socio-Economic Survey 2009–2014.

index. Although not reported, the number of children and elderly in the household, the age, gender, and education of the head of the household, whether the household lives in an urban or rural area, and province of residence, are all significantly related to household living standards in the expected manner.¹⁵

Using the coefficient estimates from Table 2, we calculate the direct household level cost associated with disability in terms of the additional consumption expenditure required for the household to achieve the same standard of living as an otherwise similar household that does not have a disabled member, as described in Section 3. Note that as household consumption expenditure enters in logged form, the direct cost of disability is in terms of the additional expenditure as a proportion of current expenditure. These costs are reported in Table 2. They show that, at the national level, having at least one disabled household member is associated with requiring an additional 19 per cent of household consumption expenditure in order to achieve the same standard of living as an otherwise similar household that has no disabled members. Costs associated with disability are higher for households with two or more members with disabilities (26%), and are higher for households with a young and older member with disability (22% versus 18%) compared to working age disabled members (15%). Finally, Table 2 shows that the cost of disability is higher in urban locations than in rural locations (24% versus 18%).

5.2. Sensitivity analysis

As discussed in Section 3, the SOL approach to estimating the cost of disability is sensitive to the variables and method used to construct the standard of living measure. In order to investigate the sensitivity of our results to this issue, we construct alternative standard of living measures based on household durable goods, on housing characteristics and access to utilities, and use alternative methods in constructing the household standard of living measure. The alternative measures of standard of living are used to form estimates of the cost of disability and these costs are shown in Table 3.

Columns one and two of Table 3 show the estimated cost of disability based on a principal component weighted index of durable assets and simple count of durable assets, respectively. The third column reports disability costs based on standard of living captured by a principal component weighted index of housing characteristics and utilities. For ease of comparison, the fourth column repeats the estimates based on the standard of living index used in our main analysis. As shown in Table 3, the estimated cost of disability is slightly higher when the living standards measure is based upon durable good items only (column 1 and 2). The housing characteristics and utilities living standards index produces lower disability cost estimates compared with the baseline results. Nonetheless, the general patterns and magnitudes of the estimated cost of disability across all standard of living measures are broadly consistent with the baseline results.

Our investigation into the cost of disability in Cambodia has excluded in the definition of disability those individuals whose highest level of functioning difficulty is reported as mild. We examine the impact of this restriction on our estimated cost of disability by considering an alternative measure of disability that includes persons whose most important functioning difficulty is reported as mild, moderate or severe. The resulting estimates of the household cost associated with disability are shown in the last column of Table 3. They are smaller than those based on the definition of disability which excludes mild functioning difficulties. For example, the cost associated with having one or more disabled household member based on the alternative measure is 14.4 per cent compared to 18.6 per cent based on the preferred measure of disability. Nonetheless, the cost associated with the broader alternative measure of disability displays a similar pattern across the disabled household types as found using the preferred measure. Overall, we conclude that the exclusion of persons with mild functioning limitations from the definition of disabled does not qualitatively affect our results, although it does increase the magnitude of the estimated cost associated with disability, as expected.

Table 3. Sensitivity tests of disability costs

	Durable goods		Housing/ utilities	Alternate	
	Index	Count	Index	Disability	Disability
Households with ≥ 1 disabled member	0.218*** (0.023)	0.255*** (0.026)	0.165*** (0.028)	0.186*** (0.022)	0.144*** (0.018)
Households with 1 disabled member	0.200*** (0.025)	0.235*** (0.028)	0.157*** (0.031)	0.174*** (0.024)	0.141*** (0.020)
Households with > 1 disabled members	0.324*** (0.054)	0.369*** (0.063)	0.208*** (0.067)	0.257*** (0.055)	0.159*** (0.038)
Households with 1 disabled member aged < 20 years	0.261*** (0.057)	0.278*** (0.063)	0.180*** (0.075)	0.217*** (0.058)	0.167*** (0.053)
Households with 1 disabled member aged 20–59 years	0.204*** (0.032)	0.258*** (0.037)	0.122*** (0.041)	0.154*** (0.030)	0.138*** (0.025)
Households with 1 disabled member aged > 59 years	0.176*** (0.040)	0.195*** (0.046)	0.192*** (0.048)	0.182*** (0.040)	0.139*** (0.033)
Households with ≥ 1 disabled member in rural areas	0.206*** (0.025)	0.243*** (0.028)	0.155*** (0.035)	0.177*** (0.025)	0.141*** (0.021)
Households with ≥ 1 disabled member in urban areas	0.308*** (0.044)	0.346*** (0.054)	0.210*** (0.044)	0.241*** (0.035)	0.189*** (0.025)

Notes: Disability is defined as having a moderate or severe functioning difficulty; alternate disability is defined as having a mild, moderate, or severe functioning difficulty. All regressions control for household size, number of children, number of elderly, rural/urban location, province, year and month of survey, and the following characteristics of the household head: age, gender, marital status, and education level. All estimations are weighted for the survey design and standard errors are bootstrapped at 100 repetitions.*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Cambodia Socio-Economic Survey 2009–2014.

5.3. The measurement of poverty

Using the estimated costs of disability, we are able to calculate the poverty head count and poverty gap taking into account the additional costs faced by households with members with disabilities. To estimate the impact of disability costs on poverty, we deduct each households estimated direct cost of disability from total household consumption expenditure and re-calculate poverty head ratios and poverty gap indices based upon national poverty lines.¹⁶ The results are shown in Table 4. We find that, for households with at least one disabled member, the unadjusted poverty head count increases from 18 per cent to 37 per cent when the additional costs of disability are taken into account. This represents a doubling in the rate of poverty in this group. In terms of the poverty gap, Table 4 shows that before accounting for the additional costs faced by households that have a disabled member, a poor household with disabled members in Cambodia fell 3 per cent beneath the poverty line, on average. However, when the financial cost of disability is accounted for, the gap more than doubles, rising to 8 per cent below the poverty line.

5.4. Formal and informal income support

As a final point of policy interest, Table 5 presents median disability costs in USD (2009 prices) and compares them to median amounts of positive unearned income received from government, non-government agencies, and relatives, also measured in 2009 USD.¹⁷ The median direct cost of having disabled household members is estimated to be 38.10 USD per month. Amongst households with a

Table 4. Estimates of the impact of disability costs on poverty

	Poverty head count			Poverty gap index		
	Unadjusted	Adjusted	Difference	Unadjusted	Adjusted	Difference
Household with ≥ 1 disabled member	18.1	36.5	18.4	3.3	7.9	4.6
Household with 1 disabled member	18.6	35.6	17.0	3.4	7.6	4.2
Household with > 1 disabled member	15.3	42.8	27.5	3.1	10.4	7.3
Household with disabled member aged < 20 years	25.3	51.7	26.4	4.6	12.6	8.0
Household with disabled member aged 20–59 years	20.7	35.1	14.4	3.9	7.6	3.7
Household with disabled member aged > 59 years	14.2	31.4	17.2	2.5	6.2	3.7
Household with ≥ 1 disabled member in rural areas	18.2	35.7	17.5	3.6	8.0	4.4
Household with ≥ 1 disabled member in urban areas	17.6	38.6	21.0	2.0	6.2	4.2

Notes: Disability is defined as having a moderate or severe functioning difficulty. All estimates are weighted for the survey design.

Source: Cambodia Socio-Economic Survey 2009–2014.

Table 5. Estimates of absolute disability costs and receipt of social protection transfers

	Disability Costs		Government		Non-Government		Remittance	
	USD	%	USD	%	USD	%	USD	
Household with ≥ 1 disabled member	38.10	3.6	25.95	3.6	1.74	44.3	3.51	
Household with 1 disabled member	35.22	3.3	25.80	3.4	1.74	43.1	3.43	
Household with > 1 disabled member	56.97	4.7	26.16	4.4	1.93	50.8	3.62	
Household with disabled member aged < 20 years	47.40	0.8	1.50	3.9	2.30	27.9	2.51	
Household with disabled member aged 20–59 years	31.35	3.4	25.73	4.3	1.74	37.1	3.46	
Household with disabled member aged > 59 years	34.99	40.0	25.95	2.2	1.42	54.0	3.52	
Household with ≥ 1 disabled member in rural areas	34.31	2.7	24.20	3.7	1.74	45.4	3.32	
Household with ≥ 1 disabled member in urban areas	77.34	9.2	32.27	3.0	10.66	37.1	7.10	

Notes: Disability is defined as having a moderate or severe functioning difficulty. Median USD per month (January 2009 prices). Transfer amounts are reported for households that received transfers. All estimates are weighted for the survey design.

Source: Cambodia Socio-Economic Survey 2009–2014.

disabled member that receive pension and social welfare payments, the median amount received is 25.95 USD per month, or around two thirds of the estimated direct cost of disability. However, less than 4 per cent of disabled households report receiving any financial support from the government in the past 12 months to survey, with receipt concentrated amongst households whose disabled member was over the age of 59. While 40 per cent of households whose disabled member is 60 years of age or older received a government pension or transfer, just 3.4 per cent of households whose disabled member is aged 20–59 received a payment, and less than 1 per cent of families whose disabled member is less than 20 received a government pension or transfer. Amongst recipients of government payments, the median amount paid is considerably lower for households in which the disabled member is less than 20 years old at just 1.50 USD per month compared to 25.73 USD per month for recipient households whose disabled member is 20–59 years old and 25.98 USD for recipient households in which the disabled household member is over the age of 59. Households with a disabled member residing in an urban area are three times as likely to receive a government transfer

payment compared to households living in a rural area (9% versus 3%). And recipients living in urban areas receive higher payments with a median payment of 32.27 USD per month compared to 24.20 USD per month for their counterparts living in rural areas. However, the median cost associated with having a disabled household member is also much higher for households in urban locations. We estimate the median cost of disability to be 77.34 USD per month for households in urban locations compared to 34.31 USD for households in rural locations.

As with government transfers, around 4 per cent of households with disabled members report receiving any financial assistance from non-government organisations in the past 12 months. In contrast to government transfers, however, financial assistance from non-government sources to disabled households are not more likely to be received by households whose disabled member is 60 years of age or older: 2.2 per cent of households with a disabled member who is aged 60 years or older report receipt of non-government transfers, compared to 4.3 per cent of households whose disabled member is aged 20–59 and 3.9 per cent of households whose disabled member is less than 20 years old. The median monthly amount of non-government transfer is 1.74 USD, but is slightly larger for households with a disabled person less than 20 (2.30 USD) and slightly less for households with a disabled person older than 59 years (1.42 USD). As in the case of government transfers, non-government transfers received by households in urban locations are significantly larger than those received by households located in rural locations (10.66 USD versus USD 1.74).

As shown in Table 5, almost half (44.3%) of households with disabled members report receipt of remittance payments from non-resident family members. Receipt of remittances is lower for households whose disabled member is less than 20 years old at 27.9 per cent, and households whose disabled member is aged 20–59 at 37.1 per cent compared to households whose disabled member is over the age of 60, at 54 per cent. Table 5 also shows that receipt of remittances from non-resident family is greater for households living in rural areas (45.4%) compared to those households with disabled members living in urban locations (37.1%). The median remittance payment reported by households with disabled members is 3.51 USD. The median amount received by households is smaller for households whose disabled member is less than 20 at 2.51 USD, and greater for households living in urban locations, at 7.10 USD.

When weighting the median payments received by the proportion receiving each type of payment, only around 7 per cent of the cost associated with disability is being met on average by payments from government, non-government, and informal sources. Households whose disabled member is under the age of 20 are the worst off, with less than 2 per cent of the cost of disability being met, while households whose disabled member is 60 or older are doing significantly better with 35 per cent of the cost of disability being met, predominantly from government sources.

6. Discussion

The majority of the world's population with disabilities live in low- and middle-income countries. Despite this, little is known about the direct cost faced by persons with disabilities in low resource settings, and the impact of accounting for this cost on measures of the prevalence and depth of poverty amongst households with disabled members in these countries. This paper addresses this issue in the context of Cambodia, one of the least developed nations in southeast Asia.

We take a Standard of Living approach to measuring the direct cost associated with disability. Our analysis uses the Cambodian Socio-Economic Survey, which measures disability based on difficulties in functioning domains. Our findings suggest that having a household member with disabilities is associated with requiring an additional 19 per cent of monthly household consumption expenditure in order to achieve the same standard of living as an otherwise similar household without disability. When we take account of the cost of disability in calculating measures of poverty we find that the poverty rate amongst households with disabled members' doubles, from 18 per cent to 37 per cent, while the poverty gap more than doubles from 3 to 8 per cent.

As with many other countries, Cambodia is currently developing social protection systems for persons with disabilities to ensure that their obligations as a party to the CRPD are met. To this end, the State has set the goal of providing the poor with assistance in meeting their disability-related expenses. An important contribution of this paper is that it provides the first estimates of the cost of disability borne by households in Cambodia, and thereby benchmarks the level of transfer payments required to ensure an adequate standard of living for the disabled and the households in which they reside. For the households in our sample, the median cost associated with having a disabled member is around 38 USD per month. The current disability pension of 5 USD per month equates to around 13 per cent of the direct cost of disability faced by Cambodian households. Only 4 per cent of households with a disabled member received a government payment over the period 2009–2014, the majority of whom were households with an elderly member with a disability which suggests the payment was more likely a retirement than disability-related benefit.¹⁸ A similarly small proportion of households receive a transfer payment from non-government agencies, and the median payment made to recipients is 2 USD. While close to half of households with disabled members receive transfers from family members, the median level of these payments is only 4 USD. Taking into account the low level access to payments, especially government transfers, only around 7 per cent of the direct costs of disability are being met in Cambodia.

In terms of placing our findings in context of the broader literature, our estimates of the direct cost of disability are at the higher end of the range of 9–20 per cent reported for middle income countries. However, our estimates reflect the costs for households whose members are reported to have moderate to severe functioning limitations whereas the previous studies report cost estimates using different, and generally broader, definitions to measure households with disability (Braithwaite & Mont, 2009; Loyalka et al., 2014; Mont & Nguyen, 2011). As part of our sensitivity analysis, we provide additional cost estimates using an alternative, broader measure of disability, and these are in line with the middle of the range reported by previous studies. Although the direct cost of disability might be expected to be lower in poorer countries due to less developed disability goods and service markets, qualitative research from Vietnam found that in a setting where disability specific services such as rehabilitation services are in low supply, the costs associated with disability stem mostly from general items that are not covered in social protection programmes or accessible, in particular pharmaceuticals, and transportation (Palmer et al., 2015). Indeed, persons with disabilities in Cambodia spend three to four times the amount on healthcare and related costs compared to persons without disability (depending upon the degree of disability), the bulk of which stems from additional private clinic and self-medication costs (World Health Organization, Ministry of Health, National Institute of Statistics, & Australian Department of Foreign Affairs and Trade, 2017). Qualitative research is required, however, to better understand the composition of the disability related costs for households in Cambodia.

Although the direct cost of disability in Cambodia that we estimate is similar to estimates for countries with a greater level of development, the impact of these costs on household poverty is much higher. In China and Vietnam, disability costs increased the rate of poverty amongst households with disabled members by 3–5 percentage points whereas in Cambodia they increased the poverty rate by 18 percentage points (Loyalka et al., 2014; Mont & Nguyen, 2011). This reflects the fact that a higher proportion of households with disabilities in Cambodia are living close to the poverty line. Our findings suggest that the extra cost of disability has serious financial consequences for persons with disabilities and their families in low resource settings and adds increased importance to provision of social protection (Aguilar, 2017).

Collectively, our findings offer several considerations for policy-makers. We show that current estimates of poverty that fail to account for the direct cost of disability lead to a significant underestimate of the breadth and depth of poverty amongst households with disabled members in Cambodia. This suggests that the current poverty eligibility criterion for the disability pension excludes a large number of households which either are pushed into poverty or experience a

significant deterioration in living standards due to the extra costs associated with disability. We show further that only a small fraction of the direct costs of disability borne by households in Cambodia are being met from outside support including formal and informal sources. This suggests that in the absence of greater coverage of financial support by the government, households with members with disabilities will continue to experience a lower standard of living compared to otherwise similar households without disability in Cambodia.

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Notes

1. Disability may also reduce household income because care-giving responsibilities restrict the type or amount of work that family members can do.
2. The literature suggests that low-income countries may have smaller gaps in economic wellbeing between households with and without disabilities compared to middle-income countries because the development process does not benefit people with disabilities. The evidence using a multidimensional measure of poverty is more robust. For example, using a multidimensional measure of poverty that includes measures of employment and education in addition to consumption and assets, Mitra et al. (2013) find that disability is significantly related to poverty in most of the 15 developing countries examined.
3. Seven of the Sustainable Development Goal targets and 14 of the Sustainable Development Goal indicators explicitly mention persons with disabilities, including reducing the proportion of persons with disabilities living below 50 per cent of the median income.
4. There exists limited information on the coverage and efficacy of social protection programmes for persons with disabilities in low- and middle-income countries. Recent evidence from China, Vietnam, Namibia, Zambia, and South Africa suggests that coverage of disability benefits is low and not commensurate with needs (Banks et al., 2017; Hanass-Hancock & McKenzie, 2017; Kumitz, 2015; Palmer, Groce, Mont, Nguyen, & Mitra, 2015). For example, in Vietnam income support for households with disabled members was estimated at between 13 per cent and 26 per cent of the minimum wage (Palmer et al., 2015); in South Africa the average disability grant received by households with more severely disabled members covered 30 per cent of the earned income gap between households without disabled members (Hanass-Hancock & McKenzie, 2017).
5. This approach has been used to value the costs of non-market goods; for example, life events such as unemployment and divorce, health, air pollution, informal care-giving, and violent crime (for example Blanchflower & Oswald, 2004; Groot & van-Den-Brink, 2006; Johnston, Shields, & Suziedelyte, 2015).
6. Mortality estimates during the Khmer Rouge period vary widely (Dy, 2007; Heuveline, 1998). Heuveline (1998) estimates a median of 2.5 million excess deaths over the period 1970–1979 of which 1.4 million were violent deaths with 1.1 million violent deaths occurring during the Khmer Rouge period.
7. A notable legacy of Cambodia's prolonged civil conflict as relates to disability is one of the highest concentration of land mines in the world (Cambodian Mine Action Centre, 2014; Merrouche, 2011).
8. This prevalence is based on persons experiencing 'a lot of difficulty' or 'cannot do' in at least one functional domain (<http://www.washingtongroup-disability.com>).
9. In practice, this is done by regressing consumption expenditure on an indicator for disability.
10. The CSES was first fielded in 1993, and has been conducted annually since 2007. Disability information has been collected in the survey since 2007. However, it was not until the 2009 wave that the structure of the disability questions

aligned with the International Classification of Functioning, Disability and Health, enquiring about difficulties in domains of functioning, and the degrees of difficulty in functioning (Palmer & Harley, 2012; World Health Organization, 2001). For this reason, our analysis uses the 2009–2014 waves of the CSES only.

11. The CSES disability questions are in the spirit of, but not identical to, those developed by the United Nation's Washington Group on Disability Statistics – Short Set of Questions on Disability – which aim to represent the majority of persons with limitation in basic actions (<http://www.washingtongroup-disability.com>).
12. The Washington Group Short Set of Questions on Disability asks 'Do you have a difficulty seeing even when wearing glasses?', so that those who had difficulty seeing that is corrected by wearing glasses would respond they had no difficulty (<http://www.washingtongroup-disability.com>).
13. The cap on three functional domains for respondents precludes us from constructing a functional score which better captures the variation of health deprivations as relates to wellbeing (Mitra, 2018).
14. Composite measures of different items (typically household assets) are recommended as they reduce the risk of single item preferences or tastes being systematically related to disability status (Zaidi & Burchardt, 2005). We do not include durable assets that are likely to generate income such as ownership of productive land and cattle or a computer.
15. These results are available by request.
16. Disability costs in absolute terms were calculated as $Y \left[\exp \left(-\frac{\ell}{a} D \right) - 1 \right]$. The poverty lines have recently been updated to account for differences in minimum living standards across geographical regions and were derived from the 2009 CSES consumption data used in this study (Ministry of Planning, 2013).
17. The question asked in the CSES is 'How much did your household receive from ..[SOURCE].. during the last 12 months?' where the three relevant sources are: (1) Pensions, social welfare/benefits, provident fund; (2) Transfers (assistance/support) from NGO or other institutions (not credit); and (3) Remittances from other relatives or others.
18. There is no state pension provision in Cambodia except for retired civil servants and war veterans.

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Appendix

Table A1. Description of variables

Variable	Definition
<i>Dependent variable</i>	
Standard of Living (SOL)	Composite index of household durable goods, housing characteristics, and access to utilities
<i>Disability variables (and models)</i>	
Household with at least one disabled member	= 1 if household contains at least one member with a moderate or severe functioning difficulty; = 0 otherwise
Household composition of disability	= 1 if household contains one member with a moderate or severe functioning difficulty; = 2 if household contains two or more members with a moderate or severe functioning difficulty; = 0 if otherwise
Life cycle of household with disabilities	= 1 if household contains one member with a moderate or severe functioning difficulty aged 0–19 years; = 2 if household contains one member with a moderate or severe functioning difficulty aged 20–59 years; = 3 if household contains one member with a moderate or severe functioning disability aged 60 years and above; = . if household contains two or more members with a moderate or severe functioning difficulty; = 0 if otherwise
<i>Other independent variables</i>	
Ln(Income)	Natural log of total household consumption expenditure (food and non-food)
Household size	Number of persons in the household
Number of children in household	Number of persons aged less than 10 years in the household
Number of elderly in household	Number of persons aged 60 years of age and above in the household
Age of household head	Age of the household head in years
Sex of household head	= 1 if household head is male; = 0 if female
Married status of household head	= 1 if household head is married; = 0 if otherwise
Education level of household head	= 1 if household head has completed less than primary level education; = 2 if household head has completed primary level education; = 3 if household head has completed lower secondary level education; = 4 if household head has completed upper secondary level education and above; = 0 if otherwise
Rural urban location	= 1 if household resides in an urban area; = 0 if in a rural area
Province of residence	24 provincial dummies
Year of interview	= 1 if 2009; = 2 if year 2010; = 3 if year 2011; = 4 if year 2012; = 5 if year 2013; = 6 if year 2014

Table A2. Summary statistics of standard of living indicators and principal component

	Mean	Standard Error	Mean			Scoring factors for first principal component
			Poorest	Middle	Richest	
			40%	40%	20%	
<i>Durable assets</i>						
Radio	0.377	(0.005)	0.356	0.381	0.412	0.026
Television	0.644	(0.008)	0.449	0.720	0.881	0.247
Mobile phone	0.665	(0.007)	0.453	0.756	0.910	0.220
Fan	0.312	(0.011)	0.110	0.335	0.668	0.322
Wardrobe	0.427	(0.008)	0.230	0.471	0.730	0.260
DVD/CD player	0.275	(0.006)	0.133	0.302	0.503	0.186
Bicycle	0.665	(0.007)	0.654	0.697	0.621	−0.032
Motorbike	0.588	(0.007)	0.339	0.691	0.880	0.215
Number of rooms for sleeping	1.426	(0.011)	1.178	1.400	1.973	0.192
<i>Type of roof material</i>						
Thatch/leaves/grass	0.097	(0.005)	0.170	0.062	0.021	−0.151
Tiles	0.265	(0.008)	0.226	0.295	0.282	0.023
Fibrous cement	0.089	(0.004)	0.068	0.099	0.110	0.027
Galvanised iron or aluminium	0.502	(0.008)	0.525	0.514	0.433	0.011
Concrete	0.040	(0.004)	0.003	0.023	0.147	0.165
<i>Type of floor material</i>						
Earth	0.064	(0.003)	0.084	0.059	0.035	−0.045
Wood plank	0.499	(0.011)	0.509	0.533	0.410	−0.071
Bamboo	0.233	(0.010)	0.332	0.209	0.081	−0.140
Hard/permanent materials ^a	0.203	(0.008)	0.073	0.198	0.474	0.263
<i>Source of lighting</i>						
Electricity	0.418	(0.013)	0.214	0.457	0.745	0.319
Generator/battery	0.362	(0.010)	0.412	0.389	0.206	−0.144
None/Other ^b	0.221	(0.007)	0.374	0.153	0.050	−0.212
<i>Source of water supply</i>						
Piped into dwelling	0.182	(0.010)	0.050	0.182	0.445	0.269
Tubed/piped well or borehole	0.230	(0.011)	0.288	0.217	0.140	−0.071
Dug well	0.168	(0.009)	0.207	0.161	0.103	−0.088
Other ^c	0.421	(0.013)	0.455	0.440	0.312	−0.083
<i>Sanitation facility</i>						
Flush toilet	0.457	(0.010)	0.255	0.496	0.782	0.315
Pit latrine	0.020	(0.002)	0.022	0.022	0.011	0.025
None/Other	0.523	(0.010)	0.723	0.482	0.208	−0.307
Eigenvalue associated with first component						6.101
Share of variance associated with first component						0.203

Notes: ^aCement, parquet, stone, brick, ceramic; ^bkerosene lamp, candle, other; ^cPond, river or stream (pumped or non-pumped), rainwater, bought, other. 'Other' type of floor material is not shown due to small number of observations. All estimates are weighted for the survey design and standard errors are in parenthesis.

Source: Cambodia Socio-Economic Survey 2009–2014.

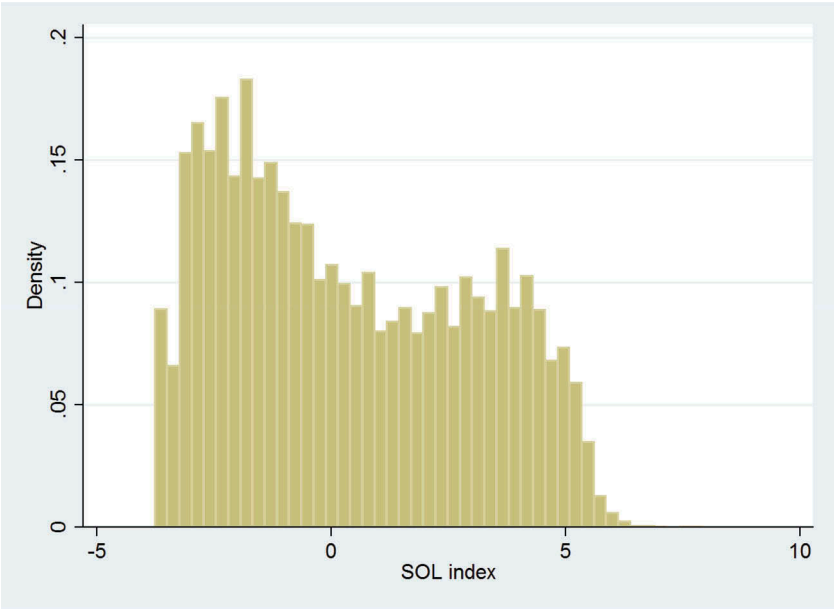


Figure A1. Histogram of standard-of-living index at country level.
Source: Cambodia Socio-Economic Survey 2009–2014.