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The State of Multidimensional Child Poverty in South Asia: A Contextual and Gendered View

Note by Oxford Poverty & Human Development Initiative (OPHI)*

Summary

Many poverty measures identify a household as poor or non-poor based on the achievements of all its members. Using the household as the unit of identification has the benefit of enabling a poverty measure to draw on information about persons of different ages and genders, and in different life situations. However, it also loses individual information because this is summarized at the level of the household. For example, the underlying microdata contain additional information on individual children. As a consequence, gendered and intrahousehold inequalities, for instance, are not evident even when data for them exist. This paper proposes methods to augment a household multidimensional poverty index (MPI) by applying individual-level analyses to the same dataset, and analysing these alongside the matrix of deprivations underlying an MPI. In particular we scrutinise (i) what proportion of deprived children live in multidimensionally poor households; (ii) what proportion of deprived children are girls or boys; and (iii) what proportion of deprived children live in households in which other children are not deprived in that same indicator. We also observe (iv) what other deprivations deprived and poor children experience in addition to the focal deprivation. Finally, we study what proportion of people live in households where children of different ages experience two different child deprivations concurrently. More complex analyses can also be undertaken that combine information on the deprivation status of more than one eligible member, and we illustrate this to identify pioneer children, who completed six years of schooling although adults in their household have not. Overall, this study provides a prototype methodology that can be mainstreamed into subsequent national and global MPI analyses in order to shine a light on child poverty multidimensionally. We illustrate the methodology with analyses of the global MPI for seven countries in South Asia.

* Prepared by Sabina Alkire, Rizwan Ul Haq and Abdul Alim within the OPHI theme on multidimensional measurement.

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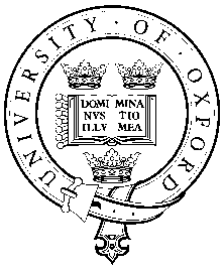

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The State of Multidimensional Child Poverty in South Asia: A Contextual and Gendered View

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Abstract
Many poverty measures identify a household as poor or non-poor based on the achievements of all its members. Using the household as the unit of identification has the benefit of enabling a poverty measure to draw on information about persons of different ages and genders, and in different life situations. However, it also loses individual information because this is summarized at the level of the household. For example, the underlying microdata contain additional information on individual children. As a consequence, gendered and intrahousehold inequalities, for instance, are not evident even when data for them exist. This paper proposes methods to augment a household multidimensional poverty index (MPI) by applying individual-level analyses to the same dataset, and analysing these alongside the matrix of deprivations underlying an MPI. In particular we scrutinise (i) what proportion of deprived children live in multidimensionally poor households; (ii) what proportion of deprived children are girls or boys; and (iii) what proportion of deprived children live in households in which other children are not deprived in that same indicator. We also observe (iv) what other deprivations deprived and poor children experience in addition to the focal deprivation. Finally, we study what proportion of people live in households where children of different ages experience two different child deprivations concurrently. More complex analyses can also be undertaken that combine information on the deprivation status of more than one eligible member, and we illustrate this to identify pioneer children, who completed six years of schooling although adults in their household have not. Overall, this study provides a prototype methodology that can be mainstreamed into subsequent national and global MPI analyses in order to shine a light on child poverty multidimensionally. We illustrate the methodology with analyses of the global MPI for seven countries in South Asia.

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The Oxford Poverty and Human Development Initiative (OPHI) is a research centre within the Oxford Department of International Development, Queen Elizabeth House, at the University of Oxford. Led by Sabina Alkire, OPHI aspires to build and advance a more systematic methodological and economic framework for reducing multidimensional poverty, grounded in people's experiences and values.

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1. Introduction

The literature on child poverty and its measurement is extensive and is being rapidly enriched by a variety of methodological and empirical innovations – many of which focus on South Asia.[1] Yet it is still difficult to obtain a rigorous, consistent, and gendered overview of multidimensional child poverty that has the following features:

1) A common yardstick is used across all countries;
2) The data are relatively comparable;
3) Child poverty indicators reflect areas of consensus such as the Convention on the Rights of the Child;
4) The analysis is gendered, showing differences between girls and boys;
5) Relevant differences are highlighted across age cohorts;
6) Poverty profiles link children's individual deprivations to multiple deprivations that strike their household;
7) Intrahousehold inequalities between children are made visible;
8) The life cycle of children from birth through 17 years of age is (at least imperfectly) reflected; and
9) The work meets high standards of technical rigour.

No single measure can fulfil all of these desiderata fully while being clear enough to shape policy. But more progress is possible than is routinely assumed.

This paper presents a new methodology for probing gendered and intrahousehold features of child poverty. Using individual-level data we augment the analysis of a multidimensional poverty index (MPI) that uses the household as the unit of identification, by setting out key analyses that combines its underlying individual-level data with the deprivations of other household members and of that individual in other indicators. The methodology focuses on indicators in which individual-level data for certain household members – in this case, children – are used (alone or in combination with other household members' information) to identify all household members as deprived or non-deprived.

1 Alkire and Roche (2012), Bastos and Machado (2009), Biggeri and Mehrotra (2011), Drèze and Khera (2012), Engle and Black (2008), Gordon et al. (2003a, b), Grantham-McGregor et al. (2007), Harttgen and Misselhorn (2006), Kabeer (2001), Miller (1997), Minujin et al. (2006), Minujin and Nandy (2012), Nandy et al. (2005), Noble et al. (2006), and Pasricha and Biggs (2010).

We illustrate this methodology using the three indicators of the global MPI that draw on individual child microdata for a set of countries in South Asia. The global MPI identifies a person as poor based on information from all household members. It is routinely disaggregated by age to profile the level and composition of acute multidimensional poverty among children. We augment that analysis by applying this methodology to individual child deprivations in nutrition, school attendance and completed years of schooling.

In extending the analysis to individual children, we first examine the condition of all eligible children for a given indicator. This enables us to say, for example, that 70 million South Asian children aged 0–4 according to these datasets, are deprived in nutrition and 36.7 million South Asian children are not attending school. Going one step further, we use the case of 'pioneer children' to demonstrate more complex analyses, which combines information on the deprivation status of more than one eligible household member – in this case, non-deprived children aged 10–17 and deprived adults with respect to the 'years of schooling' indicator, and we identify 37.5 million pioneer children.

Using the harmonised MPI dataset, which contextualizes children within households, contains household level deprivation status on ten indicators, as well as characteristics such as the child's own age and gender, and the number of children in the household and their own deprivations, we can obtain many new insights.[2] In this paper, we set out some basic comparisons:

1) **Poverty Status:** what proportion of deprived children are poor according to the MPI (MPI poor);
2) **Gender:** what proportion of deprived and poor children are girls or boys; and
3) **Intrahousehold Inequality:** what proportion of deprived children live in households where other children are not deprived in that same indicator.

   In order to view the joint deprivations children experience in their households, we further compare

4) **Composition:** the composition of MPI by indicator experienced by children who themselves are deprived in a particular indicator, with children who are not deprived.

   Finally, looking across households we observe

5) **Integrated Analysis:** what proportion of people live in households where children of different ages experience more than one child deprivation concurrently.

2 Many further analyses are present in OPHI and UNICEF (2019).

The paper proceeds as follows. Section 2 situates this study in the literature on multidimensional child poverty measurement; Section 3 formally introduces the five analyses named above. Section 4 introduces the global MPI datasets and empirical strategy; Section 5 presents the results, and Section 6 concludes.

2. Background

In 2016, the World Bank estimated that close to 385 million children in the world lived in extreme poverty (UNICEF and World Bank Group, 2016). The United Nations estimates that by 2030, 167 million children will still remain in extreme poverty if the world does not take action to improve health and education (UNICEF, 2018). In OPHI's global MPI report 2018, estimates show that of the 1.3 billion people who live in multidimensional poverty, nearly half are children aged 0–17 (OPHI, 2018). This simple age disaggregation sparks both curiosity and concern.

The long-term benefits of addressing multiple deprivations faced in early childhood began to come to light through work by Heckman and Masterov (2007). More recently Heckman and Karapakula (2019) found that investing in very young children has powerful and positive long-term effects. They show that high-quality early childhood interventions can positively impact the children in targeted programmes during all the different phases of life, and can also benefit the children of the original participants decades later. A separate study suggested that on average, each additional dollar invested in high-quality early childhood development (ECD) programmes yields an estimated return of between $6 and $17 (Garcia et al., 2016). Also pivotal is the gender dimension – for example the direct link between girls' education and child survival. According to UNESCO (2014), if all girls in low-income and lower-middle-income countries completed secondary education, under-five child mortality could be cut in half.

On the flip side of this inter-generational cycle, evidence links the experience of poverty in early childhood to the onset of diseases leading to higher rates of mortality in adulthood, which, in their turn have an adverse impact on the next generation. In 1998 the US Center for Disease Control clearly demonstrated the causal links between 'adverse childhood events' (ACE) due to household poverty that affects children and leading causes of adult deaths in the US, showing the enormous economic costs to society and highlighting the cost in terms of preventable unrealised human potential (Felitti et al., 1998).

Despite strong evidence suggesting that childhood multidimensional poverty has a detrimental effect on both human dignity (what Amartya Sen (2009) terms capabilities and freedoms) and economic development (humans as economic capital), measures to look closely within the household are relatively under-developed. This leads to a critical weakness when it comes to designing child responsive economic policies in developing countries. The relative lack of attention to this can perhaps be attributed to the ease of using the household as a unit of analysis, as well as to real limitations in the data available to measure

intrahousehold difference in the experience of multidimensional poverty among different household members. Yet, a lack of straightforward methodological tools compounds the problem.

While household monetary poverty remains prominent in policy-making processes, in its 2018 Poverty and Shared Prosperity Report, *Piecing Together the Poverty Puzzle*, the World Bank fully recognises the need to go beyond monetary measures while also citing the lack of comprehensive data that would enable this to move forward.[3] This is supported by studies that indicate that monetary and multidimensional measures (while linked) are not good proxies for each other (Roelen, 2017; Ballón et al., 2018). Hoolda et al. (2019) show that while there is some overlap between the experience of monetary and multidimensional poverty, children escaping from monetary poverty do not always exit from multidimensional poverty.

In parallel to household measures, a literature on how to measure multidimensional child poverty is rapidly expanding. An ample literature now focuses on child-specific analysis of MPIs that are built at the household level (Hjelm et al., 2016). In addition, a set of studies constructs individual child MPIs using a counting-based methodology (Alkire and Foster, 2011). Some papers include one or more measures that together cover indicators for children across childhood (0–17 years).[4] Other papers focus on children in particular age ranges.[5] These papers, almost without exception, advocate the movement to the individual level because household-level MPIs are constrained by the fact that they obscure the gender or age of deprived children and fail to look with precision at multiple children within the same household.

Given the significance of understanding and responding to the experience of multidimensional poverty within the household, its specific impact on different age groups and genders, and the implications of such evidence for societal harmony and social justice, by focusing on children in the context of their households, this paper addresses this largely unaddressed but potentially important angle on individual child poverty. The methodology outlined below thus seeks to narrow the widely recognised gap between household and individual (child) poverty analyses.

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3 'When we estimate individual poverty rates on the basis of broader consumption patterns including nonfood goods, women fare slightly better than men in Bangladesh. In Malawi, by contrast, women have a significantly higher poverty rate (73 percent) than men (49 percent). Children in both countries suffer from significantly higher poverty rates. We need more comprehensive data to deepen our understanding of how poverty affects individuals and to assess how social programs can be better tailored to meet their needs.'

4 CEPAL and UNICEF, 2010; García and Ritterbusch, 2015; Hjelm et al., 2016; Notten and Roelen, 2010, 2012; Omotoso and Koch, 2018; Roelen and Notten, 2011; SAHRC and UNICEF, 2014; and Vasquez, 2016.

5 Roelen et al. 2009, 2011, 2014, 2017, 2018; Amarante et al., 2010; Apablaza and Yalonetzky, 2011; De Roche, 2013; Hameed and Padda, 2017; Plavgo et al., 2013; Arndt et al., 2017; Chzhen et al., 2015; Chzhen et al., 2017; De Lannoy et al., 2015, 2016a,b; Roelen et al., 2010; de Neubourg et al., 2012a; Dickerson and Popli, 2013; Mishra et al., 2016, 2018; Biggeri et al., 2010, Trani et al., 2013; Chzhen & Ferrone, 2017; Callander et al., 2012; and Trani and Cannings, 2013.

3 Methodology

We begin with the standard exposition of a multidimensional poverty index based on the Alkire Foster methodology (2011). Consider a population of n persons whose well-being is evaluated by d indicators. We denote the achievement of person i in indicator j by $x_{ij} \in \mathbb{R}$ for all $i = 1, \dots, n$ and $j = 1, \dots, d$. The achievements of n persons in d indicators are summarized by an $n \times d$ dimensional matrix X, where rows denote persons and columns denote indicators. Each indicator is assigned a weight based on the value of a deprivation in that indicator relative to other deprivations in other indicators. The deprivation value attached to each indicator j is the same across all persons and is denoted by w_j, such that $w_j > 0$ and $\sum_{j=1}^{d} w_j = 1$. The weights are summarized by vector $\boldsymbol{w}$.

In a unidimensional poverty measure, persons are identified as poor if their income (for example) is less than a given 'poverty line'. In a multidimensional counting approach using the dual-cutoff approach each person is identified as poor or non-poor in two steps. In the first step, a person is identified as deprived or not in each indicator using a deprivation cutoff. We denote the *deprivation cutoff* for indicator j by z_j, and the deprivation cutoffs are summarized by vector $\boldsymbol{z}$. Any person i is deprived in any indicator j if $x_{ij} < z_j$ and non-deprived, otherwise. We assign a *deprivation status score* g_{ij} to each person in each indicator based on the deprivation status. If person i is deprived in indicator j, then $g_{ij} = 1$; and $g_{ij} = 0$, otherwise.

In the second step we use the weighted deprivation status scores of each person in all d indicators to identify the person as poor or not. An overall *deprivation score* $c_i \in [0,1]$ is computed for each person by summing the deprivation status scores of all d indicators, each multiplied by their corresponding weights, such that $c_i = \sum_{j=1}^{d} w_j g_{ij}$. A person is identified as poor if $c_i \geq k$, where $k \in (0,1]$, and non-poor, otherwise. The deprivation scores of all n persons are summarized by vector $\boldsymbol{c}$. It may prove convenient to generate an n-dimensional identification (column) vector, $I(k)$, such that a typical element, $\rho_i(k)$, is defined by: $\rho_i(k) = \mathbb{I}(c_i \geq k)$.[6] The identification vector elements take two values: 0 and 1. The entry $\rho_i(k) = 1$ if and only if person i is identified as multidimensionally poor, according to deprivation cut-offs $\boldsymbol{z}$, weights $\boldsymbol{w}$ and poverty cut-off k and $\rho_i(k) = 0$ otherwise.

After identifying the set of poor and their deprivation scores, we obtain the adjusted headcount ratio (M_0) which is also referred to as the Multidimensional Poverty Index (MPI). It will prove useful, after identification, to explore the distribution of deprivation scores. Therefore we create the censored deprivation score vector $c(k)$ from $\boldsymbol{c}$, such that $c_i(k) = c_i$ if $c_i \geq k$ and $c_i(k) = 0$, otherwise. The M_0

[6] $\mathbb{I}(a)$ is an indicator function whose value is 1 if and only if a is true. Otherwise, it is equal to 0.

is equal to the average of the censored deprivation scores, where these are distributed to each person in the household:

$$M_0 = MPI = \frac{1}{n}\sum_{i=1}^{n} c_i(k)\,.^{7}$$

Although the above is a standard presentation of a counting-based indicator, when an indicator draws on individual data, the conclusion that the i^{th} person is deprived in indicator j may be a function of information that is available for only some eligible household members. To be able to study the intrahousehold features we observe that each person is a member of household h. Therefore it will prove convenient to re-index each individual by assigning them to a household as follows:

Households (indexed $h = 1,2,\ldots,m$) contain **individuals** (indexed within each household $i = 1,2,\ldots,n_h$, where n_h is the number of individuals who live in household h). Each individual has achievements in d **indicators** (indexed $j = 1,2,\ldots,d$). So x_{ij}^{h} is the **achievement** of individual i, residing in household h, in indicator j. The total number of individuals is $N = \sum_{h=1}^{m} n_h$. Note that the individual index i runs **within** households, not over all individuals in all households.

The collection (over individuals, households and indicators) of all of the x_{ij}^{h} achievements of the population is the equivalent of the usual 'achievement matrix'. However, it is not a matrix, as its elements have three indices, whereas the elements of a matrix have two indices. But it can be configured in various ways, to create matrices that summarise achievement information usefully.

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[7] Alternatively, we can express M_0 as a product of two components: the share of the population who are multidimensionally poor, or multidimensional headcount ratio (H), and the average of the deprivation scores among the poor only, or intensity (A):

$$M_0 = MPI = \frac{q}{n} \times \frac{1}{q}\sum_{i=1}^{n} c_i(k) = H \times A;$$

where q is the number of poor.

A third and final way of explaining M_0 is that it can be expressed as an average of the censored headcount ratios of indicators weighted by their deprivation value. The censored headcount ratio of an indicator is the proportion of the population that is multidimensionally poor and is simultaneously deprived in that indicator. Let us denote the censored headcount ratio of indicator j by h_j. Then M_0 can be expressed as

$$M_0 = \mathrm{MPI} = \sum_{j=1}^{d} w_j h_j = \sum_{j=1}^{d} w_j \left[\frac{1}{n}\sum_{i=1}^{n} g_{ij}(k)\right],$$

where $g_{ij}(k) = g_{ij}$ if $c_i \geq k$ and $g_{ij}(k) = 0$, otherwise.

For example, fixing h (that is, looking at a particular household h), X^h is an $(n_h \times d)$ matrix with elements x_{ij}^h, which summarises the achievements of the n_h members of the household (rows) in each of the d indicators (columns). There are m such matrices, one for each household. Depending on their characteristics, for example, age, some individuals are not 'eligible' for certain indicators. So some elements of the matrix X^h will be 'blank'.

To clarify **eligibility**, let $e_{ij}^h \in \{0,1\}$ be a zero-one indicator for whether individual i, residing in household h, is eligible to provide information for indicator j. For certain indicators (notably nutrition) the definition of deprivation may also depend on the individual's characteristics. In that case, we could expand the possible values of the eligibility indicator, $e_{ij}^h \in \{0,1,2,\dots\}$ to identify the relevant **group** that individual i in household h belongs to.

Now considering **individual deprivations**, let $g_{ij}^h \in \{0,1\}$ be a zero-one indicator of individual deprivation status. We set $g_{ij}^h = 1$ if eligible individual i, residing in household h, is deprived in indicator j. We set $g_{ij}^h = 0$ if individual i, residing in household h, is non-deprived or not eligible for indicator j. Typically an (eligible) individual i in household h will be deprived in indicator j if their achievement in that indicator x_{ij}^h falls below its deprivation cut-off u_j, so $g_{ij}^h = e_{ij}^h \mathbb{I}(x_{ij}^h < u_j)$. For an indicator j with group-specific deprivation definitions, the cut-off u_j will depend on group e, so $g_{ij}^h = \mathbb{I}\left(x_{ij}^h < u_j\left(e_{ij}^h\right)\right)$.[8]

The **deprivation status of household** h in indicator j is s_{hj} which will be some function of the household members' deprivation statuses, $s_{hj} = f_j\left(g_{1j}^h, \dots, g_{n_h j}^h\right)$. For an indicator j with group-specific deprivation definitions, we can also evaluate household deprivation status separately for each group, $s_{hj}(e) = f_j\left(g_{1j}^h, \dots, g_{n_h j}^h, e_{1j}^h, \dots, e_{n_h j}^h\right)$. For example if j is nutrition and $e = 1$ identifies children, then $s_{hj}(1)$ could be defined to represent child malnutrition.

The **poverty status of household** h is $s_h(k)$. As before, an overall household *deprivation score* $c_h \in [0,1]$ is computed for each household by summing the household deprivation status scores of all d indicators, each multiplied by their corresponding weights, such that $c_h = \sum_{j=1}^{d} w_j s_{hj}$. A household and all its members is identified as poor if $c_h \geq k$, where $k \in (0,1]$, and non-poor, otherwise. Note that any

[8] The use of more than one deprivation cut-off only applies to the indicator nutrition in the global MPI, which uses: (1) Two indicators and deprivation cutoffs combined using union for stunting and underweight for children 0-4; (2) Age-specific cutoffs used for one indicator (BMI) for people 5-19; and (3) One cutoff of 18.5 used for the BMI indicator for people 20-70.

individual-specific attribute will be indexed by h, so we will assign their household's deprivation score c_h to individual i living in household h.

Now we can consider how to generate the analyses that combine individual level deprivation status with the joint deprivations of that person across other indicators.

Malnourished and Out of School Children

If indicator $j =$ 'nutrition' (or 'school attendance') and e identifies the relevant (eligibility) group then child i, residing in household h, suffers from child malnutrition (or is out of school) if $e_{ij}^h = e$ and $x_{ij}^h < u_j(e)$. As above, $g_{ij}^h = \mathbb{I}\left(x_{ij}^h < u_j\left(e_{ij}^h\right)\right)$. It will be useful to define $b_{ij}^h = \mathbb{I}\left(e_{ij}^h = e\right)$, so b_{ij}^h is a zero-one indicator for membership of the relevant eligibility group.

- The number of eligible children in each household h is $v_{hj}^e = \sum_{i=1}^{n_h} b_{ij}^h$
- The total number of eligible children is $v_j^e = \sum_{h=1}^{m} v_{hj}^e$
- The total number of malnourished/OOS children is $q_j^e = \sum_{h=1}^{m}\sum_{i=1}^{n_h} g_{ij}^h b_{ij}^h$.
- The total number of eligible children who are MPI poor is

$$q^e(k) = \sum_{h=1}^{m}\sum_{i=1}^{n_h} b_{ij}^h s_h(k)$$

- The total number of children who are MPI poor and malnourished/OOS is

$$q_j^e(k) = \sum_{h=1}^{m}\sum_{i=1}^{n_h} g_{ij}^h\, b_{ij}^h s_h(k)$$

- The headcount ratio of children who are poor and malnourished/OOS is $H_j^e = \frac{q_j^e(k)}{v_j^e}$.
- All (eligible) children in household h are malnourished/OOS if $\sum_{i=1}^{n_h} g_{ij}^h b_{ij}^h = v_{hj}^e$.

Pioneer children

Let indicator j be completed years of schooling and let $e_{ij}^h = 1$ for children aged 10-17 and $e_{ij}^h = 2$ for adults (with $e_{ij}^h = 0$ for all children aged less than 10).

A child i living in household h is a pioneer child if he or she is aged 10-17 and has completed at least six years of schooling, $x_{ij}^h \mathbb{I}\left(e_{ij}^h = 1\right) \geq 6$ AND no adults in the household have completed six years of schooling, $\max_{l=1,\ldots,n_h} x_{lj}^h \mathbb{I}\left(e_{lj}^h = 2\right) < 6$.

In this case, as pioneer status is a specially defined non-deprived status, let us define a particular pioneer status indicator, that is $p_i^h = \mathbb{I}\left(x_{ij}^h \mathbb{I}\left(e_{ij}^h = 1\right) \geq 6\right)\mathbb{I}\left(\max_{l=1,\ldots,n_h} x_{lj}^h \mathbb{I}\left(e_{lj}^h = 2\right) < 6\right)$.

Household h contains a pioneer child if it contains an eligible child who has completed at least six years of schooling, $\max_{i=1,\ldots,n_h} x_{ij}^h \mathbb{I}\left(e_{ij}^h = 1\right) \geq 6$, AND none of its adults have completed six years of schooling, $\max_{l=1,\ldots,n_h} x_{lj}^h \mathbb{I}\left(e_{lj}^h = 2\right) < 6$,. This can be represented by

$$p_h = \mathbb{I}\left(\max_{i=1,\ldots,n_h} x_{ij}^h \mathbb{I}\left(e_{ij}^h = 1\right) \geq 6\right)\mathbb{I}\left(\max_{l=1,\ldots,n_h} x_{lj}^h \mathbb{I}\left(e_{lj}^h = 2\right) < 6\right).$$

Composition of MPI for eligible groups

One can compare the contributions for eligible individuals who are, and are not, deprived in a particular indicator j, as follows:

The Absolute Contribution of indicator j to MPI for deprived eligible individuals is

$$D_j^e = \frac{1}{N}\sum_{h=1}^{m}\sum_{i=1}^{n_h} w_j s_{hj}\, \mathbb{I}(c_h \geq k)\mathbb{I}\left(e_{ij}^h = 1\right)\mathbb{I}\left(g_{ij}^h = 1\right).$$

The percentage contribution is obtained by dividing the above expression by MPI. The comparison with non-deprived is obtained by the Absolute Contribution of indicator j, to MPI for non-deprived eligible individuals,

$$N_j^e = \frac{1}{N}\sum_{h=1}^{m}\sum_{i=1}^{n_h} w_j s_{hj}\, \mathbb{I}(c_h \geq k)\mathbb{I}\left(e_{ij}^h = 1\right)\mathbb{I}\left(g_{ij}^h = 0\right).$$

Integrated Analysis

Let indicator l be child nutrition and indicator o be school attendance. A household h that contains a pioneer child ($p_h = 1$) also contains a malnourished child if $s_{hl} = 1$ it also contains an out of school child if $s_{ho} = 1$.

- A household h contains a pioneer child and a malnourished child if $p_h s_{hl} = 1$.
- A household h contains a pioneer child and an out of school child if $p_h s_{ho} = 1$.
- household h contains a malnourished child and an out of school child if $s_{ho} s_{hl} = 1$.
- A household contains a pioneer child, a malnourished child and an out of school child if $p_h s_{hl} s_{ho} = 1$

4. Data and Global MPI

To illustrate this methodology we draw on the global MPI, using the structure and microdata of 2018, when the global MPI was adjusted to better reflect the SDGs.[9], [10] The 2018 global MPI – which is available for 105 countries and 5.7 billion people – covers three dimensions and ten indicators (Alkire and Jahan, 2018; Appendix I). It assesses household-level data for the six indicators of living standards: assets, housing, electricity, drinking water, sanitation, and cooking fuel. It also considers whether the household has lost a child in the last five years. In addition, it includes three indicators that draw on individual level achievements: (i) school attendance, (ii) nutrition, and (iii) years of schooling, applying the methodology outlined above. The datasets used in this analysis are depicted in Table 1.

Table 1. Data sources for the global MPI in South Asia

Country	Survey	Year
Afghanistan	DHS	2015–16
Bangladesh	DHS	2014
Bhutan	MICS	2010
India	DHS	2015–16
Maldives	DHS	2016–17
Nepal	DHS	2016
Pakistan	DHS	2017–18

The data on school attendance are drawn solely from individual child data and show whether the household has any school-age child who is not attending school up to the age at which they should complete class 8. The official school entrance age is used as the benchmark and is obtained from the database of the Institute for Statistics at the United Nations Educational, Scientific and Cultural Organization (UNESCO). In most countries in South Asia this refers to children who are 6 to 14 years of age; in Pakistan the age range is 5 to 13 and in Afghanistan, 7 to 15. We will analyse this data on 'out-of-school children' further in the next section.

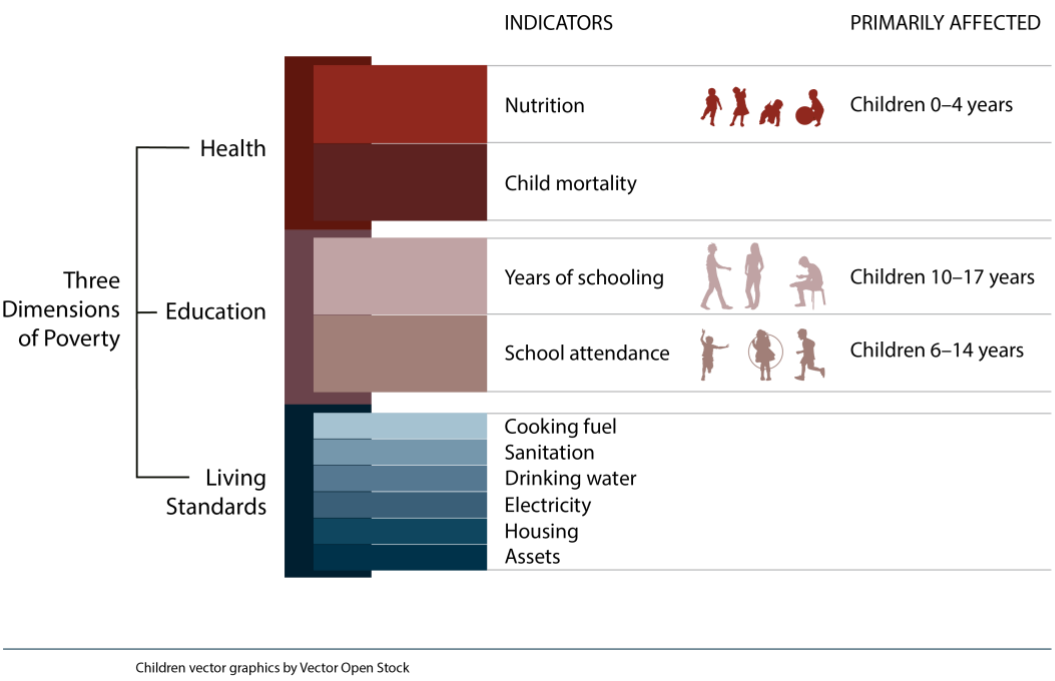
In terms of nutrition, the global MPI identifies a person as deprived if any household member under 70 years of age for whom there is nutritional data is nutritionally deprived. In this analysis we consider only data on children below the age of 5. Such children are defined as deprived if either their height-for-age (stunted) or their weight-for-age (underweight) or both, is below minus two standard deviations from the

9 The global MPI methodology and country-specific indicator treatment is specified in Alkire Kanagaratnam and Suppa 2018 and 2019, with treatments for Pakistan and Maldives being in 2019 and the rest from 2018. As this paper illustrates the methodology, for simplicity we present point estimates without standard errors or statistical inference. All regional totals are population weighted. Population numbers use 2016 UNDESA population data.

10 Relative to children, key adjustments were the inclusion of stunting of children under 5 and age- and gender-specific Body Mass Index cutoffs for children 15–17, limiting the consideration of child mortality to the last five years, and a focus on households where no one aged 10 and above had completed six years of schooling.

median of the reference population (meaning that they are either stunted or underweight or both). In Afghanistan we lack nutritional data for children aged 0 to 4, and so cannot include it in this analysis

Figure 1. Individual child information contained in the global MPI



A new category, 'pioneer children' is also introduced. Pioneer children are defined as children aged 10 to 17 years who have completed six years of schooling and who live in a household where none of the adults (aged 18 and above) have completed six years of schooling. The pioneer child's schooling attainments thus make the household non-deprived in years of schooling.

Naturally, this study is data-constrained. Not all aspects of child or multidimensional poverty can be covered, and component indicators vary somewhat across countries in definition and year. While the indicators cover different age cohorts, deprivations of children aged five are not covered in any indicator. Also, most datasets are relatively recent – such as Pakistan (2017/18), Maldives (2017/18), Nepal (2016), Afghanistan (2016), and India (2015/16) are relatively recent, but other datasets are not. Bhutan is not emphasised for example, because its data come from 2010.

5. Results

This section applies our methodology to the global MPI in South Asia to illustrate how child analyses can be linked to a household MPI.[11]

11 A more comprehensive empirical analysis is presented in OPHI and UNICEF (2019).

A. Age-specific Child Deprivation Levels in Nutrition and School Attendance

We first compute individual deprivation headcount ratios (H_j) using child-level data. We find that out of roughly 330 million school-age children in the countries covered, 36.7 million children are out-of-school children, which is 11.1% of all children in South Asia. So, one in nine children is not attending school.

Around 163 million children below 5 years of age reside in the countries of South Asia that have data on child nutrition (Afghanistan does not), and fully 42.8% of these children – more than two out of every five children – are either stunted or underweight or both. This is a total of nearly 70 million nutritionally deprived children. Table 2 compares the numbers and percentages of children deprived in these indicators.

Table 2. Children deprived in the school attendance and nutrition indicators in South Asia (% and number)

	School attendance			Nutrition	
Country	School-age children not attending school (%)	School-age children not attending school (#)	Percentage of the population living with a child who is not attending school[a]	Children (aged 0–4) who are individually malnourished (%)	Malnourished children (aged 0–4) (#)
Afghanistan	37.7	3,455,991	48.7	-	-
Bangladesh	11.4	3,922,776	11.2	39.7	6,540,001
Bhutan	10.1	16,537	10.8	33.5	25,792
India	7.4	17,431,407	6.4	44.2	51,508,525
Maldives	1.0	751	1.3	18.6	8,239
Nepal	5.0	319,730	5.5	37.9	1,143,351
Pakistan	26.3	11,592,612	28.5	391	10,480,891
South Asia	**11.1**	**36,739,804**	**10.1**	**42.8**	**69,706,799**

[a] This is the same as the uncensored or 'raw' headcount ratio for school attendance, as only child deprivations are used in this indicator.

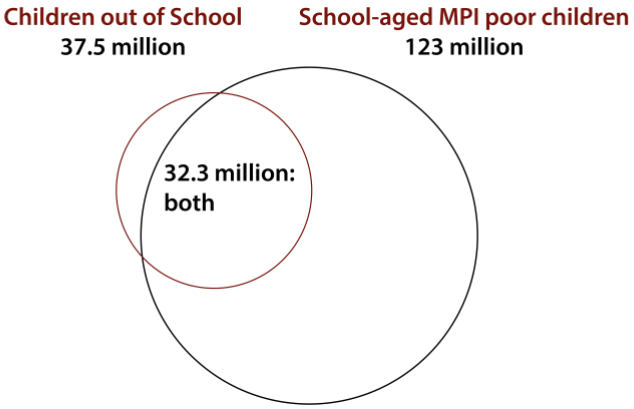
Source: Authors' calculations based on surveys listed in Table 1.

B. What Proportion of Deprived Children Live in Households That Are MPI Poor?

As is already known from the global MPI 2018, when we allocate out-of-school children to households, we find that over one in ten persons in South Asia share their household with a child who is not attending school. Zooming in on the individual data, when we take the intersection of MPI poverty status and deprivations in school attendance, we find that more than 32.3 million out-of-school children, or 88% of all out-of-school children live in MPI poor households. This suggests that most of the out-of-school

children are MPI poor.[12] On the positive side, we also find that nearly three-quarters of MPI poor school-age children are attending school. Still, the challenges are visible: nearly one in ten school-age children are not attending school and are MPI poor in South Asia.

Figure 2. Overlap between total number of school-age MPI poor and OOS children



In terms of children who are under 5 years of age, more than 45% (over 74 million) of them are multidimensionally poor. This is similar to the number of children who are nutritionally deprived (42.8%), and we might imagine that they were mainly the same children. However, only 65% of malnourished children (45 million children) live in an MPI poor household. Table 3 presents these findings.

Table 3. Children deprived in school attendance and nutrition who are also MPI poor (% and Number)

Country	School-age children who are MPI poor and not attending school (%)	School age children who are MPI poor and not attending school (#)	School-age children not attending school who live in MPI poor households (%)	Children aged 0–4 who are MPI poor and malnourished (%)	Children aged 0–4 who are MPI poor and malnourished (#)
Afghanistan	34.0	3,111,348	90.1	-	-
Bangladesh	9.7	3,334,075	85.0	30.8	5,070,224
Bhutan	8.3	13,505	81.7	24.2	18,624
India	6.5	15,248,224	87.5	27.7	32,250,744
Maldives	0.1	100	12.3	0.6	285
Nepal	4.5	286,764	89.7	26.3	792,234
Pakistan	23.4	10,339,014	89.2	27.2	7,296,573
South Asia	**9.8**	**32,333,030**	**88.0**	**27.9**	**45,428,685**

Source: Authors' calculations based on surveys listed in Table 1.

12 Note that indicator definitions have data limitations in matching school start dates and child birth dates, which create errors of inclusion.

C. Gender Equity Among Poor and Deprived Children

Of the out-of-school children identified, 17.4 million are boys and 19.3 million are girls. This means that 52.6% of out-of-school children are girls. Overall, 9.0% of boys and 10.7% of girls are MPI poor and out of school. Country patterns vary considerably. In Afghanistan 24.8% of boys aged 7–15 are multidimensionally poor and out of school, compared with 44.0% of girls. In Bangladesh the gender pattern is reversed: 12.1% of boys are multidimensionally poor and out of school, compared with 7.2% of girls.

In contrast, gender-disaggregated data on child nutrition reveal that the total number of South Asian girls below 5 years of age who are malnourished is around 5 million fewer than boys in the same age range. In terms of population shares, there is a rough equality in most countries, with a marginally higher incidence of deprivation in Nepal and Pakistan. This suggests that gender inequality in child nutrition is less severe than in school attendance. The findings are presented in Table 4.

Table 4: Children who are MPI poor and deprived in school attendance and nutrition in South Asia, by gender (%)

Country	School-age boys/girls who are MPI poor and not attending school		Children under 5 years of age who are MPI poor and malnourished	
	Boys	**Girls**	**Boys**	**Girls**
Afghanistan	24.8**	44.0**	-	-
Bangladesh	12.1**	7.2**	30.6	31.0
Bhutan	8.7	7.8	24.2	24.3
India	6.1**	6.8**	27.6	27.8
Maldives	0.1	0.1	0.6	0.7
Nepal	3.1**	6.0**	25.5	27.0
Pakistan	19.7**	27.2**	26.6	27.8
South Asia	**9.0**	**10.7**	**27.7**	**28.1**

Note: * Gender differences are statistically significant at 5%;
** Gender differences are statistically significant at 1%.
Source: Authors' calculations based on surveys listed in Table 1.

D. What Proportion of Poor and Deprived Children Experience Intrahousehold Inequalities?

Using the harmonised database for the global MPI which has the household location of each child, we can study intrahousehold patterns. Overall, 11.2% of school-age children live in an MPI poor household with intrahousehold inequality in school attendance: at least one school-age child is attending school but another school-age child is not. Intrahousehold inequalities are by far the highest in Afghanistan and Pakistan, followed by Bangladesh.

Considering both poor and non-poor children, a striking 22.7% of children aged 0-4 live in a household riven by intrahousehold inequality in nutrition – in which some are and some are not malnourished. This inequality is by far the highest in Pakistan, where over one-third of children live in a household with intrahousehold inequality in child nutrition, followed by India, at 21.8%.

Table 5: Children experiencing intrahousehold inequality in South Asia with regard to school attendance and nutrition (%)

	Percentage of school-age children who reside in an MPI poor household where at least one school-age child does not attend school and another does	Percentage of children aged 0–4 who reside in MPI poor households where at least one child is malnourished and another is not
Afghanistan	34.3	-
Bangladesh	12.7	12.1
Bhutan	9.9	14.7
India	8.1	21.8
Maldives	0.3	16.1
Nepal	7.0	17.4
Pakistan	22.4	33.7
South Asia	**11.2**	**22.7**

Source: Authors' calculations based on surveys listed in Table 1.

E. Pioneer Children

As mentioned above, we define pioneer children as children between 10 and 17 years of age who have completed six years of education and live in a household that is not deprived in years of schooling (because of these 'pioneer children'), while none of the adult members (people above 17 years of age) have competed six years of schooling.[13]

Focusing first on adult deprivations, a startling 436 million South Asians – one in four – live in a household in which no adult has completed six years of schooling.

Introducing children's attainments within the context of each household we find that of those 436 million people, 135 million – just under a third – live with a pioneer child: a child aged 10–17 who has completed six years of schooling.

While they might seem to be a rare phenomenon, 37.5 million children aged 10–17 in South Asia – one child in eight – are pioneer children. This is a surprisingly high proportion of children in the present generation. There are more pioneer children than out of school children in South Asia.

13 Recall that the age cohort of interest starts at age 10, but even non-poor children aged 10, 11, and 12 in some cases, may ordinarily not have completed six years of schooling.

Of these, 10.5 million pioneer children (28.4% of pioneer children) live in an MPI poor household, which means they experience other deprivations in at least one-third of the weighted indicators. Locating these children in households, we observe that 46 million MPI poor people are not deprived in years of schooling precisely because they share their household with a pioneer child (or children). In Nepal and India, one in ten poor persons has a pioneer child in their household.

A gendered analysis reveals the important finding that more than half of all pioneer children are girls. Overall in South Asia, 12.8% of boys are pioneer children and 13.3% of girls. Details vary by country. In Afghanistan and Pakistan, girls' educational attainments are markedly lower. But in Nepal, Bangladesh, and India, a higher percentage of girls are pioneer children than boys – which promises to bring intergenerational changes of other kinds as well.[14]

However as before, intrahousehold inequalities are important. For instance, 31.5% of pioneer children in Afghanistan live with at least one other child aged 10–17 who has not completed six years of schooling and is out of school. Table 6 presents key gendered and intrahousehold statistics associated with pioneer children.

Another way of understanding the context of pioneer children on their households is by investigating how the presence of a pioneer child in the household affects the composition of poverty. Figure 3 presents the contribution of different indicators to MPI for poor households with and without a pioneer child.

Among households with a pioneer child, nutritional deprivations contribute less than in households without a pioneer child (with the exception of Afghanistan, which lacks nutritional data). So pioneer children do not mean that nutritional deprivations vanish. In Afghanistan, the contribution of children not attending school is considerably higher.

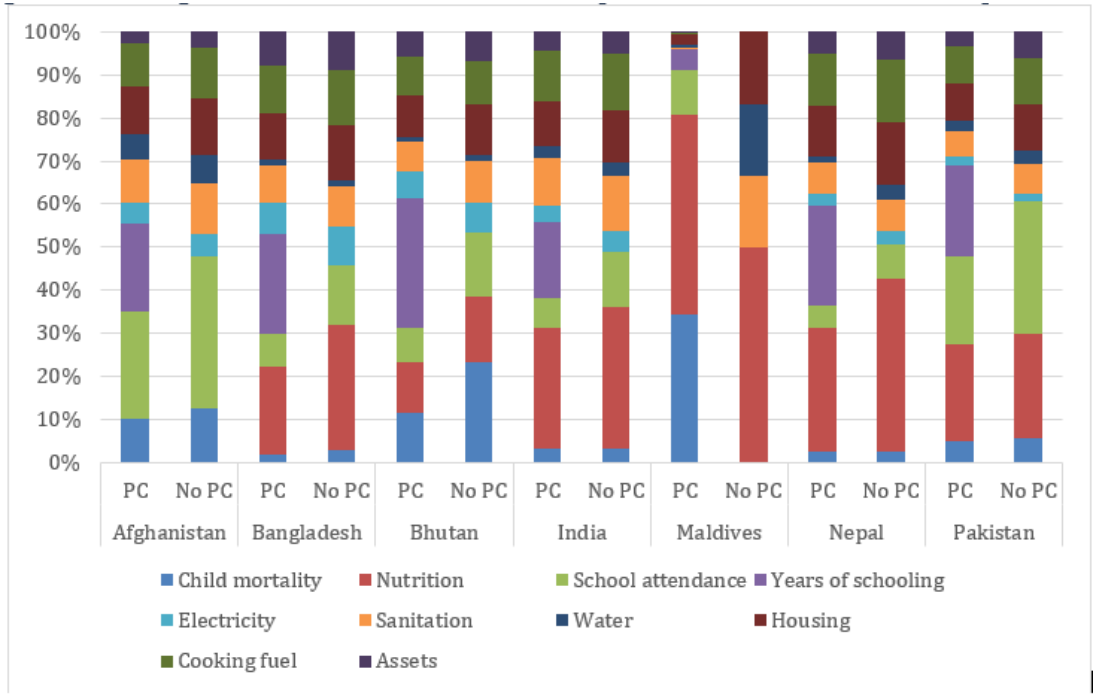
The story of pioneer children is striking and could be a point of departure for qualitative studies on who these children are, how they understand their role, and what are they doing to combat their other deprivations. The hope is that by identifying and properly supporting these children, they can be agents of change.

14 The term 'pioneer' should not be interpreted as reflecting an intrinsic quality of the child. Children's status as pioneer children tends to be the result of decisions made by the adults in the household.

Table 6. Pioneer children in South Asia: Their MPI poor status, gender, and the intrahousehold inequality

Country	Percentage of pioneer children among all children (10–17)	Total number of pioneer children	Percentage of pioneer children who are MPI poor	Percentage of pioneer boys/girls among all boys/girls (10–17)		Percentage of pioneer children living with at least one other child aged 10–17 who has not completed 6 YOS and is out of school		Percentage of the population who are not deprived in YOS due to pioneer children	Number of people who are not deprived in YOS due to pioneer children
				Boys	Girls	Non-poor	Poor		
Afghanistan	7.1	519,338	42.0	9.3	4.7	8.1	23.4	9.0	3,126,545
Bangladesh	14.4	4,283,753	27.8	12.8	16.0	3.8	6.3	10.5	17,032,199
Bhutan	13.3	18,928	16.8	13.8	12.9	4.4	4.4	10.5	83,729
India	14.2	29,740,901	28.9	13.9	14.4	2.8	4.3	7.7	101,487,833
Maldives	5.0	2,945	0.4	5.2	4.7	1.5	0.0	2.2	9,428
Nepal	20.6	1,121,774	23.4	18.7	22.4	2.2	2.6	13.0	3,778,337
Pakistan	5.1	1,788,269	19.6	5.7	4.6	21.5	12.7	4.7	9,155,099
South Asia	**13.0**	**37,475,910**	**28.4**	**12.8**	**13.3**	**3.8**	**5.1**	**7.7**	**134,673,080**

Figure 3. Percentage contribution of indicators to MPI for poor households with and without a pioneer child



Source: Authors' calculations.

F. An Integrated Child Analysis

According to the surveys analysed, there are about 37.5 million pioneer children (aged 10–17), 36.7 million out-of-school children (aged around 6–14, depending on national standards), and 70 million malnourished children (aged 0–4) in South Asia. How many people live in households that experience only one of these three conditions? How many people live in households that are doubly deprived, because they have at least one malnourished child aged 0–4 and another out-of-school child? And how many people live with incongruity: they have a pioneer child but also have a child who is deprived in one or both of the other indicators? This kind of analysis, covering children of different ages and with differing deprivations, is rarely presented but is potentially very powerful. Naturally it is affected by differences in household size and compositions, and many households do not have a child in each age bracket. But given this understanding, the results still add value.

Table 7. Levels of deprivation in the school attendance and nutrition indicators in South Asia, and their overlaps, by household (#)

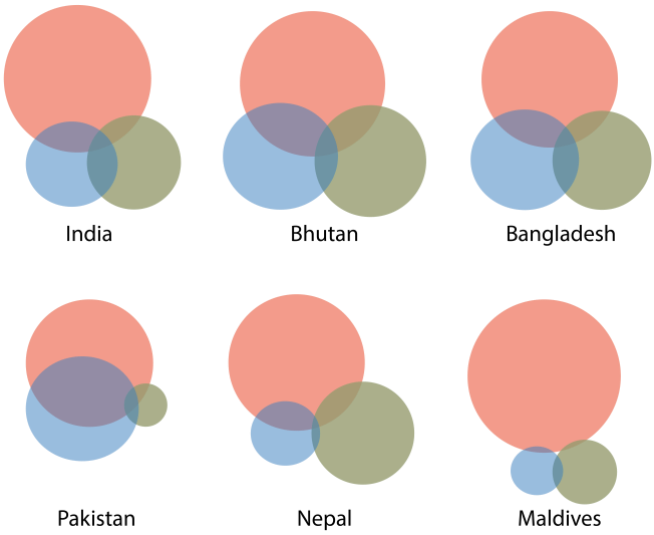
	Bangladesh	Bhutan	India	Maldives	Nepal	Pakistan	South Asia
Malnourished child(ren) only	32,908,395	138,480	256,392,034	54,238	5,745,176	67,853,061	**363,091,384**
Out-of-school (OOS) child(ren) only	18,221,535	86,477	84,416,116	5,574	1,590,830	54,966,389	**159,286,921**
Pioneer children only	17,032,199	83,729	101,487,833	9,433	3,778,337	9,196,485	**131,588,016**
Malnourished child(ren) and OOS child(ren)	4,786,546	20,630	27,301,448	386	465,678	30,410,227	**62,984,915**
OOS child(ren) and pioneer child(ren)	2,483,966	9,241	13,305,253	386	239,318	3,013,974	**19,052,138**
Malnourished child(ren) and pioneer child(ren)	2,424,944	11,272	13,025,206	386	439,058	2,395,723	**18,296,589**
All three	573,412	2,155	2,804,052	-	22,832	1,101,260	**4,503,711**

Note: OOS = Out-of-school
Source: Authors' calculations based on surveys listed in Table 1.

A total of 759 million people share their household with a child in one or more of the three conditions studied. By far the most of these – 363 million – have a malnourished child at home. Either there are no other children in the household, or those who are, are attending school but not a pioneer child. 159 million only have an out-of-school child and nearly 132 million only have a pioneer child. So 86% of the persons living in households with one of these conditions, do not experience the other two. However the overlaps are important. For example, across South Asia, 63 million people live in a household where one child (aged 6–14 or so) is out of school and a different child (aged 0–5) is malnourished. But surprisingly, more of

these live in Pakistan (30.4 million) than India (27.3 million). The incongruity of a household that has a pioneer child – hence a sign of hope – and deprived child – is measured concretely. India has 13.3 million people who live with a pioneer child and an out-of-school child and another 13.0 million who live with a pioneer child and a malnourished child. Across South Asia, 4.5 million people have the striking incongruity of experiencing all three conditions at the same time. The global MPI database draws on child level data, but in the case of years of schooling and nutrition, it also draws on adult data where available. By restricting deprivations to children, and studying the overlaps, this integrated analysis enables us to pinpoint the households where children are at risk, and the characteristics of those households could then, data permitting, be further examined. The analysis presented here can also be used to track changes over time.

Figure 4. 'Integrated child analysis: Millions of people living in households with each child condition or combination of conditions'(that's how the figure is labeled in the OPHI-UNICEF Report)



6. Concluding Remarks

Children carry a disproportionate burden of poverty, and childhood deprivation can have lasting intergenerational effects. For that reason, the literature on child poverty has recently explored multidimensional poverty measures that draw on individual child data. This paper has presented a methodology by which analyses of an MPI that uses the household as the unit of identification can be further extended through analysis of the individual (in this case, child) deprivations underlying the component deprivations. It seeks to narrow the widely recognised gap between household and individual (child) poverty analyses, by outlining a methodology that can – and when the data are appropriate and high quality, should – be mainstreamed in the analyses of multidimensional poverty indices.

Methodologically, we defined the individual nested within the household, and marked the eligible individuals for any indicator, in order to be able to estimate several new types of analyses that may be of

policy relevance. Using the global MPI 2018, we illustrate the methodology drawing on three indicators that pertain to different stages of childhood. It is clear that children in South Asian countries, apart from the Maldives, suffer high rates of deprivation and that these deprivations are interwoven in a complex way. The overlapping deprivations faced by these children can have lifelong negative repercussions. Conversely, progress made by a single child might ripple outward, starting with their own household and moving out into their community and beyond. The task of this paper has been to set up a framework for a gendered analysis of child deprivations, that considers intrahousehold inequalities, illuminates how the composition of poor children's MPI varies between children who are, and are not, deprived in a given indicator, and tracks overlaps across child deprivations.

Naturally many research questions arise from such a study. Methodologically many relationships can be estimated using the broad framework (of individuals nested within households, with eligible individuals marked). We have proposed a small number that seem empirically important, but many more can be generated. This can also be extended to gendered analysis – for example of the years of schooling indicator among adults, and of nutrition in some countries, or employment in other datasets. Empirically, this analysis can be extended to cover all countries in the global MPI (data permitting), but it could also be applied to child variables in national or regional MPIs. Further analysis where possible of disaggregation by additional variables (ethnicity, subnational region) or household characteristics could uncover additional policy salient information, although close attention to sample design is required in order to ensure that the results are representative. Demographically, the accurate interpretation of intertemporal trends in child deprivations must consider demographic patterns such as fertility rates, household composition, and so on. The gendered and intrahousehold features of child multidimensional poverty and deprivations would be appropriate for mixed-method and/or longitudinal studies, with pioneer children being a prominent example. In sum, this study is a first but not a last word on the subject.

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Appendix

Table A.1 The dimensions, indicators, deprivation cutoffs, and weights of the global MPI 2018.

Dimension of poverty	Indicator	Deprived if…	Weight
Health	Nutrition	Any adult under 70 years of age or any child for whom there is nutritional information is undernourished.[a]	1/6
	Child mortality	Any child has died in the family in the five-year period preceding the survey. [b]	1/6
Education	Years of schooling	No household member aged 10 years or older has completed six years of schooling.	1/6
	School attendance	Any school-age child[c] is not attending school up to the age at which he/she would complete class 8.	1/6
Living standards	Cooking fuel	The household cooks with dung, wood, charcoal, or coal.	1/18
	Sanitation	The household's sanitation facility is not improved (according to SDG guidelines) or it is improved but shared with other households.[d]	1/18
	Drinking water	The household does not have access to improved drinking water (according to SDG guidelines) or safe drinking water is at least a 30-minute walk from home, round trip.[e]	1/18
	Electricity	The household has no electricity.	1/18
	Housing	At least one of the three housing materials for roof, walls, and floor are inadequate: the floor is of natural materials and/or the roof and/or walls are of natural or rudimentary materials.[f]	1/18
	Assets	The household does not own more than one of these assets: radio, TV, telephone, computer, animal cart, bicycle, motorbike, or refrigerator, and does not own a car or truck.	1/18

Note

[a] Adults 20 to 70 years are considered malnourished if their Body Mass Index (BMI) is below 18.5 m/kg^2. Those 5 to 20 years of age are identified as malnourished if their **age-specific BMI cutoffs** are below minus two standard deviations. Children under 5 years are considered malnourished if their z-score for either height-for-age (stunting) or weight-for-age (underweight) is below minus two standard deviations from the median of the reference population. In the majority of the countries, BMI-for-age covered people aged 15 to 19 years, as anthropometric data was only available for this age group; if other data were available, BMI-for-age was applied for all individuals above 5 years and under 20 years.

[b] All reported deaths are used if the date of child's death is not known.

[c] Data source for age children start school: United Nations Educational, Scientific and Cultural Organization, Institute for Statistics database, table 1. Education systems [UIS, **http://stats.uis.unesco.org/unesco/TableViewer/tableView.aspx?ReportId=163**].

[d] A household is considered to have access to improved sanitation if it has some type of flush toilet or latrine, or ventilated improved pit or composting toilet, provided that they are not shared. If survey report uses other definitions of 'adequate' sanitation, we follow the survey report.

[e] A household has access to clean drinking water if the water source is any of the following types: piped water, public tap, borehole or pump, protected well, protected spring or rainwater, and it is within 30 minutes' walk (round trip). If survey report uses other definitions of 'safe' drinking water, we follow the survey report.

[f] Deprived if floor is made of mud/clay/earth, sand or dung; or if dwelling has no roof or walls or if either the roof or walls are constructed using natural materials such as cane, palm/trunks, sod/mud, dirt, grass/reeds, thatch, bamboo, sticks or rudimentary materials such as carton, plastic/ polythene sheeting, bamboo with mud/stone with mud, loosely packed stones, uncovered adobe, raw/reused wood, plywood, cardboard, unburnt brick or canvas/tent.