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Analyzing Individual Deprivations alongside Household Poverty: Possibilities for Gendered, Intrahousehold, and Multidimensional Analyses

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Abstract
Most poverty measures identify a household as poor based on achievements of all its members, hence gendered and intrahousehold inequalities are not illuminated even when data for individual household members exist. This paper provides a framework for jointly analysing individual deprivations alongside poverty status and composition, to illuminate gendered and intrahousehold disparities and intergenerational patterns. The illustration applies the methodology to multidimensional poverty in seven countries in South Asia and monetary poverty in Pakistan. The paper thus prototypes a general methodology that can be incorporated into standard poverty reporting to shine a light jointly on individual deprivations and household poverty.

Keywords: Poverty Measurement, Multidimensional Poverty Measurement, Gender, Intrahousehold Inequality, Child Poverty, South Asia, Education, Nutrition, Intergenerational mobility.

JEL classification: I32, J13, O1

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1. Introduction

In *The Great Escape,* Deaton observes that "Averages are no consolation to those who have been left behind." This is true not merely within nations but also within households (Deaton 2013; cf Sen 2016; Penglase 2021). In multidimensional poverty measurement, as in its unidimensional counterpart, the relationship between household and individual poverty measures is imperfect.

Household poverty measures take the household as the unit of identification, so if a household is identified as poor, all its members are identified as poor. Such measures reflect a recognition that one person's capabilities or deprivations affects other household members (Basu and Foster, 1998), but they generally overlook intrahousehold inequalities.[1] Haddad and Kanbur's 1990 paper (cf Messer, 1997) catalyzed a literature mainly on monetary poverty that models probable intrahousehold inequalities (Chiappori and Meghir, 2015 and the references cited therein). Espinoza-Delgado and Klasen (2018) and Klasen and Lahoti (2021) raise the issue of intrahousehold inequalities with respect to multidimensional household poverty measures – with the latter paper arguing that intrahousehold inequality accounts for 30% of total inequality.

In individual measures, every person is individually identified as poor or non-poor. Individual multidimensional poverty indices have been estimated and analyzed by many with a gender focus.[2] They have the advantage of being able to provide gendered information and to illuminate intrahousehold inequalities in individual functionings such as education, work, health or nutrition.[3] In parallel, research on individual multidimensional poverty measures for children is rapidly expanding.[4] This research generally advocates individual-level measures because household-level MPIs do not include in-depth indicator sets that are vital to children's capabilities, rights and poverty, nor do they reflect disparities across gender or age, nor capture deprivation patterns across multiple children within the same household.

An extensive literature provides important arguments as to whether individual or household measures are 'better' in the sense that they capture policy relevant information that is occluded by the other. Yet neither option alone provides complete information for adequate policy responses.

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1 An exception is when indicators in a household MPI reflect inequities, such as by using gendered definitions. For example, Afghanistan's national MPI has separate indicators for female schooling and male schooling, while Pakistan's national MPI requires at least one female and one male to have completed a minimum number of years of schooling (www.mppn.org).

2 These include Batana (2008, 2013); Ura et al. (2012); Alkire et al. (2013); Vijaya, Lahoti, and Swaminathan (2014); Bessell (2015); Pogge and Wisor (2016); Alkire and Apablaza (2017); Espinoza-Delgado and Klasen (2018); and Klasen and Lahoti (2021)

3 See also footnote 4, and axiomatic analyses by Chakravarty, Chattopadhyay, and D'Ambrosio (2022).

4 An ample literature now focuses on child analyses of MPIs built at the household level (Dirksen and Alkire, 2021). In addition, a set of studies implements individual child MPIs using counting-based methodology (Alkire and Foster, 2011). Some papers cover children across childhood (0–17 years) (CEPAL and UNICEF, 2010; Notten and Roelen, 2010, 2012; Roelen and Notten, 2011; SAHRC and UNICEF, 2014; García and Ritterbusch, 2015; Alkire et al., 2016; Vasquez, 2016; Omotoso and Koch, 2018; Dirksen and Alkire, 2021). Others focus on children of particular age groups (Gordon et al. 2003; Roelen, Gassmann, and de Neubourg, 2009, 2010, 2011; Amarante, Arim, and Vigorito, 2010; Biggeri and Mehrota, 2011, Alkire and Roche, 2012; Callander, Schofield, and Shrestha, 2012; Roche, 2013; Plavgo et al., 2013; Trani and Cannings, 2013; Trani, Biggeri, and Mauro, 2013; Chzhen et al., 2015; De Lannoy, Frame, and Leibbrandt, 2015; Arndt et al., 2017; Chzhen and Ferrone, 2017; Roelen, 2017, 2018; Chzhen, Bruckauf, and Toczydlowska, 2018; Dickerson and Popli, 2018; Mishra, Ray, and Risse, 2018).

This paper proposes a different strategy: analyzing individual deprivations of individuals alongside a monetary or multidimensional poverty measure for that household. We illustrate the proposed methodology with respect to children, but it is general and could equally be applied to individual indicators for other groups. Children are a natural focus because according to the global Multidimensional Poverty Index (MPI),[5] of the 1.3 billion people who live in multidimensional poverty half are children aged 0–17 (UNDP and OPHI, 2022): one in three children live in MPI-poor households, compared to one in seven adults. This elementary age disaggregation establishes the importance of understanding the situation of children.[6]

Our methodology re-analyses 'individual indicators' – in which individual-level data for some household members are used to identify all household members as deprived or non-deprived in that indicator. In multidimensional poverty, individual data of eligible household members may include indicators of child school attendance, completed years of schooling, nutritional status, early marriage and childbearing, employment, and so on. In income poverty, the income earned by individual household members may be of this type. Monetary data sources also commonly include individual data for education, that can be used as our example shows. In monetary and multidimensional measures individual-level data are aggregated across eligible household members according some rule. In multidimensional poverty measures, the intrahousehold aggregation criterion may be defined such that all members of the household are deprived if *any* eligible household member is deprived in that indicator, or *all* eligible household members, or some specified combination (which may itself consider gender and/or age). Thus, all household members are identified as deprived in that indicator according to an intrahousehold aggregation of data from individual deprivations. By re-analyzing individual indicators separately, we augment the analysis of a poverty measure that uses the household as the unit of identification, with further information from individual-level data. While many relationships could be studied, six basic comparisons are highly informative.

1. **Poverty status**: what proportion of deprived individuals are poor?
2. **Gender:** what proportion of deprived (and poor) individuals are female, male, or other categories?
3. **Intrahousehold inequality:** what proportion of deprived (and poor) individuals live in households where other eligible individuals are present but are not deprived in that same indicator?
4. **Complex categories:** which households contain one group of individuals who are deprived in one indicator, and another group who are not deprived in the same indicator?
5. **Composition:** the composition of MPI by indicator experienced by people living in households with individuals who themselves are deprived in a particular indicator (and poor), compared to households in which individuals are not deprived. A related comparison could be done at the individual level.

   Finally, looking across households and different eligible populations we can observe:

5 See Alkire, Kanagaratnam, and Suppa (2018, 2019) and the references cited therein.

6 Heckman and Masterov (2007) and Heckman and Karapakula (2019) explore the long-term beneficial effects of addressing multiple deprivations faced in early childhood.

6. **Integrated analyses:** what proportion of people live in households where eligible individuals for different individual indicators are concurrently deprived in more than one individual indicator?

To illustrate this methodology, we first analyze the global MPI and its underlying microdata in South Asia, focusing on three individual indicators: nutrition, school attendance and completed years of schooling. For a monetary poverty measure, building on Brown, Ravallion and van de Walle (2019) who observe that around one half of undernourished women and children in Africa are not found in the (asset) poorest 40% of households, we use the cost of basic needs (CBN) poverty line in Pakistan to construct a parallel analysis of the relationships of poverty status, gender, and intrahousehold inequalities for out-of-school children and pioneer children, and compare this with the global MPI analysis from a similar year. In both cases, and in contrast to existing modelled methodologies of analysis, the gendered and intrahousehold relationships are measured directly. Our results illustrate that widely available individual variables in monetary and multidimensional poverty datasets may provide powerful insights.

We suggest that linked analyses of individual and household information such as that demonstrated in this paper should become a standard component of the information platform of multidimensional and monetary poverty measures that use the household as the unit of identification. Just as disaggregation by population subgroups is now a regular component of poverty analysis, and the breakdown of multidimensional poverty by component indicators is a standard component of the multidimensional poverty information platform, so too should gendered and intrahousehold patterns of individual deprivations become a routine component of poverty reports. Similarly, monetary poverty measures should be routinely linked to deprivations in individual indicators either within or external to the monetary aggregate. This will improve the gendered and intrahousehold information available for policy responses to poverty, complement model-based analyses,[7] and make apt use of commonly available individual data.[8] Such analysis may not capture all the potential value-added of individual poverty measures, which may incorporate additional variables when constructed from bespoke surveys. But it will greatly augment the informational power of standard household poverty analyses, and may have advantages in terms of generality.[9]

7 Bargain, Donni, and Kwenda (2014); Chiappori, Fortin, and Lacroix (2002); Dunbar, Lewbel, and Pendakur (2013); Browning et al. (2013); Chiappori and Meghir (2015).

8 Surveys with more precise intrahousehold data should also be analyzed using these techniques. See de Vreyer and Lambert (2021).

9 This analysis can be complemented by other measurement strategies – such as building individual multidimensional poverty measures (for example, for children) that are structurally linked to, and extend, household measures, so that the pair of linked measures provide compact yet complementary insights (Alkire, Vaz and Oldiges, forthcoming; Dirksen and Alkire, 2021).

2. Data

To illustrate this methodology for South Asia, we draw on the global MPI 2019,[10] which is available for 101 countries and 5.7 billion people, and covers three dimensions and 10 indicators (Alkire, Kanagaratnam, and Suppa, 2019). It includes three individual indicators: nutrition, years of schooling, and school attendance. It also assesses household deprivations for the six indicators of living standards: cooking fuel, sanitation, drinking water, electricity, housing, and assets and, in health, considers whether the household has lost a child in the last five years.

The global MPI identifies a person as poor if they are deprived in one-third or more of the weighted indicators. Because the household is the unit of identification, all members of the same household will be deprived in the same indicators, and will all be defined as poor or non-poor. The global MPI results for each country are age disaggregated to profile the level and composition of acute multidimensional poverty across age cohorts, including children and adults. However, previous analyses have not systematically gone beyond age disaggregation to profile the gendered and intrahousehold patterns in the underlying individual deprivations.[11] Table 1 lists the datasets used in the MPI analysis.

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 school attendance data are drawn solely from individual child data. A household is deprived if any school-age child is not attending school up to the age at which they should complete grade 8. The official school entrance age is used as the benchmark and is obtained from the database of the Institute for Statistics at UNESCO. In most South Asian countries this refers to children who are 6 to 14 years old; the age range is 5 to 13 in Pakistan and 7 to 15 in Afghanistan. We define children who are individually deprived in school attendance as 'out-of-school' children.

The global MPI identifies a household and all its members as deprived in nutrition if any member under 70 years of age for whom there is nutritional data is nutritionally deprived. Our analysis only focuses on children below the age of 5, who are defined as nutritionally deprived if their height-for-age or weight-for-age, or both, are below minus two standard deviations from the median of the reference population (e.g., they are either stunted or underweight, or both). As we lack nutritional data for Afghanistan, we only analyze this variable for six countries.

10 The global MPI methodology and country details are in Alkire, Kanagaratnam, and Suppa (2018, 2019). This paper uses global MPI estimations from 2018 for India and from 2019 otherwise. Regional totals are population weighted using UNDESA population data for 2016, which is closest to the population weighted mean of the year in which South Asian data were collected.

11 Table 3 of Alkire, Kanagaratnam, and Suppa (2019) presents age disaggregation.

For pioneer children we use the variable years of schooling, which considers a household deprived if no person aged 10 and above has completed six years of schooling.

Turning to the example of monetary poverty in Pakistan, the CBN poverty measure is computed using the Household Integrated Survey (HIES) 2018/19 and compared to Pakistan's results in the DHS 2017/18. The definitions of out-of-school and pioneer children, along with the reference population, are harmonized between the HIES and DHS to permit meaningful comparisons.

Both HIES and Pakistan DHS are nationwide surveys, representative at the provincial as well as urban and rural levels. HIES has a sample size of 25,800 households, compared to 16,240 households in the Pakistan DHS. Both sample designs are based on the latest 2017 census.

3. Methodology

For assessments of multidimensional poverty we build out from the notation of Alkire and Foster (2011) to articulate the intrahousehold framework underlying this analysis.12 Consider a population of n persons whose well-being is evaluated by d indicators. Let us 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. First, 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

12 It would also be possible and interesting to use the Alkire-Foster method to generate individual MPIs from datasets that cover multiple household members, then convert the present notation to explore intrahousehold relationships in that context.

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: $\rho_i(k) = \mathbb{I}(c_i \geq k)$.13 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 cutoffs $\boldsymbol{z}$, weights $\boldsymbol{w}$ and poverty cutoff 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), also referred to as the MPI. It will be 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 is equal to the average of the censored deprivation scores, where these are distributed to each person in the household: $M_0 = MPI = \frac{1}{n}\sum_{i=1}^{n} c_i(k)$ .14

The above is a standard presentation of a counting-based indicator, and the aggregate components M_0, H, A, h_j can be disaggregated by population subgroups such as gender or age cohort.

Note that the conclusion that the i^{th} person is deprived in indicator j may be a function not of a simple deprivation cutoff but rather of information that is available for only some eligible household members. To study the intrahousehold features we observe that each person is a member of household h. It will prove convenient to re-index each individual by assigning them to a household as follows.

Households (indexed $h = 1,2, \dots, m$) contain **individuals** (indexed within each household $i = 1,2, \dots, n_h$, where n_h is the number of individuals who live in household h). Each individual has achievements in d **indicators** (indexed $j = 1,2, \dots, d$). 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 we have redefined the individual index i so that it now runs **within** households, not over all individuals in all households.

The collection (over individuals, households, and indicators) of all 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 summarize achievement information usefully.

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 summarizes the achievements of the n_h members of the household (rows) in each of the d indicators

13 $\mathbb{I}(a)$ is an indicator function whose value is 1 if and only if a is true. Otherwise, it is equal to 0.

14 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 poor people only, or intensity (A). A third 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.

(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, such as nutrition, the definition of deprivation may also depend on the individual's characteristics (for example, in the global MPI, children under 5 are deprived if they are either underweight or stunted, people aged 5–19 are deprived if their Body Mass Index (BMI) is below the age-specific standard, and people aged 20 and above are deprived if their BMI is less than 18.5). 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 (child under 5, person 5–19, etc.)

To further elaborate the deprivation cutoff in the case of individual indicators, 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 cutoff 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 cutoff u_j will depend on group e, so $g_{ij}^h = \mathbb{I}\left(x_{ij}^h < u_j(e_{ij}^h)\right)$.[15]

The **deprivation status of household** h in indicator j, denoted s_{hj}, will be some function of the household members' deprivation statuses, $s_{hj} = f_j(g_{1j}^h, \dots, g_{n_h j}^h)$. For an indicator j with group-specific deprivation definitions, we can also evaluate household deprivation status separately for each group, $s_{hj}(e) = f_j(g_{1j}^h, \dots, g_{n_h j}^h, e_{1j}^h, \dots, e_{n_h j}^h)$. For example, if j is nutrition and $e = 1$ identifies children under 5 years of age, then $s_{hj}(1)$ could be defined to represent child undernutrition.

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 are identified as poor if $c_h \geq k$, where $k \in (0,1]$, and non-poor, otherwise. Note that any individual-specific attribute will be indexed by h, so we assign their household's deprivation score c_h to each individual i living in household h.

15 The use of more than one deprivation cutoff 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 aged 0–4; (2) age-specific cutoffs used for one indicator (BMI) for people aged 5–19; and (3) one cutoff of 18.5 used for the BMI indicator for people aged 20–70. This paper only covers nutrition for children aged 0–4.

We can now consider how to scrutinize the individual-level deprivation status alongside other information (data permitting) such as the person's gender or age cohort, or the joint deprivations of that person across other indicators.[16]

A. Identifying Individual Deprivations

This section provides convenient statistics for the individual analyses that link to household poverty status, primarily by identifying individuals as individually deprived or not in a given indicator. If indicator $j =$ an individual indicator such as nutrition or school attendance, and e identifies the relevant (eligible) group of individuals for that indicator, then individual i, residing in household h, is deprived 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 is convenient 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. For each indicator j, the:

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

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

- total number of individuals who are MPI poor and deprived in the focal indicator is

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

- headcount ratio of individuals who are poor and deprived in the focal indicator is $H_j^e = \frac{q_j^e(k)}{v_j^e}$.

All (eligible) individuals in household h are deprived if $\sum_{i=1}^{n_h} g_{ij}^h b_{ij}^h = v_{hj}^e$.

B. Complex Categories: The Case of Pioneer Children

Additional situations might be defined by combining individual attainment and deprivation information from household members in different categories. For example, let us define pioneer children as children aged 10–17 who have completed at least six years of schooling, but live in a household where no adults aged 18 and above have completed six years of schooling.

16 As disaggregation, data permitting, by population subgroups is elementary and appropriate for headcount ratios or numbers of deprived or pioneer children, further notation for subgroup decompositions is not provided.

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 under 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, $x_{ij}^h \mathbb{I}(e_{ij}^h = 1) \geq 6$ and no adults in the household have completed six years of schooling, $\max_{l=1,\ldots,n_h} x_{lj}^h \mathbb{I}(e_{lj}^h = 2) < 6$.

In this case, as pioneer status is a specially defined non-deprived status, let us define a particular pioneer status indicator, p_i^h. Household h contains a pioneer child if it contains an eligible child who has completed at least six years of schooling, $\max_{i=1,\ldots,n_h} x_{ij}^h \mathbb{I}(e_{ij}^h = 1) \geq 6$, and none of its adults have completed six years of schooling, $\max_{l=1,\ldots,n_h} x_{lj}^h \mathbb{I}(e_{lj}^h = 2) < 6$,. This can be represented by

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

C. Composition of the MPI for Eligible Groups

One can also compare the contributions for eligible individuals who are, and are not, deprived in a particular indicator j. The absolute contribution of indicator j to the MPI for deprived eligible individuals is

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

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

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

D. Integrated Analysis

It may also be convenient to explore the joint distribution of deprivations across households for a set of individual deprivations such as undernutrition or out-of-school child(ren), or complex categories in the case of pioneer children.

Let l o and p be three individual indicators. A household h contains a person deprived in p if ($p_h = 1$); a person deprived in l if $f_{hl} = 1$; and a person deprived in o if $f_{ho} = 1$.

- A household h contains at least person deprived in p and l if $p_h f_{hl} = 1$.
- A household h contains at least one person deprived in p and o if $p_h f_{ho} = 1$.
- A household h contains at least one person deprived in o and l if $f_{ho} f_{hl} = 1$.

- A household h contains at least one person deprived in each of the three indicators if $p_h f_{hI} f_{ho} = 1$

E. Observations

The Alkire-Foster method, which underlies the multidimensional poverty measure used here, satisfies several properties (Alkire and Foster 2011, 2019). Three lead to insights that are particularly relevant for policy: **subgroup decomposability,** which observes that the measure can be disaggregated by mutually exclusive exhaustive population subgroups and recomputed as the population-weighted sum of those subgroups; **dimensional breakdown**, which observes that the measure can be equivalently expressed as the weighted sum of censored headcount ratios of its component indicators; and **dimensional monotonicity**, which observes that the reduction of any deprived dimension of poor people will reduce poverty. All properties are satisfied for the household-level poverty measure and for individuals insofar as they are assigned the household deprivation profile.

For individual indicators, the MPI may be consistently disaggregated into three population subgroups: a) poor people living in households without any eligible person; b) poor people living in households with an eligible person who is non-deprived in the focal individual indicator; and c) poor people living in households with an eligible person who is deprived in the focal indicator. Provided the data are representative of each group, subgroup decomposability, dimensional breakdown, and dimensional monotonicity hold for these disaggregations, and comparisons between them may be illuminating, as in the case of the dimensional composition of the MPI for individuals living in households which are and are not deprived in a given individual indicator;

Note that empirical comparisons naturally need to consider the demographic structures of the comparator populations: what percentage of the population are eligible; what percentage of households have an eligible member; what is the sex ratio for the eligible population, or the population shares of households with single versus multiple eligible members. As these relationships are taken from the household surveys, analysts naturally will also need to scrutinize the sample design, missing values, and unweighted observations used for each cell, and justify decisions to use the datasets for this analysis. They will also cross-check figures such as the sex ratio against other demographic source data. Due to space constraints, this paper assumes that demographic verification has been completed.

4. Results

We first compute individual deprivation headcount ratios (H_j) using child-level data for eligible children. We find that out of roughly 330 million school-age children in the countries covered, 36.7 million (11.1%) are out-of-school. So, one in nine of all children in South Asia are not attending school.[17]

A. Individual Child Deprivations in Nutrition and School Attendance

Table 2. Children deprived in the school attendance and nutrition indicators in South Asia

	School attendance			Nutrition	
Country	School-age children not attending school (%)	Number of school-age children not attending school *(thousands)*	Population living with a child who is not attending school (%)[a]	Children (aged 0–4) who are individually deprived in nutrition (%)	Number of nutritionally deprived children (aged 0–4) *(thousands)*
Afghanistan	37.7	3,456	48.7	-	-
Bangladesh	11.4	3,923	11.2	39.7	6,540
Bhutan	10.1	16.5	10.8	33.5	25.8
India	7.4	17,431	6.4	44.2	51,509
Maldives	1.0	0.7	1.3	18.6	8
Nepal	5.0	320	5.5	37.9	1,143
Pakistan	26.3	11,593	28.5	39.1	10,481
South Asia	**11.1**	**36,740**	**10.1**	**42.8**	**69,707**

Note: [a] This is the same as the uncensored headcount ratio for school attendance.

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

Around 163 million children under 5 years of age reside in South Asian countries 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 stunted or underweight, or both. This is a total of 69.7 million nutritionally deprived children in total. Table 2 provides the numbers and percentages of children deprived in each indicator.

B. Deprived Individuals Living in Multidimensionally Poor Households

The global MPI shows that over one in ten people in South Asia share their household with a child who is not attending school. When we look at 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

17 A more comprehensive survey of the South Asian and UNICEF-related literature on child poverty is presented in Alkire, Alim and Ul Haq 2019.

households.[18] On the positive side, nearly three-quarters of MPI-poor, school-age children are attending school. The challenges are clear: one in nine school-age children are not attending school and are MPI poor in South Asia, and 88% of those children are multidimensional poor.

More than 45% (over 74 million) of children under 5 years of age 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 two-thirds (65%) of nutritionally deprived children (45 million out of 69.7 million) 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

Country	School-age children who are MPI poor and not attending school		Share of out-of-school school-age children who live in MPI-poor households	Children aged 0–4 who are MPI poor and nutritionally deprived		Share of nutritionally deprived children 0–4 who live in MPI-poor households
	(%)	(*thousands*)	(%)	(%)	(*thousands*)	(%)
Afghanistan	34.0	3,111	90.1	-	-	-
Bangladesh	9.7	3,334	85.0	30.8	5,070	77.5
Bhutan	8.3	13.5	81.7	24.2	19	72.2
India	6.5	15,248	87.5	27.7	32,251	62.6
Maldives	0.1	0.1	12.3	0.6	0.3	3.5
Nepal	4.5	287	89.7	26.3	792	69.2
Pakistan	23.4	10,339	89.2	27.2	7,297	69.6
South Asia	**9.8**	**32,333**	**88.0**	**27.9**	**45,429**	**65.2**

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

C. Gender Inequalities in Individual Indicators of poor Individuals

Of the out-of-school children identified, 17.4 million are boys and 19.3 million are girls, so 52.6% of out-of-school children are girls. Overall, 9% 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 to 44% of girls. The gender pattern is reversed in Bangladesh: 12.1% of boys are multidimensionally poor and out of school, compared to 7.2% of girls. All these differences are statistically significant (Table 4).

In contrast, gender-disaggregated data on child nutrition reveal that around 3.7 million fewer South Asian girls below 5 years of age are deprived in nutrition, compared to boys in the same age range (36.7 million boys and 33 million girls). The same pattern is observed among poor children: 23.4 million poor boys are nutritionally deprived, compared to 22 million girls. The population shares are roughly equal in most countries, with a marginally higher incidence of deprivation in Nepal and Pakistan, but no differences are statistically significant (Table 4).

18 Indicator definitions have data limitations in matching school start dates and child birth dates, which create errors of inclusion.

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 (%)		Gender ratio	Boys/girls under 5 years of age who are MPI poor and nutritionally deprived (%)		Gender ratio
	Boys	*Girls*	*Boys/Girls*	*Boys*	*Girls*	*Boys/Girls*
Afghanistan	24.9**	44.0**	111	-	-	-
Bangladesh	12.1**	7.2**	103	30.6	31.0	108
Bhutan	8.7	7.8	95	24.2	24.3	102
India	6.1**	6.8**	108	27.6	27.8	109
Maldives	0.1	0.1	108	0.6	0.7	103
Nepal	3.1**	6.0**	105	25.5	27.0	110
Pakistan	19.7**	27.2**	99	26.6	27.8	103
South Asia	**9.0**	**10.7**	**106**	**27.7**	**28.1**	**108**
Number of children *(thousands)*	15,229	17,104		84,514	78,452	

Notes: ** Gender differences are statistically significant at 1%.

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

D. Intrahousehold Inequalities in Individual Indicators of Poor Individuals

Table 5 depicts intrahousehold patterns, using the harmonized database for the global MPI which has the household of each child. Considering both poor and non-poor children, a striking 22.9% of children aged 0–4 in South Asia live in a household riven by intrahousehold inequality in nutrition (Columns 5+6) – in which at least one child is nutritionally deprived and one child is not. Over 60% of these, 14.1% of eligible children, live in a poor household with intrahousehold inequality. This inequality is by far the highest in Pakistan, where over one-fifth of children live in a poor household with intrahousehold inequality in child nutrition, followed by India, at 13.1% of children.

Overall, 11.2% of school-age children live in an MPI-poor household with intrahousehold inequality in school attendance, meaning that at least one school-age child is attending school, but at least one other school-age child is not. Table 5 shows there are either similar populations of boys and girls in households with inequality, or more boys.[19]

Intrahousehold inequalities are by far the highest in Afghanistan and Pakistan, followed by Bangladesh. As intrahousehold inequality in both indicators is high in Pakistan, where over one-fifth of children (9.9 million for schooling; 5.9 million for nutrition) live in a poor household with intrahousehold inequality, we further investigated the gender patterns. Among poor children, 32% of boys (1.7 million) and 58% of girls (2.7 million) have intrahousehold inequality in schooling and are themselves out of school, and the differences are statistically

19 Gendered analysis will also be shaped by the share of households with children of both genders, which is very data demanding, hence further demographic analysis should accompany this analysis.

significant. For nutrition, 46.8% of eligible boys (1.4 million) and 47.6% of girls (1.4 million) are nutritionally deprived and there is no significant difference. Turning to non-poor children who experience intrahousehold inequality in schooling, 34.9% of boys (417,000) and 37.3% of girls (440,000) are out of school and the differences are not statistically significant. Among the non-poor children who experience intrahousehold inequality in nutrition, 46.8% of boys (792,000) and 38.5% of girls (556,000) are nutritionally deprived, but there is no statistically significant difference. Hence we find no significant gender disparity among non-poor children.

Thus, among poor children living in households with intrahousehold inequality there is a large disparity in school attendance for girls, suggesting boy-children are preferentially sent to school. while in nutrition there is gender parity. Sample permitting, gendered patterns of intrahousehold inequality should regularly be explored this way, alongside further demographic analysis.

Table 5. Percentage of children experiencing intrahousehold equality or inequality and poverty in South Asia

	The only eligible child is deprived		**All eligible children are deprived**		**Eligible children with intrahousehold inequality**		**The only eligible child is not deprived**		**All eligible children are non-deprived**	
	Non-Poor	*Poor*	*Non-poor*	*Poor*	*Non-poor*	*Poor*	*Non-poor*	*Poor*	*Non-poor*	*Poor*
Nutritionally deprived (cells show percentage of children 0–4 in each category)										
Bangladesh	6.3	21.2	1.0	5.2	3.3	**8.7**	29.3	13.0	8.6	3.3
Bhutan	6.6	14.7	0.7	4.4	4.2	**10.5**	29.5	11.3	12.4	5.7
India	8.5	11.6	3.8	9.4	8.7	**13.1**	22.6	5.7	12.6	3.9
Maldives	8.4	0.4	2.4	0.0	15.7	**0.4**	42.9	0.1	29.5	0.1
Nepal	6.9	13.3	1.9	7.1	5.9	**11.5**	28.3	9.6	10.3	5.2
Pakistan	4.2	7.3	2.7	9.5	11.7	**22.0**	13.4	4.5	19.6	5.2
Boys	4.1	7.2	3.0	9.2	12.4	**21.9**	14.0	4.3	17.9	6.0
Girls	4.3	7.5	2.4	9.8	10.9	**22.0**	12.8	4.7	21.3	4.4
South Asia	**7.5**	**11.9**	**3.3**	**9.0**	**8.6**	**14.1**	**21.9**	**6.3**	**13.3**	**4.1**
Out of school (cells show percentage of school-aged children in each category)										
Afghanistan	0.4	2.7	0.6	15.8	7.3	**34.3**	3.2	1.4	27.7	6.6
Bangladesh	0.8	2.4	0.3	1.8	1.4	**12.7**	20.6	11.6	28.8	19.6
Bhutan	0.7	2.9	0.1	1.2	2.7	**9.9**	16.2	7.1	40.6	18.6
India	0.3	1.3	0.1	1.8	1.4	**8.1**	19.3	5.7	45.8	16.2
Maldives	0.2	0.0	0.0	0.0	1.6	**0.3**	35.1	0.2	62.3	0.3
Nepal	0.3	0.8	0.0	0.9	0.6	**7.0**	19.0	8.2	40.4	22.8
Pakistan	0.4	2.1	0.5	11.4	5.4	**22.4**	7.9	1.8	39.4	8.8
Boys	0.3	1.8	0.5	10.4	5.4	**23.5**	7.5	2.3	38.7	9.6
Girls	0.5	2.5	0.6	12.3	5.3	**21.3**	8.2	**1.2**	40.2	8.0
South Asia	**0.3**	**1.6**	**0.2**	**3.5**	**2.1**	**11.2**	**17.5**	**5.7**	**42.6**	**15.4**

Note: Rows sum horizontally to 100% of the population of eligible children.

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

E. Complex Categories: Pioneer Children

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 the pioneer child(ren)), although none of the adult members (people aged 18 and above) have completed six years of schooling.[20]

Focusing first on individual 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 shows that of those 436 million people, 135 million – just under one-third – live with a pioneer child. 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 number: there are more pioneer children than out-of-school children in South Asia.

Of these, 10.6 million (28.4% of all pioneer children) live in an MPI-poor household. 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 people has a pioneer child in their household.

A gendered analysis reveals the important finding that roughly half of all pioneer children are girls. Overall, in South Asia, 12.8% of boys are pioneer children (18.8 million) and 13.3% of girls (18.7 million). 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.[21]

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

Table A1 in the Appendix. presents more information on pioneer children related to households, with all possible combinations of information on adults and children that do and do not have six years of schooling. The level of incidence (or MPI, intensity below) among households with a pioneer child ranges from 0.6% in Maldives to 48.9% in Afghanistan. In every country except India, households with pioneer children have lower incidence and MPI than the national average; in India, pioneer children are poorer on average. Both categories that demonstrate a deprivation

20 From 2020 the global MPI has used country-specific lower bounds for new datasets, because normally 10-year-old children would not have completed six years of schooling, so the percentage of eligible children who are pioneers is a lower bound in this study as the population of eligible children is probably smaller.

21 'Pioneer' refers only to the first-generation nature of these children's education within their household.

in six years of schooling have far higher MPI and incidence than the national average. The two least-poor groups in every country except Maldives are those in which either at least one adult and one child has six years of schooling, or there are no eligible children and at least one adult is educated.

Due to sample size limitations, it is not useful to explore the indicator composition of the MPI by these categories. Thus, to investigate the contributions to poverty we compare three groups of poor people: pioneer children, and those who are deprived or non-deprived in years of schooling due, at least in part, to adult attainments.

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

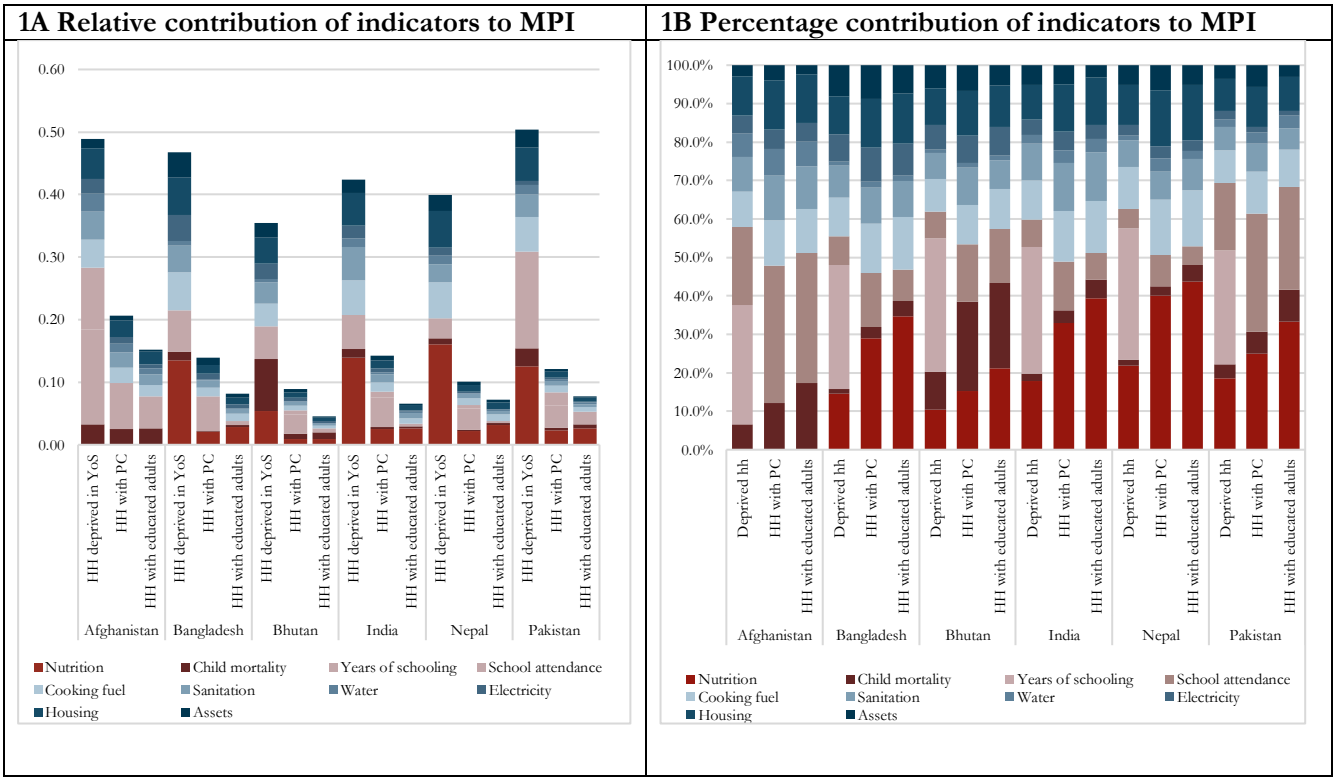
Country	**Percentage of pioneer children among all children (10–17)**	**Total number of pioneer children (*thousands)***	**Percentage of pioneer children who are MPI poor**	**Percentage of pioneer boys/girls among all boys/girls (10–17)**		**Percentage of pioneer children living with at least one other child aged 10–17 who has not completed six years of schooling and is out of school**		**Percentage of the population who are not deprived in years of schooling due to pioneer children**	**Number of people who are not deprived in years of schooling due to pioneer children (*thousands)***
				Boys	*Girls*	*Non-poor*	*Poor*		
Afghanistan	7.1	519	42.0	9.3***	4.7***	8.1	23.4	9.0	3,127
Bangladesh	14.4	4,284	27.8	12.8***	16.0***	3.8	6.3	10.5	17,032
Bhutan	13.3	19	16.8	13.8	12.9	4.4	4.4	10.5	84
India	14.2	29,741	28.9	13.9	14.4***	2.8***	4.3	7.7	101,488
Maldives	5.0	2.9	0.4	5.2	4.7	1.5	0.0	2.2	9.3
Nepal	20.6	1,122	23.4	18.7***	22.4***	2.2	2.6	13.0	3,778
Pakistan	5.1	1,788	19.6	5.7	4.6	21.5	12.7	4.7	9,155
South Asia	**13.0**	**37,476**	**28.4**	**12.8**	**13.3**	**3.8**	**5.1**	**7.7**	**134,673**

F. Composition of the MPI for Deprived and Non-deprived Children

Analysis of the indicator composition of poverty should be a standard part of all gendered and intrahousehold analyses; an illustration is given for pioneer children here, and similar results should be studied for households with and without nutritionally deprived children (and/or adults), and with and without school-aged children who are/are not attending school.

Figure 1A presents the absolute contribution of MPI by indicator, and Figure 1B presents the percentage contribution of each indicator for households with pioneer children, and those deprived and non-deprived in the years of schooling indicator. The height of the bar in 1A is the MPI level, so the level of MPI is strikingly higher among the population that is deprived in years of schooling, compared to households with pioneer children or with educated adults (and, perhaps, educated children as well).

Figure 1. Absolute and percentage contribution of indicators to MPI for poor people with pioneer child, and with/without six years of schooling



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

A clear pattern can be seen if we compare the censored headcount ratios for all indicators for three types of households: deprived in years of schooling; with pioneer children; and where at least one adult has minimum years of schooling.[22] Except for child mortality, households with education deprivations are significantly poorer than the households with pioneers or educated adults (and perhaps, children) in every indicator in every country (Table 7). This is a striking finding, and shows that the households with pioneer children are significantly different from

22 Maldives is omitted from this figure due to having a small number of observations.

households with no one who has completed six years of schooling. They are similar to households with educated adults – but slightly poorer. In Afghanistan and India, households with educated adults have significantly lower censored headcount ratios in every indicator than households with pioneer children. In contrast, in Nepal and Pakistan, there is no significant difference between deprivations in censored headcount ratios for both household types across health and education indicators, electricity and sanitation (plus water, in Pakistan).

Table 7. Significant differences in censored headcount ratios between households with pioneer children, those deprived in schooling, and those non-deprived in schooling due to adults.

	Afghanistan			**Bangladesh**			**Bhutan**			**India**			**Nepal**			**Pakistan**		
	PC vs Dep	Non vs Dep	PC vs Non	PC vs Dep	Non vs Dep	PC vs Non	PC vs Dep	Non vs Dep	PC vs Non	PC vs Dep	Non vs Dep	PC vs Non	PC vs Dep	Non vs Dep	PC vs Non	PC vs Dep	Non vs Dep	PC vs Non
Child mortality	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	0
Nutrition	.	.	.	1	1	1	1	1	0	1	1	1	1	1	0	1	1	0
School attendance	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0
Electricity	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0
Sanitation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0
Water	1	1	1	1	1	0	1	1	0	1	1	1	0	1	1	1	1	0
Housing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cooking fuel	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Assets	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Notes: 0 indicates no significant difference at 95% and 1 indicates significant difference. PC = pioneer children; Dep = deprived in years of schooling; Non = non-deprived in years of schooling due to adult attainment (at least in part).

Source: Authors' computations based on surveys in Table 1.

The intriguing findings of pioneer children could be a springboard for further investigation, including 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 intergenerational mobility.

G. Relationship of the MPI and Consumption-based Poverty with Out-of-school Children and Pioneer Children – Example from Pakistan

A natural question is whether and how these kinds of analyses might apply to monetary poverty. When income data are individual indicators, with information from all contributing household members, as well as their actual and desired percentage of working time, it would be possible to explore gendered and intrahousehold patterns of monetary poverty. Similarly, when consumption data (for example, on food items) are present for each household member, a parallel analysis could be applied (Oldiges, 2017). Even in the absence of such data, useful intrahousehold and gendered analyses pertaining to children can usually be implemented. Nearly all household surveys used to generate monetary poverty have variables on completed years of schooling and school attendance (World Bank, 2018). These are the same variables used to construct the out-of-school and pioneer child assessments presented here. Furthermore, those data also have information on the monetary poverty status of each household. It is elementary and useful to explore parallel patterns among monetary as well as multidimensionally poor and non-poor children.

To explore the relationship of child schooling with the MPI and a consumption-based poverty measure, we compare the results of out-of-school and pioneer children for Pakistan with their poverty status computed from the CBN poverty measure and the MPI. Table 8 presents the results.

Table 8. Out-of-school and pioneer children based on CBN and MPI in Pakistan

		Pakistan DHS 2017/18	**HIES 2018/19**
MPI (DHS) or monetary poverty (HIES) headcount ratio (incidence)		38.3	21.9
School-age children not attending school (%)		26.3	26.2
Percentage of the population living with a child who is not attending school		28.5	28.9
School-age children who are MPI/monetary poor and not attending school (%)		23.4	12.5
Share of school-age children not attending school who live in MPI/monetary-poor households (%)		89.2	47.7
School-age boys/girls who are poor and not attending school (%)	Boys	19.7**	10.5**
	Girls	27.2**	14.7**
School-age boys/girls who are non-poor and not attending school (%)	Boys	2.6	11.4**
	Girls	3.0	16.1**
The only school-age child in the household is out of school	Non-poor	0.4	2.3
	Poor	2.1	0.8
All school-age children in the household are out of school	Non-poor	0.5	4.4
	Poor	11.4	6.2
All school-age children in the household are out of school, irrespective of number of children and household poverty status (sum of above four rows)		**14.4**	**13.7**
School-age children experience intrahousehold inequality	Non-poor	5.4	17.1
	Poor	22.4	**12.0**
All school-age children show intrahousehold inequality, irrespective of household poverty status (sum of above two rows)		**27.8**	**29.1**
The only school-age child goes to school	Non-poor	7.9	9.8
	Poor	1.8	1.0
All school-age children go to school	Non-poor	39.4	38.8
	Poor	8.8	7.7
All children go to school, irrespective of number of children and household poverty status (sum of above four rows)		**57.9**	**57.3**
Percentage of pioneer children among all children (10–17)		5.1	7.1
Percentage of pioneer children who are MPI or monetary poor		19.6	18.7
Percentage of pioneer boys/girls among all boys/girls (10–17)	Boys	5.7	8.5
	Girls	4.6	5.6
Percentage of pioneer children living with at least one other child aged 10–17 who has not completed six years of schooling and is out of school	Non-poor	21.5	22.1
	Poor	12.7	7.9
Percentage of the population who are not deprived in years of schooling due to pioneer children		4.7	6.5

Note: ** gender difference is significant at 99%.

Source: Authors' computations from HIES 2018/19 and Pakistan DHS 2017/18 surveys.

Using the CBN approach, the incidence of monetary poverty for Pakistan was 21.9% (Government of Pakistan, 2021), while according to the global MPI definition, the incidence of MPI was 38.3%. The household-level distribution of out-of-school children is quite similar according to both surveys, as are the percentages of out-of-school children (see bold figures in Table 8). The percentage of pioneer children among children (10–17) is slightly higher in the HIES (7.1% from HIES 2018/19, compared to 5.1% from Pakistan DHS 2017/18). Similarly, in both datasets 28 to 29% of out-of-school children experience intrahousehold inequalities, and over 30% of pioneer children share their household with an out-of-school child, so both datasets provide congruent raw information. As expected, there are differences in the estimates among the poor children because the incidence of monetary poverty (21.9%) is over 16 points lower than that of the MPI (38.3%).

However, the monetary comparisons do not always duplicate the MPI results. For example, 21.9% of people are monetary poor and 26.2% of children are out of school, so it would be possible for 89% of out-of-school children to be in monetary-poor households – as they are in the case of multidimensional poverty. In fact, fewer than half (12.5%) of out-of-school children live in monetary-poor households. This contrasts with pioneer children, where a similar percentage are MPI and monetary poor. Implementing such measured rather than modelled analyses serves to triangulate across datasets and identify comparisons that merit further exploration across other datasets.

H. An Integrated Child Analysis

According to the surveys analyzed, there are roughly 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 nutritionally deprived 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 nutritionally deprived 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, using household-level information to reflect on the differing conditions of children of different ages, is rarely presented but potentially very powerful. It is also deeply affected by differences in household size and compositions, as many households do not have a child in each age category, but accompanied by additional demographic analysis, these results could be a springboard for other studies.

Table 9. Levels of deprivation in the school attendance and nutrition indicators in South Asia, and overlap with pioneer children, by household (thousands)

Household has:	**Bangladesh**	**Bhutan**	**India**	**Maldives**	**Nepal**	**Pakistan**	**South Asia**
Nutritionally deprived child(ren) only	32,908	138	256,392	54	5,745	67,853	**363,091**
Out-of-school child(ren) only	18,222	86	84,416	5.6	1,591	54,966	**159,287**
Pioneer child(ren) only	17,032	84	101,488	9.4	3,778	9,196	**131,588**

Nutritionally deprived plus out-of-school child(ren)	4,787	21	27,301	0.4	466	30,410	**62,985**
Out-of-school child(ren) plus pioneer child(ren)	2,484	9.2	13,305	0.4	239	3,014	**19,052**
Nutritionally deprived plus pioneer child(ren)	2,425	11	13,025	0.4	439	2,396	**18,297**
All three	573	2.2	2,804	-	22.8	1,101	**4,504**

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

A total of 759 million South Asians share their household with a child in one or more of the three conditions studied. Most of these – 363 million – only have a nutritionally deprived child at home (Table 9); 159 million only have an out-of-school child and nearly 132 million only have a pioneer child. So, 86% of the people living in households with one of these conditions, do not experience either of the others. However, 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 0–4) is nutritionally deprived. Most of these people live in Pakistan (30.4 million) and India (27.3 million). The incongruity of a household that has a pioneer child – a sign of hope – and deprived child is also evident. India has 13.3 million people who live with a pioneer child and an out-of-school child, and another 13 million who live with a pioneer child and a nutritionally deprived child. Across South Asia, 4.5 million people have the striking incongruity of experiencing all three conditions in their household at the same time. In the case of years of schooling and nutrition, the global MPI draws on both child and adult data where available. By restricting deprivations to children, and studying the overlaps, an integrated analysis enables identification of households with different child deprivation profiles. Naturally, this line of enquiry on children's home environments needs to be accompanied by a close analysis of demographics, household composition, and trends across time.

5. Concluding Remarks

This paper presents a general methodology by which the information platform of consistent sub-and partial-indices accompanying a MPI that uses the household as the unit of identification can be extended through gendered and intrahousehold analysis of individual (in this case, child) deprivations using individual indicators. It narrows the widely recognized gap between household and individual poverty measures, by outlining a methodology that can – and when the data are appropriate and high quality, should – be mainstreamed in the analyses of poverty indices that use households as their unit of identification.

Methodologically, we define the individual nested within the household, and define the eligible individuals for any indicator, in order to establish a framework to analyze six poverty, gendered and intrahousehold relationships using data on individual deprivations. Using the global MPI in South Asia, we illustrate the methodology using three indicators that pertain to different stages of childhood – school attendance, nutrition, and completed years of schooling – and provide examples of topics that could be further studied. We find, for example, that 88% of out-of-school children are multidimensionally poor, compared to 65% of nutritionally deprived children under 5 years of age, so the proportion of deprived children who are poor varies. While there is no significant difference between boys and girls at the regional level in either school attendance or nutrition, and none by any country for nutrition, individual countries do show gender disparity in school attendance – with a higher percentage of girls out of school than boys in Afghanistan, Pakistan, Nepal, and India, but significantly more girls in school in Bangladesh. Overall, 11.2% of school-age children are poor and experience intrahousehold inequalities in school attendance – where one child is out of school but another attends school – and 14.1% experience intrahousehold inequalities in nutrition.

Taking the analysis to the next step in the case of Pakistan, we find significant gender disparity, with more girls than boys not attending school in these households; whereas there is no significant gender disparity for nutrition. We also study pioneer children, who are the first generation to have completed six years of schooling in the household. While one-quarter of households in South Asia (436 million people) live in households in which no adults have completed six years of schooling, 135 million of these have a first-generation pioneer child who has completed six years of schooling. One in eight children (37.5 million) are pioneer children in South Asia – more than the number of out-of-school children (32.3 million) – and half of all pioneer children are girls. Finally, we explore the indicator composition of poverty – illustrated for pioneer children – and find that households with pioneer child have significantly lower censored headcount ratios in every indicator except child mortality, in every country with one exception only (water, for Nepal). This is a springboard for further study.

We then compare the poverty status, gender, and intrahousehold patterns of out-of-school children and pioneer children in relation to the CBN monetary poverty measure alongside the MPI, and find sometimes converging and sometimes diverging results. For example, less than half of out-of-school children live in monetary-poor households – while this is 88% of such children living in multidimensionally poor households. This demonstrates the value-added of undertaking parallel analyses using readily available education data in income and expenditure surveys, as well as of triangulating different datasets and definitions of poverty.

The methodology narrows the gap between household and individual poverty measures by augmenting household poverty measures with consistent gendered and intrahousehold analyses. To our knowledge this is the first such systematic exposition of this methodology.

Naturally research questions arise from such a study. Methodologically, many additional relationships can be estimated using the broad framework. Studies of demographic changes and household composition are also essential complements to deepen this analysis. Empirically, while this South Asia focus on child indicators could be extended globally, applications should also be extended to gendered analysis among adults and other groups of interest. Similarly, a deprivation density measure for multi-individual households should be constructed, to bring into view 'intrahousehold monotonicity' – when some deprivations of household members are reduced, but not enough for that household to be considered non-deprived in, for example, schooling or nutrition.

Analysis of the relationships uncovered can be extended to study the determinants of deprivations and of pioneer children – individuals nested within their respective households – using multilevel models, especially hierarchical statistical models to extract unbiased and reliable results. Multiple models should be explored and compared (Woodhouse and Goldstein, 1988). Multilevel modelling enables analysts to probe where and how the effects are translated, so is a natural next step (Nuttall et al., 1989).

Empirically, all the analysis presented here can also be used to track changes over time. Further analysis, such as disaggregation by additional variables (ethnicity, subnational region) or household characteristics could uncover additional policy salient information, data permitting. Naturally the accurate interpretation of intertemporal trends 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.

The measurement methodology proposed and implemented in this paper fills a significant gap in the literature, using readily available data to illuminate both the joint distribution of deprivations across household members as well as across households in a society.

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Appendix Table A1.

Incidence of poverty H

		Afghanistan	Bangladesh	Bhutan	India	Maldives	Nepal	Pakistan
Intergenerational progress	HH with a PC: Only child(ren) have six YOS	48.9%	32.8%	20.8%	34.6%	0.6%	26.8%	28.3%
	Only adult(s) have six YOS, not child(ren)	52.7%	24.5%	19.6%	26.6%	0.6%	23.5%	34.8%
Adults and children are same	Both adult(s) and child(ren) have six YOS	33.5%	17.5%	9.6%	17.2%	1.1%	20.7%	14.0%
	Both adult(s) and child(ren) don't have six YOS	93.6%	92.1%	76.8%	89.7%	9.1%	86.2%	93.4%
No children	Adult(s) with six YOS -- no child in the HH	17.5%	20.9%	7.2%	14.7%	0.3%	16.7%	11.4%
	Adult(s) without six YOS -- no child in the HH	85.1%	87.4%	70.3%	80.2%	2.1%	78.1%	81.9%
	National total	**56.1%**	**41.1%**	**37.3%**	**27.5%**	**0.8%**	**35.3%**	**38.3%**

MPI

		Afghanistan	Bangladesh	Bhutan	India	Maldives	Nepal	Pakistan
Intergenerational progress	HH with a PC: Only child(ren) have six YOS	0.207	0.139	0.089	0.142	0.002	0.101	0.121
	Only adult(s) have six YOS, not child(ren)	0.223	0.102	0.082	0.109	0.002	0.093	0.155
Adults and children are same	Both adult(s) and child(ren) have six YOS	0.140	0.069	0.039	0.067	0.004	0.076	0.060
	Both adult(s) and child(ren) don't have six YOS	0.530	0.493	0.387	0.484	0.030	0.441	0.539
No children	Adult(s) with six YOS -- no child in the HH	0.078	0.081	0.029	0.056	0.001	0.060	0.047
	Adult(s) without six YOS -- no child in the HH	0.404	0.433	0.322	0.384	0.007	0.363	0.444
	National total	**0.273**	**0.194**	**0.175**	**0.121**	**0.003**	**0.154**	**0.198**

Intensity A

		Afghanistan	Bangladesh	Bhutan	India	Maldives	Nepal	Pakistan
Intergenerational progress	HH with a PC: Only child(ren) have six YOS	42.3%	42.4%	42.8%	41.0%	33.3%	37.7%	42.8%
	Only adult(s) have six YOS, not child(ren)	42.3%	41.6%	42.0%	41.0%	37.2%	39.4%	44.4%
Adults and children are same	Both adult(s) and child(ren) have six YOS	41.7%	39.2%	40.5%	38.6%	33.3%	36.9%	42.7%
	Both adult(s) and child(ren) don't have six YOS	56.6%	53.5%	50.4%	54.0%	33.3%	51.1%	57.6%
No children	Adult(s) with six YOS -- no child in the HH	44.8%	38.9%	40.1%	38.0%	37.1%	35.9%	40.7%
	Adult(s) without six YOS -- no child in the HH	47.5%	49.5%	45.7%	47.9%	35.1%	46.5%	54.2%
	National total	**48.7%**	**47.3%**	**46.8%**	**43.9%**	**34.4%**	**43.6%**	**51.7%**

Notes: PC = pioneer child; YOS = years of schooling; HH = household.

Appendix Table A2

Population and MPI estimates and Child Disaggregation for South Asian Countries

Country	Year	Population (2016)	Headcount ratio of MPI (H)	Intensity (A)	MPI	MPI of children 0-17	Headcount ratio of children 0-17 (H)	Intensity of children 0-17 (A)	Share of children 0-17 in the population	Number of MPI poor children 0-17 (*thousands*)	Share of South Asian MPI poor children living in each country
Afghanistan	**2015/16**	34,656,032	56.1%	48.7%	0.273	0.291	59.2%	49.1%	53.7%	11,012	4.6%
Bangladesh	**2014**	162,951,560	41.1%	47.3%	0.194	0.226	46.3%	48.7%	39.6%	29,822	12.4%
Bhutan	**2010**	797,765	37.3%	46.8%	0.175	0.19	39.4%	48.1%	38.5%	121	0.1%
India	**2015/16**	1,324,171,354	27.5%	43.9%	0.121	0.157	34.6%	45.3%	34.0%	155,874	64.7%
Maldives	**2016/17**	428,756	0.8%	34.4%	0.003	0.003	0.9%	34.2%	35.2%	1	0.0%
Nepal	**2016**	28,982,771	35.3%	43.6%	0.154	0.178	39.9%	44.5%	40.5%	4,681	1.9%
Pakistan	**2017/18**	193,203,476	38.3%	51.7%	0.198	0.238	44.8%	53.0%	45.4%	39,275	16.3%
Total		**1,745,191,714**	**30.7%**	**45.6%**	**0.140**	**0.180**	**38.0%**	**47.3%**	**36.3%**	**240,787**	**100%**