The Basics of the Cross-Country Multiple Overlapping Deprivation Analysis (MODA)

MODA In Brief 1

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The MODA methodology has been developed by UNICEF to define and measure child poverty both at a national and international level, taking into consideration the complex, multifaceted realities of poverty children experience at different stages of their lives. The Cross-Country Multiple Deprivation Overlapping Deprivation Analysis (CC-MODA) is a specific application of the general MODA methodology, designed as a child poverty measure to analyse multidimensional child deprivation in low- and middle-income countries. The dimensions, indicators and thresholds defining deprivation are standardised to be comparable across countries. This brief describes the basics of the CC-MODA and its methodology; it highlights its main characteristics and illustrates the type of results which can be obtained from this type of analysis. This brief does not go into the actual results emerging from the CC-MODA analysis or of the CC-MODA study on 30 sub-Saharan African countries (de Milliano & Plavgo, 2014), but rather serves as a guide to how the findings were calculated and how to approach these findings.

Measuring child poverty
The MODA methodology builds on existing multidimensional poverty research¹ and seeks to combine various elements into a holistic approach to child poverty and deprivation analysis. As a starting point, the MODA methodology differentiates between various concepts of poverty, setting income or monetary poverty apart from multidimensional deprivation. The methodology adopts a child rights approach concentrating mainly on children’s access to the goods and services crucial for their survival and development, and thus distinguishing this from whether there are sufficient means in the household to obtain these basics. MODA encourages using both concepts of poverty as complementary poverty measures, with the monetary poverty measurement concentrating on the average financial means available to the households where children live, and the deprivation measurement determining whether children’s basic needs are satisfied. Measuring both types of poverty simultaneously for each child allows identifying the different groups of children that may require different policy responses depending on what type of poverty they experience.²

MODA acknowledges the fact that children experience poverty differently to adults due to changing needs at various stages in children’s lives (e.g., the relative importance of nutrition and vaccinations in the first 1,000 days; the importance of education as children grow older). The MODA method uses the child as unit of analysis and seeks to include individual-level indicators whenever possible so that differences between children of the same age and children in the same household may be captured. Generally, indicators are only adopted if they are relevant for children, as opposed to indicators which have relevance to the well-being of other household members. Indicators measured at a household level, such as the quality of

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¹ See for instance the Multidimensional Poverty Index (Alkire & Santos, 2011) and UNICEF’s Global study on Child Poverty and Disparities (Gordon et al. 2003; UNICEF, 2007).

² This type of analysis is possible when the information on deprivations and monetary poverty comes from the same dataset, as the two measures need to be applied at an individual child level to study overlap. See for instance EU-MODA (Chzhen et al, 2014), Mali (de Milliano and Handa, 2014), and Madagascar (Plavgo, forthcoming).
water and sanitation, are included if they can directly affect children’s well-being. Besides, MODA adopts a life-cycle approach, selecting indicators that are relevant for each child depending on his or her age, capturing the needs of each individual depending on their stage in life. A multidimensional approach to child poverty can be used, capturing the multiple aspects of children’s well-being simultaneously and looking at child poverty through a lens of overlapping deprivations. Addressing deprivations through vertical, sector-based approaches has led to considerable advances in terms of identifying the deprived children by sector and improving access to particular goods and services. Addressing deprivations through a horizontal, multidimensional approach brings deprivations down to the level of the child, helping to understand how severely children are deprived and which deprivations they experience simultaneously (see Figure 1). Going across sectors places the child at the centre of the analysis and helps to identify the most vulnerable children with higher numbers of deprivations. Besides, the analysis of the overlap between various dimensional deprivations reveals possible feedback loops and interactions between the various sectors. MODA generates profiles based on geographical and socio-economic characteristics of the multiply deprived, allowing for better targeted, more effective policy responses and interventions.

**Cross-Country Multiple Overlapping Deprivation Analysis (CC-MODA)**

As part of UNICEF’s global research efforts the MODA methodology has been applied to low- and middle-income countries, using datasets from Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS) carried out during the period 2008-2013. The Cross-Country MODA (CC-MODA) methodology has been standardised across these countries, and the results are therefore comparable. This Brief presents the results of CC-MODA analysis to illustrate the MODA methodology.

The CC-MODA follows internationally accepted standards as guiding principles for the construction of a core set of dimensions, indicators and thresholds that are essential to any child’s development irrespective of their country of residence, socio-economic status, or culture. Decisions have further been made in accordance with sector-specialists. CC-MODA uses DHS and MICS survey data for the relative richness of information on child deprivations as well as to ensure international comparability of the data. Eight different deprivation dimensions have been selected, three of which – water, sanitation, and housing – are always available for all children regardless of their age-group. Nutrition and health are age-specific for infants and children in early childhood (below the age of 5), while education and information are used for children of school age and adolescence (5 to 17 years). For both age-groups, the inclusion of ‘Protection from violence’ depends on data availability. Figure 2 shows the dimensions and indicators selected for each age-group in CC-MODA.

**Figure 2: Life-cycle stages, dimensions and indicators used for the CC-MODA analysis**

![Figure 2 - Life-cycle stages, dimensions and indicators used for the CC-MODA analysis](image)

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3 See an overview of all CC-MODA analyses at the end of this Brief, or see the MODA web portal: www.unicef-irc.org/MODA.

4 Other MODA applications are national-specific analyses (N-MODA) using national datasets and based on country-specific decisions on indicators, dimensions and thresholds (see for instance de Milliano and Handa, 2014; Plavgo, forthcoming) and EU-MODA as a regional analysis for the countries of the European Union (Chzhen & de Neubourg, 2014). Besides the differences in the selected indicators and dimensions, these applications differ in their selection and working process: CC-MODA and EU-MODA follow a predetermined framework, while N-MODA has a tailor-made approach where decisions are usually made in concurrence with national stakeholders.

5 A more detailed description of the indicators and thresholds can be found in the ‘CC-MODA Technical Note’ – Table 3, p. 15.
Each of the dimensions is composed of one or two indicators, identifying a child as deprived with regards to a given dimension if at least one of the indicators shows a deprivation. For example, a child is deprived in nutrition if he or she is wasted, has received inadequate (breast) feeding or both. This method is used because a deprivation in any chosen indicator already signifies inadequate access to the goods or services captured in the dimension. It should be noted that MODA complements sector-based approaches by showing the joint experience of deprivations, and thus does not go into great detail into analysing each dimension separately.

In order to identify children as multidimensionally deprived, the dimensional deprivations \( j \) are counted for each child \( i \) reflecting the total number of dimensions (\( D \)) each child is deprived in. No weights are applied to the dimensions, meaning that implicitly each dimension receives the same value. Table 1 shows an example, in which the deprivation status (deprived=1, not deprived=0) in each dimension \( j \) of a child \( i \) is given for four child observations \( i_1, i_2, i_3, i_4 \). A child is identified as multidimensionally deprived if he or she is deprived in an equal or a higher number of dimensions than the specified cut-off point, \( k \). The multidimensional deprivation status, \( y_k \), and the number of deprivations experienced by the multidimensionally deprived, \( c_k \), are used to calculate the multidimensional deprivation ratios, i.e. the multidimensional deprivation headcount rate (\( H \)), the average deprivation intensity (\( A \)) and the adjusted multidimensional deprivation headcount rate (\( M \)).

**Table 1: Matrix and formulas for multidimensional deprivation indices**

<table>
<thead>
<tr>
<th>( j_1 )</th>
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<th>( j_4 )</th>
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\( q_k = \sum y_k \)

\( \sum c_k \)

\( H = \frac{q_k}{n} \)

\( A = \frac{\sum y_k c_k}{q_k \times d} \)

\( A \) in numbers: \( A \times d \)

\( M = \frac{\sum c_k}{n+d} \)

\( n \) - Total number of children

\( d \) - Total number of dimensions considered per child

\( D_i \) – Total number of dimensions each child \( i \) is deprived in

\( k \) – a cut-off point – a number of deprivations starting from which a child is considered as multidimensionally deprived

\( y_i \) - Deprivation status of a child \( i \) depending on the cut-off point \( k \). \( i = \text{poor} (D_i \geq k), 0 = \text{non-poor} (D_i < k) \)

\( q_k \) - Total number of multidimensionally deprived children affected by at least \( k \) deprivations. \( \sum y_i \)

\( c_k \) - Number of deprivations each multidimensionally deprived child \( i \) experiences. \( \sum y_k c_k \)

\( H \) - Multidimensional deprivation headcount ratio according to cut-off point \( k \). \( H = \frac{q_k}{n} \)

\( A \) - Average deprivation intensity according to the cut-off point \( k \). \( A = \frac{\sum y_k c_k}{q_k \times d} \)

\( M \) - Adjusted multidimensional deprivation headcount ratio among children with at least \( k \) deprivations. \( M = \frac{\sum y_k c_k}{n+d} = H \times A \)
CC-MODA results and interpretation

MODA analyses normally include a basic set of elements that are used in all types of MODA applications: a single deprivation analysis, and a multiple deprivation analysis, including the distribution of the number of deprivations children experience; deprivation overlap analysis; and multidimensional deprivation indices. In country-specific MODA studies these elements are usually accompanied by additional analysis such as monetary child poverty analysis; monetary poverty and deprivation overlap analysis; and deprivation determinants analysis.

This Brief highlights the core elements of the deprivation analysis by using examples presented in the paper on multidimensional child deprivation in 30 countries in sub-Saharan Africa (de Milliano & Plavgo, 2014). The paper uses the CC-MODA methodology and its results as a basis, but goes beyond these findings by calculating the deprivation for children across the selected 30 countries and by comparing multidimensional deprivation outcomes with countries’ economic performance in terms of GDP and monetary poverty levels. Additionally, in order to be telling about the experience of child deprivation across sub-Saharan Africa, predictions have been made for the region as a whole, including the countries unavailable in the study. These findings are discussed in more detail in other Briefs on CC-MODA.

Single deprivation analysis

The single deprivation analysis by indicator or dimension points at the deprivation levels of particular indicators or dimensions. Even though the analysis of single dimensions is not the focus of MODA, these results serve as a valuable starting point to understand which field should deserve particular attention, and which sectors contribute to the multidimensional deprivation findings. To provide some additional information, deprivation headcount rates of single dimensions are presented by individual and household background characteristics such as area, region, mother’s educational level etc. Figure 3 shows, for instance, that for children below the age of 5 in the 30 selected sub-Saharan African countries, sanitation and health are the most severe issues for children in rural areas, and protection from violence and nutrition in urban areas.

Deprivation count and distribution

The multidimensional deprivation analysis looks beyond single sectors, and captures the number of deprivations experienced by each child. CC-MODA initiates the multiple deprivation analysis with the distribution of the number of deprivations, presented at a national level or by a given background characteristic. The distribution is used to give an insight into the depth of deprivation. As illustrated below in Figure 4, when the distribution has a peak on the left of the centre the average experience of multiple deprivations is lower than when the figure has a peak to the right. Knowing the proportion of children experiencing each given number of deprivations allows to distinguish various groups of children: not deprived; moderately deprived; or severely deprived. In Tanzania, about 1% of children below 5 years living in rural areas is not deprived, 54% are moderately deprived in 1 to 3 dimensions, and 44% are severely deprived experiencing 4 or 5 deprivations at the same time. The deprivation distribution is different in rural areas of Rwanda, where the majority of children below age five experience 0 to 2 deprivations.

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6 See Brief 2 on the results of the deprivation count and distribution across 30 countries in sub-Saharan Africa.
Deprivation overlap analysis

The number of deprivations experienced by children captures the severity of multidimensional deprivation, but does not explain which of the dimensional deprivations are most frequently experienced together with others. The overlap analysis helps to identify which deprivations are commonly associated with each other, and which deprivations are more often found as a unique problem, not overlapping with other deprivations. As an example, across 30 countries in sub-Saharan Africa the level of deprivation in nutrition is similar for rural and urban areas. The overlap analysis shows, however, that nutrition deprivation in urban areas is much more often a stand-alone issue, while in rural areas for the vast majority of children nutrition deprivation is experienced together with 2 to 4 other deprivations.

In addition, the results of the Venn-diagram show the overlap between particular dimensions. In this case, the findings of the deprivation in nutrition, as described above, are supported by the findings in the overlap analysis between nutrition, health and sanitation, where the spheres are more integrated in rural areas as compared to urban areas. In addition, the deprivation rates for sanitation and health are more than twice as high for rural areas as compared to urban areas, leading to only 7% of children in rural areas not being deprived in any of the three selected dimensions, while this is so only for 30% of children below the age of 5 in urban areas.

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7 See Brief 3 on the results of the deprivation overlap across 30 countries in sub-Saharan Africa.
As a third set of multiple deprivation results MODA uses multidimensional deprivation indices. Indices produce single figure results, which can be used for reporting purposes, comparisons or further analyses. The MODA methodology incorporates three types of indices. The first is the multidimensional deprivation headcount ratio (H) which measures the proportion of multidimensionally deprived children according to a given threshold or cut-off point. Figure 7 shows that 94% of children below the age of five in Ethiopia are multidimensionally deprived in at least 2 out of 5 dimensions (K=2).

The second index measures the average intensity of deprivation among the deprived (A), showing that, for example, the 94% of deprived children in Ethiopia have 74% of all possible deprivations in the country (which is equal to 3.7 deprivations per child on average). In other words, while Malawi and Mozambique have the same proportion of children multidimensionally deprived in at least 2 dimensions, the children in Malawi on average suffer from a lower number of deprivations. The third measure combines the aspects of incidence and breadth of deprivation into one number: the adjusted multidimensional deprivation headcount ratio, \( M_0 \). For this measure the deprivation headcount and average intensity are multiplied, leading to a rate between 0 and 1 (see Table 1 for the formula and calculation). The adjusted deprivation headcount ratio can be used for comparison of multidimensional deprivation between countries or regions, and the ratio can be decomposed to observe which dimensions have made the largest contribution to this overall deprivation rate.

**Figure 7: Multidimensional deprivation indices for children below the age of five**

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8 See Brief 4 on the results of the deprivation indices for 30 countries in sub-Saharan Africa.

9 See Brief 5 on the decomposition of the adjusted deprivation headcount for 30 countries in sub-Saharan Africa.
Concluding remarks

This Brief presents the multidimensional deprivation analysis of 30 sub-Saharan African countries to demonstrate the basics of the MODA methodology and the specifics of the Cross-Country study. MODA has been developed to create a holistic methodology for analysing child well-being. Since children have needs different to those of adults and have needs that are changing throughout their life-course, a multidimensional deprivation analysis adopting a life-cycle approach is fitting to assess their well-being. CC-MODA is an application of the MODA methodology distinctive for its standardised use of indicators, dimensions and thresholds through which cross-country comparison is enabled. The results of CC-MODA are presented on an interactive MODA web portal, and the findings of 30 countries are used as the basis for a study on multidimensional deprivation in sub-Saharan Africa (see de Milliano & Plavgo, 2014). The type of findings derived from the CC-MODA comprise of a set of elements which together seek to provide information on various aspects of multidimensional child deprivations. It captures the incidence of single as well as multiple deprivations; the breath of multidimensional deprivation; the joint experience of particular dimensional deprivations; and it decomposes multidimensional deprivation to highlight what the main contributors are to the overall multidimensional deprivation experienced by children in a given country or context.

LIST OF COUNTRIES FOR WHICH CC-MODA IS AVAILABLE AT THE MODA WEB PORTAL

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Sources
MODA web portal:
www.unicefirc.org/MODA

CC-MODA Technical Note:

CC-MODA results of sub-Saharan Africa:

MODA guidelines:

Background on MODA and multidimensional poverty analysis:

References

Briefs Related to CC-MODA:
- Brief 1: The Basics of the Cross-Country Multiple Overlapping Deprivation Analysis (MODA)
- Brief 2: Distribution of Deprivations among Children in Sub-Saharan Africa
- Brief 3: Overlap Analysis of Deprivations in Sub-Saharan Africa
- Brief 4: Cross-Country Comparison of Multidimensional Child Deprivation Incidence and Intensity in Sub-Saharan Africa
- Brief 5: Composition of Multidimensional Child Deprivation in Sub-Saharan Africa by Dimension
- Brief 6: Multidimensional Child Deprivation in Sub-Saharan Africa
- Brief 7: Multidimensional Child Deprivation and Monetary Poverty in Sub-Saharan Africa