



A methodological note on the global Multidimensional Poverty Index (MPI) 2022 changes over time results for 84 countries

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Attribution

The levels and changes over time estimates of the global Multidimensional Poverty Index (MPI) are produced by Sabina Alkire, Usha Kanagaratnam and Nicolai Suppa using 205 harmonised survey datasets. The harmonised level and changes over time results – covering country, age groups, rural and urban areas, and subnational regions – are published in OPHI's [Table 6](#). This updates the 2021 version of Table 6 by the same authors.

This work builds on the 80 country study of changes over two points in time research project by Sabina Alkire, Fanni Kovesdi, Corinne Mitchell, Monica Pinilla-Roncancio, and Sophie Scharlin-Pettee published in 2020.

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1. Overview

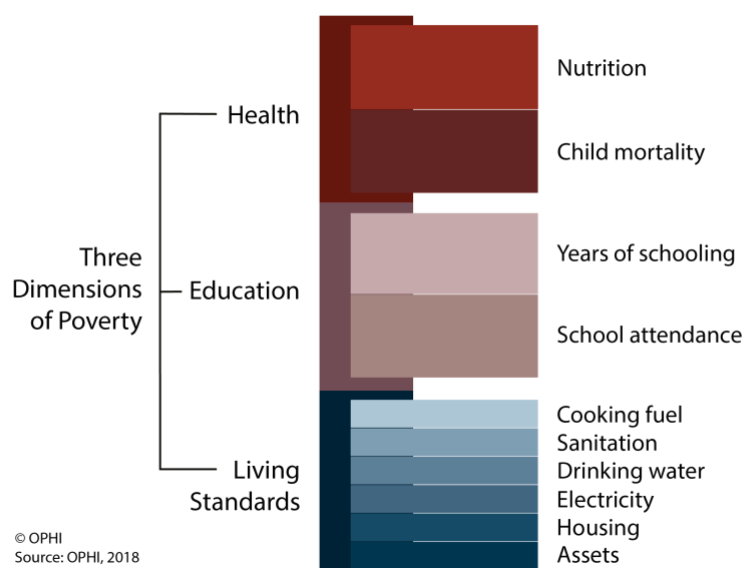
This Methodological Note presents the methodology and policies that underlie the changes over time in multidimensional poverty for 84 countries. 35 of the 84 countries have trends for three points in time; while poverty trends in 48 countries are based on two points in time. Gambia is the only country where we have presented results for four points in time.

We also estimate how multidimensional poverty changed by four major age categories (0 to 9 years, 10 to 17 years, 18 to 59 years, and over 60 years) and by two age categories covering children aged 0 to 17 years and adults 18 years and older in all countries. Our results also show poverty trends by rural-urban area and by 810 subnational regions. We standardised and harmonised 205 survey datasets to estimate the changes in multidimensional poverty. Indicator standardisation is detailed in Alkire, Kanagaratnam and Suppa (2022b).

This document, focused on harmonisation methodology and principles, is structured as follows. Section 2 presents the global MPI structure and indicator definitions. Section 3 provides an outline of the global MPI and its partial indices that we estimate and publish. Section 4 summarises the changes over time methodology. Section 5 provides a summary of the harmonised surveys. Section 6 outlines the principles and decisions that underlie our harmonisation work. Section 7 summarises the country-specific decisions that were applied for the datasets harmonised in this round. We conclude with brief reflections.

2. The global MPI structure

The global MPI, published annually since 2010, captures acute multidimensional poverty in the developing regions of the world (Alkire and Santos, [2014](#) & [2010](#)). This measure is based on the dual-cutoff counting approach to poverty developed by Alkire and Foster ([2011](#)). The global MPI is composed of three dimensions (health, education, and living standards) and ten indicators (Figure 1). Each dimension is equally weighted, and each indicator within a dimension is also equally weighted.

Figure 1. Composition of the Global MPI – Dimensions and Indicators

In 2018, the first major revision of the global MPI, that is, the adjustments in the definition of five out of the ten indicators was undertaken. Alkire, Kanagaratnam, Nogales and Suppa (2022a) provide a comprehensive analyses of the consequences of the 2018 revision. The normative and empirical decisions that underlie the revision of the global MPI, and adjustments related to the child mortality, nutrition, years of schooling and housing indicators are discussed in Alkire and Kanagaratnam (2021). The revision of assets indicator is detailed in Vollmer and Alkire (2022).

The global MPI begins by establishing a deprivation profile for each person, showing in which of the 10 indicators they are deprived. Each person is identified as deprived or non-deprived in each indicator based on a deprivation cutoff (Table 1). In the case of health and education, each household member may be identified as deprived or not deprived according to available information for other household members. For example, if any household member for whom data exist is undernourished, each person in that household is considered deprived in nutrition. Taking this approach – which was required by the data – is intuitive and assumes shared positive (or negative) effects of achieving (or not achieving) certain outcomes. Next, looking across indicators, each person’s deprivation score is constructed by adding up the weights of the indicators in which they are deprived. The indicators use a nested weight structure: equal weights across dimensions and an equal weight for each indicator within a dimension.

Table 1. Global MPI – Dimensions, Indicators, Deprivation Cutoffs, and Weights

Dimensions of poverty	Indicator	Deprived if...	SDG area	Weight
Health	Nutrition	Any person under 70 years of age for whom there is nutritional information is undernourished . ¹	SDG 2	1/6
	Child mortality	A child under 18 has died in the household in the five-year period preceding the survey. ²	SDG 3	1/6
Education	Years of schooling	No eligible household member has completed six years of schooling . ³	SDG 4	1/6
	School attendance	Any school-aged child is not attending school up to the age at which he/she would complete class 8 . ⁴	SDG 4	1/6
Living Standards	Cooking fuel	A household cooks using solid fuel , such as dung, agricultural crop, shrubs, wood, charcoal, or coal. ⁵	SDG 7	1/18
	Sanitation	The household has unimproved or no sanitation facility or it is improved but shared with other households. ⁶	SDG 6	1/18
	Drinking water	The household's source of drinking water is not safe or safe drinking water is a 30-minute or longer walk from home, roundtrip. ⁷	SDG 6	1/18
	Electricity	The household has no electricity . ⁸	SDG 7	1/18
	Housing	The household has inadequate housing materials in any of the three components: floor, roof, or walls . ⁹	SDG 11	1/18
	Assets	The household does not own more than one of these assets : radio, TV, telephone, computer, animal cart, bicycle, motorbike, or refrigerator, and does not own a car or truck.	SDG 1	1/18

Notes: The global MPI is related to the following SDGs: No Poverty (SDG 1), Zero Hunger (SDG 2), Health and Well-being (SDG 3), Quality Education (SDG 4), Clean Water and Sanitation (SDG 6), Affordable and Clean Energy (SDG 7), and Sustainable Cities and Communities (SDG 11).

¹ Children under 5 years (60 months and younger) are considered undernourished if their z-score of either height-for-age (stunting) or weight-for-age (underweight) is below minus two standard deviations from the median of the reference population. Children 5–19 years (61–228 months) are identified as deprived if their age-specific BMI cutoff is below minus two standard deviations. Adults aged 20 to 70 years (229–840 months) are considered undernourished if their Body Mass Index (BMI) is below 18.5 m/kg².

² The child mortality indicator of the global MPI is based on birth history data provided by mothers aged 15 to 49. In most surveys, men have provided information on child mortality as well but this lacks the date of birth and death of the child. Hence, the indicator is constructed solely from mothers. However, if the data from the mother are missing, and if the male in the household reported no child mortality, then we identify no child mortality in the household.

³ If all individuals in the household are in an age group where they should have formally completed 6 or more years of schooling, but none have this achievement, then the household is deprived. However, if any individuals aged 10 years and older reported 6 years or more of schooling, the household is not deprived.

⁴ Data source for the age children start compulsory primary school: DHS or MICS survey reports; and <http://data.uis.unesco.org/>.

⁵ If the survey report uses other definitions of solid fuel, we follow the survey report.

⁶ A household is considered non-deprived in sanitation if it has some type of flush toilet or latrine, or ventilated improved pit or composting toilet, provided that they are not shared. If the survey report uses other definitions of improved sanitation, we follow the survey report.

⁷ A household is considered non-deprived in drinking water if the water source is any of the following types: piped water, public tap, borehole or pump, protected well, protected spring, or rainwater. It must also be within a 30-minute walk, round trip. If the survey report uses other definitions of improved drinking water, we follow the survey report.

⁸ A small number of countries do not collect data on electricity because of 100% coverage. In such cases, we identify all households in the country as non-deprived in electricity.

⁹ Deprived if floor is made of natural materials or if dwelling has no roof or walls or if either the roof or walls are constructed using natural or rudimentary materials. The definition of natural and rudimentary materials follows the classification used in country-specific DHS or MICS questionnaires.

3. The global MPI and its partial indices

In the global MPI, a person is identified as multidimensionally poor or MPI poor if they are deprived in at least one-third of the weighted MPI indicators. After the poverty identification step, we aggregate across individuals to obtain the **incidence** of poverty or headcount ratio (H) which represents the percentage of poor people in the population. We then compute the **intensity** of poverty (A), representing the average percentage of weighted deprivations experienced by the *poor*. We then compute the adjusted poverty headcount ratio (M_0) or **MPI** by combining H and A in a multiplicative form ($MPI = H \times A$).

Both the incidence and the intensity of these deprivations are highly relevant pieces of information for poverty measurement. Imagine two countries: in both, 30 percent of people are poor (incidence). Judged by this piece of information, these two countries are equally poor. However, imagine that in one of the two countries poor people are deprived – on average – in one-third of the dimensions, whereas in the other country, the poor are deprived – on average – in two-thirds. By combining the two pieces of information – the intensity of deprivations and the proportion of poor people – we know that these two countries are not equally poor, but rather that the second is poorer than the first because the intensity of poverty is higher among the poor. The MPI will show this difference.

A headcount ratio is also estimated using two other poverty cutoffs. Individuals are identified as **vulnerable** to poverty if they are close to the one-third threshold, that is, if they are deprived in 20 to 33.33 percent of weighted indicators. The tables also apply a higher poverty cutoff to identify those in **severe poverty**, meaning those deprived in 50 percent or more of the dimensions.

The AF methodology has a property that makes the global MPI even more useful—dimensional breakdown. This property makes it possible to consistently compute the percentage of the population who are multidimensionally poor and simultaneously deprived in each indicator. This is known as the **censored headcount ratio** of an indicator. The weighted sum of censored headcount ratios of all MPI indicators is equal to the MPI value.

4. Changes over time methodology¹

Trends are estimated using indicators in the global MPI that are harmonised across the time periods. Harmonisation is necessary to ensure that any differences observed are due to changes in the conditions of poverty in the country rather than changes in the questionnaire. We estimate the harmonised levels of MPI and its partial indices using the harmonised indicators. This is important: in poverty analysis, the headline of interest is often the overall change in poverty measures. People want to know whether poverty has reduced, increased, or remain unchanged over time. Therefore, the prominent component of poverty comparisons is the absolute pace of change across periods or points in time.

Absolute rate of change

The absolute rate of change is the simple difference in poverty levels between two periods. We denote the initial period by t^1 and the final period by t^2 . The corresponding achievement matrices for these two periods by X_{t^1} and X_{t^2} , respectively. Note that the parameters of the poverty measure – deprivation cutoff z , weight w_j and poverty cutoff k – used in each period remain unchanged. The absolute rate of change (Δ) is the difference in MPIs between two periods and is computed as (and similarly for H and A , which are not presented):

$$\Delta MPI = MPI(X_{t^2}) - MPI(X_{t^1}).$$

The significance of the difference is determined by t-tests and is reported at 90% (*), 95% (**), and 99% (***) confidence levels in [Table 6 ‘Trends Results MPI 2022’](#).

The absolute rate of change is indifferent to the initial level. For example, a 10-percentage point reduction could mean that the headcount ratio decreased from 80 to 70 percent or from 15 to 5 percent. To look at the proportion of the change with respect to the initial level we use a relative measure.

Relative rate of change

The relative rate of change is the difference in poverty as a percentage of the initial poverty level. Interpreting the analysis of absolute and relative changes together provides a clear sense of overall

¹ The changes over time estimates using global MPI specifications was first published in 2013 covering 22 countries (Alkire, Conconi and Roche, [2013](#); Alkire and Roche, [2013](#)), which included a special focus on changes in poverty in India over two time point (Alkire and Seth, [2015](#), [2013](#)). In 2014, trends over time results was available for 34 countries (Alkire, Roche and Vaz, [2017](#), [2014](#)). This was followed by a study on multidimensional poverty in Sub-Saharan Africa (Alkire, Jindra, Robles and Vaz, [2017](#)). In the 2018 global MPI, we published India’s momentous progress in reducing multidimensional poverty within a decade using the revised global MPI specification (Alkire, Oldiges and Kanagaratnam, [2021](#); Alkire, Kanagaratnam and Suppa, 2018; and OPHI, 2018). The 2020 global MPI presented a study of 80 countries with changes over two points in time (Alkire, Kovcsdi, Mitchell and others, [2020](#)), and the 2021 global MPI covered 84 countries and added three points in time for 28 countries.

progress. The relative rate of change (δ) is computed for the MPI (and similarly for H and A , which are not presented) as:

$$\delta MPI = \frac{MPI(X_{t2}) - MPI(X_{t1})}{MPI(X_{t1})} \times 100.$$

Annualised change

However, the absolute and relative changes are not comparable for different countries when the reference periods (duration between survey years) are of different length. To compare the rates of poverty reduction across countries that have different periods of reference, annualised changes are used. The annualised absolute rate of change ($\bar{\Delta}$) is computed for the MPI as:

$$\bar{\Delta} MPI = \frac{MPI(X_{t2}) - MPI(X_{t1})}{t^2 - t^1}.$$

The annualised relative rate of change ($\bar{\delta}$) is computed for the MPI as:

$$\bar{\delta} MPI = \left[\left(\frac{MPI(X_{t2})}{MPI(X_{t1})} \right)^{\frac{1}{t^2 - t^1}} - 1 \right] \times 100.$$

We have used the same formula to compute and report annualised changes in the other partial indices, namely H , A , and censored headcounts.

For surveys that are fielded between years, the analysis takes the average of the years for calculating annualised change (Alkire, Kovesdi, Mitchell and others, 2020). For instance, in the case of India, we compute changes in poverty using harmonised data from three survey datasets, namely DHS 2005-2006, 2015-2016 and the most recent survey is 2019-2021. The annualised change between 2005-2006 and 2015-2016 is then $2015.5 - 2005.5 = 10$ years; while the annualised change between 2015-2016 and 2019-2021 is $2020 - 2015.5 = 4.5$ years.

As a measure of robustness, we also computed annualised change using two alternative approaches in the case of India (Table 2). We assess the implications of two alternative year policies on the change in the headcount ratio, as it is the most sensitive result. The first alternative approach is counting the mean of the month and year of the interviews to produce the annualised change; while the second alternative approach is counting the median instead of the mean. The current approach of the changes over time methodology which takes the average across the survey years shows we are going with a lower bound of possible absolute annual reduction.

Table 2. Comparing alternative approaches to estimating annualised change

		t1		t2		Duration between t1 & t2	Multidimensional Headcount Ratio (H _T)				
		initial year		final year			Abs annualised change	t ₁	t ₂		
		Survey	Year	Survey	Year						
Current approach: For surveys fielded between survey years, the analysis takes the average of the years for calculating annualised change.	India	DHS	2005- 2006	DHS	2015- 2016	2005.5	2015.5	10.0	55.07	27.68	-2.74
	India	DHS	2015- 2016	DHS	2019- 2021	2015.5	2020	4.5	27.68	16.39	-2.51
Mean approach: The average of the interview months and years used to compute the annualised changes.	India	DHS	2005- 2006	DHS	2015- 2016	Mar-06	Dec-15	9.7	55.07	27.68	-2.83
	India	DHS	2015- 2016	DHS	2019- 2021	Dec-15	May-20	4.3	27.68	16.39	-2.60
Median approach: The median of the interview months and years used to compute the annualised changes.	India	DHS	2005- 2006	DHS	2015- 2016	Mar-06	Dec-15	9.8	55.07	27.68	-2.81
	India	DHS	2015- 2016	DHS	2019- 2021	Dec-15	Feb-20	4.1	27.68	16.39	-2.76

Note: DHS survey contain only year and month of interview. Date of interview is not available.

Changes in deprivations among the poor

The reductions in MPI can be broken down by indicators. An analysis of changes in MPI considers both changes in the raw or uncensored headcount ratios and in the censored headcount ratios. The changes in censored headcount ratios depict changes in deprivations among the poor.

Disaggregation of subgroups over time

In addition, we have estimated changes in the MPI and its partial indices by age groups, rural-urban areas and subnational regions. Our analyses of poverty changes by population subgroups allows us to identify if the poorest subgroups reduced poverty faster than less poor subgroups and to see the dimensional composition of reduction across subgroups. Note that the population shares for each period must always be analysed alongside subgroup trends in order to consider demographic shifts such as migration or population growth, as these can significantly influence the interpretation of results.

The changes in poverty over time estimates using the global MPI specifications are produced using the Stata package ‘mpitb’ developed by Suppa ([2022](#)).

5. Survey details of harmonised global MPI 2022

The analysis of changes in multidimensional poverty draws on datasets from 84 countries. We also estimated how multidimensional poverty changed by four major age categories: 0 to 9 years, 10 to 17 years, 18 to 59 years, and over 60 years in 84 countries using harmonised datasets. In addition, we also publish the disaggregation by two major age groups: for children aged 0 to 17 years and adults 18 years and older. At the area level, we were able to produce changes in multidimensional poverty by rural-urban area for all countries – except for Trinidad and Tobago, as the initial survey period (MICS 2006) lacked this information.

35 of these countries having three points in time, 48 two points in time and changes in multidimensional poverty in Gambia covers four points in time. Collectively, we standardised and harmonised 205 survey datasets $[(35*3) + (48*2) + (1*4)]$ across these 84 countries.

5.1 Harmonised survey datasets

In 28 countries, we harmonised DHS data sets across all time points, and used only MICS data sets in 22 countries. For three countries (China, Ecuador and Mexico), the harmonisation work is exclusively based on national data sets, while for Morocco we have used PAPFAM across time points. For Bolivia and Peru, the harmonised datasets include a combination of DHS surveys and national surveys. For 28 countries we have used a mix of DHS and MICS across time points, namely Afghanistan, Bangladesh, Benin, Burkina Faso, Cameroon, Chad, Congo, Côte d'Ivoire, Democratic Republic of Congo, Dominican Republic, Gambia, Ghana, Guinea, Guyana, Honduras, Lesotho, Madagascar, Malawi, Mali, Mauritania, Moldova, Nepal, Sao Tome and Principe, Sierra Leone, Togo, Ukraine, Yemen, and Zimbabwe. The decision to use mix data sources between time points was possible because MICS and DHS usually have comparable sample designs and questionnaires.

5.2 Countries excluded from data harmonisation

For 27 countries that are part of the global MPI 2022 – Angola, Argentina, Barbados, Bhutan, Botswana, Brazil, Comoros, Costa Rica, Cuba, El Salvador, Georgia, Guatemala, Jamaica, Kiribati, Libya, Maldives, Myanmar, Papua New Guinea, Paraguay, Saint Lucia, Samoa, Seychelles, South Africa, South Sudan, Sri Lanka, Tonga and Tuvalu – harmonisation of datasets over time is not possible. This is because these countries (1) lack surveys for earlier time period or (2) the older and newer surveys have incomparable sample designs. For example, in 2018, the sample design for the Jamaica Survey of Living Conditions (JSLC) was revised. As such, direct comparisons with previous survey rounds – namely JSLC 2010 and 2014 are not recommended (PIOJ and STATIN, 2021, p.139).

6. Harmonisation principles and decisions²

It is common for indicator definitions to vary across survey years because it may be the case that survey providers may have changed how questions are asked, from whom these are collected or the response categories. Another reason may be that we are using different survey sources with comparable sampling design to capture changes over time in a country, and as such indicator definitions may require adjustment across these survey sources (e.g., comparing DHS and MICS). Harmonisation seeks to make two or more MPI estimations comparable by exactly aligning the indicator definitions. In other words, harmonisation, where necessary, re-creates the indicators in the global MPI so that they are using the same information and deprivation cutoffs across survey years.

6.1 General harmonisation principles

Several general principles are applied in the global MPI harmonisation process. In cases of differences between available indicators between the two surveys, we resort to the most restricted condition. For example, if one year of the surveys did not collect information needed to construct the nutrition indicator and the other year did, the indicator was dropped from the year that includes the information, and the indicators within the dimensions were re-weighted to maintain equal weights across dimensions and match the survey with the more restricted data. In our sample of 84 countries, four countries dropped the nutrition indicator from one year to match the year that did not collect anthropometric measurements (Colombia, Dominican Republic, Trinidad and Tobago, and Yemen). Two countries (North Macedonia and Suriname) dropped the child mortality indicator from one year. Furthermore we removed the school attendance indicator from one year in one country (Philippines) and cooking fuel indicator in two countries (Lesotho and Turkmenistan) to harmonise with the other dataset. The next section builds on these general principles to describe the indicator-specific decisions required in the harmonisation process.

6.2 Indicator-specific decisions

Nutrition

Most MICS surveys used in this analysis collect anthropometric measurements only for children under 5 years of age. In comparisons where in one year the survey is a DHS and in the other the survey is a MICS, the nutrition indicator is harmonised to include anthropometric information only for children under 5 years. Following this principle, adult nutrition is excluded from the harmonised nutrition indicator for 26

² The text in this section is drawn from OPHI MPI Methodological Note 50 (Alkire, Kovesdi, Mitchell and others, [2020](#)). It is useful to include similar text in each methodological note, in order to be transparent of the principles and decisions that are applied while harmonising indicators over survey years.

of the 84 countries, involving 39 of the datasets. These countries and datasets are: Armenia DHS 2015-2016, Bangladesh DHS 2014, Burkina Faso DHS 2010, Benin DHS 2017-2018, Cameroon DHS 2011 and 2018, Republic of Congo DHS 2005, Democratic Republic of the Congo DHS 2007 and 2013-2014, Ethiopia DHS 2011 and 2016, Gambia DHS 2013 and 2019-2020, Guinea DHS 2018 and 2018, Ghana DHS 2014, Guyana DHS 2009, Honduras DHS 2005-2006 and 2011-2012, Lesotho DHS 2009 and 2014, Madagascar DHS 2008-2009, Mali DHS 2006 and 2018, Republic of Moldova DHS 2005, Mauritania DHS 2019-2021, Malawi DHS 2010 and 2015-2016, Nepal DHS 2011 and 2016, Senegal DHS 2005, Sao Tome and Principe DHS 2008-2009, Sierra Leone DHS 2019 and 2013, Togo DHS 2013-2014, Zambia DHS 2007 and 2013-2014, Zimbabwe DHS 2010-2011 and 2015.

In addition, for the nutrition indicator, if the reference populations were changed, the harmonised estimates follow the year with the more limited eligibility conditions. For example, in Peru ENDES 2018 and 2019 surveys, eligible women for height and weight measurement included all women aged 12 to 49 years, whereas in Peru DHS 2012, eligible women included all women aged 15 to 49 years. As a result, in Peru, only women aged 15 to 49 years are considered as eligible for nutrition measurement for both years. This restricted condition principle also applies when one year includes nutrition information from men and the other year does not; in that case, men's nutritional information would be excluded from the harmonised indicator.

Child mortality

The child mortality indicator was constructed using birth history information – whether the mother gave birth in the last five years preceding the survey and how old the child was when they died. Often, the older surveys do not include a birth history questionnaire and thus do not have information on the age and time of passing of the child. When one year includes birth history information and the other does not, the more restricted condition principle is followed, and information on age and year of death are removed from the survey that has them. In this case, the child mortality indicator then takes on the deprivation cutoff from the 2010 global MPI specifications, which considers whether any child has died in the household. Following this principle, birth history information is excluded from the harmonised child mortality indicator for 12 of the 84 countries, involving 19 of the datasets. These datasets are: Afghanistan DHS 2015-2016, Belize MICS 2015-2016, Burkina Faso DHS 2010, Central African Republic MICS 2019, Chad DHS 2014-2015 and MICS 2019, Ecuador ENSANUT 2018, Gambia DHS 2013, MICS 2018 and DHS 2019-2020, Kyrgyzstan MICS 2014 and 2018, Morocco PAPFAM 2017-2018, Mongolia MICS 2013 and 2018, Turkmenistan MICS 2019 and 2015-2016, and Togo MICS 2017 and DHS 2013-2014.

The child mortality indicator also considers whether any child has died in the household when neither survey has birth history information. This principle is applied on 12 datasets across five countries, namely

Kazakhstan MICS 2010-2011 and 2015, Montenegro MICS 2013 and 2018, Serbia MICS 2019, 2014 and 2010, Thailand MICS 2019, 2015-2016 and 2012, and Trinidad and Tobago MICS 2011 and 2006.

In addition, attention was paid to which individuals provide information on child mortality to ensure the applicable populations match between the two years. For instance, in the Bolivia 2016 dataset, women who are eligible to provide child mortality information are all women aged 14 to 49 years, and in the 2008 and 2003 datasets, eligible women were aged 15 to 49 years. Therefore, only child mortality information from women aged 15 to 49 years is included in the indicator for all three years, following the more restricted condition principle. However, child mortality information from eligible men was not excluded even when not present in the other year, as it is only used to identify zero child mortality at the household level in the absence of information from eligible women.

Years of schooling

For the years of schooling indicator, DHS data contains a variable that states the total number of years of education for the individual. In contrast, the MICS data does not provide an equivalent variable. Instead, when using MICS data, the total number of years of schooling is computed by combining the education level and highest-grade variables, taking into consideration the country's national education system, as described in the survey report. In cases where this information is not included in the survey report, we refer to the UNESCO Institute for Statistics (UIS) databank. In cases of mismatch between the survey report and the national guidance, we investigate this issue with respective national statistical offices or the survey providers. For the DHS and MICS comparisons, the DHS variable was treated as equivalent to the MICS composite variable (e.g. six years of schooling in the DHS variable corresponds to the first six years of education in MICS). All adults are eligible for the years of schooling indicator; while the youngest eligible persons are specified using country-specific age cutoffs that correspond to the age at which they are expected to complete class six (Alkire, Kanagaratnam, and Suppa, 2020). For example, in India, children start school at the age of six years so we would expect a child aged 12 years to have completed six years of schooling. Hence the minimum age of eligibility for years of schooling indicator for India is from 12 years old. On the other hand, in Indonesia, children start school at the age of seven years and so would complete six years of schooling at the age of 13. Hence the minimum eligibility for years of schooling indicator in Indonesia is 13 years.

School attendance

The school attendance indicator is manually computed using the age range for the indicator based on the national entry age to compulsory schooling. The official national entry age to compulsory schooling is selected using either the survey report (where possible) or the UNESCO Institute for Statistics data (if not available in the survey report). In cases of mismatch between the report and the UNESCO guidance, we

consult the national statistical offices or the survey providers. For most countries included in the changes over time analysis, the official entry age for primary schooling is six years, although this differs for a few countries. For example, the official entry age is 7 years for Indonesia, and for Pakistan, the official entry age is five years. When the official entry age changes between the two surveys, often due to education policy changes, we retain the exact official entry age in each survey and do not harmonise across the years in order to fully capture the range of eligible children.

Electricity

The electricity indicator does not have any indicator-specific harmonisation decisions, beyond the general principles of only using information that is available in datasets from both survey years.

Sanitation

For the sanitation indicator, two conditions are used – whether other households share the toilet facility and whether the toilet facility is considered an improved or unimproved facility – to define a household's access to improved sanitation. If, there is no information on whether the facility is shared in one year, but the other year does have that information, the more limited information is considered in both years. This principle was only applied for Central African Republic MICS 2019 and 2010 where the shared toilet facility is excluded from the harmonised sanitation indicator because the initial survey – MICS 2000 – lacked this information.

Regarding categorising labelled types of toilet facilities as improved or unimproved, if survey report classifications differ between the two years, we consider the more recent data's definition of improved facilities for both years. If a first-year survey specifies a category for sanitation facilities that the second year does not; we would leave the category labelled as is in the first year.

Drinking water

For the drinking water indicator, there are two conditions to consider – how long it takes the respondent to fetch water from the main drinking water source of the household and whether the main drinking water source is considered an improved or unimproved source – to define a household's access to basic drinking water. If in one year, there is no information on how long it takes to fetch water, but the other year does have that information, that information is dropped to accord with the year that has the more limited information. Following this principle, information on time to collect water is excluded from the harmonised drinking water indicator for three countries involving four datasets, namely Jordan DHS 2017-2018, Republic of Moldova MICS 2012, and the State of Palestine MICS 2019-2020 and 2014.

Further, when different main drinking water sources are considered improved between the two years, we follow the standard in the more recent survey. Lastly, unless directly specified otherwise by the report,

because the quality of bottled water is unknown, households that use bottled water for drinking are classified as using an improved source only if the water they use for cooking and hand washing comes from an improved source. This information exists in a non-drinking water variable, which often is not present in the earlier surveys. When there is no information on non-drinking water in one year, as in Tajikistan DHS 2012, but the second year does have that information, as in Tajikistan DHS 2017, the condition is dropped to accord with the year that has the more limited information. Often, when this is the case, the reports specify that bottled water is an improved source, and, consequently, it is coded as such. In surveys released since 2020, bottled water is considered as improved source of drinking water. The information on non-drinking water is no longer considered to determine the quality of bottled water. This is consistent with the SDG definition of safe drinking water. In such case, we consider bottled water as improved source of drinking water across survey years even if older surveys applied the non-drinking water criterion.

Cooking fuel

For the cooking fuel indicator, households are defined as deprived when they cook with solid fuels: dung, agricultural crop, shrubs, wood, charcoal, or coal. To follow the principle of harmonising to the latest survey, when one survey codes a fuel source as solid fuel and the other does not, both years are coded to consider that fuel source to be solid whatever the classification is in the later year. In the rare instance where a report does not specify a list of solid fuels, we follow the global MPI specification and consider ‘other’ cooking fuel responses to reflect non-deprived sources.

Housing

For the housing indicator, the household is considered as deprived if they live in inadequate housing, where the floor is of natural materials, or the roof or walls are of natural or rudimentary materials. Following the principle of differing classifications reverting to the more recent standard, when the first year considers a housing material (constituting the dwelling’s floor, roof, or walls) as natural or rudimentary and the second (more recent) year does not, both years are coded to consider that housing material as an improved housing material.

Further, when information on one or two of the three housing components (floor, roof, walls) is missing in one year, the information from the year where it exists is removed to match the missing year. This restricted condition principle was applied on the harmonised housing indicator for eight countries involving 13 datasets, namely Democratic Republic of the Congo DHS 2013-2014 and 2017-2018, Mali MICS 2015 and DHS 2018, Mozambique DHS 2011, Niger 2012, the State of Palestine MICS 2014 and 2019-2020, Sao Tome and Principe MICS 2014 and 2019, Senegal DHS 2017 and 2019, Yemen DHS 2013

Assets

The assets indicator considers whether a household owns a radio, television, telephone, computer, animal cart, bicycle, motorbike, refrigerator, or car/truck. When in one year there is no information on certain assets, those assets are dropped from the assets indicator in the later years to accord with the more limited information available. The most common asset item that is missing in one year is computer, followed by animal cart. For example, in 23 countries across 33 datasets, we excluded computer from the harmonised assets indicator because this information was not available in at least one of the surveys. These datasets are: Afghanistan DHS 2015-2016, Bosnia and Herzegovina MICS 2011-2012, Burkina Faso DHS 2010, Central African Republic MICS 2010 and 2019, Chad MICS 2019, Colombia DHS 2015-2016, Democratic Republic of the Congo DHS 2013-2014 and 2017-2018, Republic of Congo DHS 2005, Ethiopia DHS 2016 and 2019, Gabon DHS 2012, Gambia DHS 2013, MICS 2018 and DHS 2019-2020, Guinea MICS 2016 and DHS 2018, Indonesia DHS 2017, Madagascar MICS 2018, Malawi DHS 2015-2015 and MICS 2019-2020, Namibia DHS 2013, Niger DHS 2012, Suriname MICS 2006 and 2018, Tanzania DHS 2015-2016, Timor-Leste DHS 2016, Togo DHS 2013-2014 and MICS 2017, Uganda DHS 2016, and Zambia DHS 2013-2014 and 2018.

Our definition of telephone ownership includes information on whether a household owns a landline or mobile telephone. In earlier surveys, as is the case in Mozambique DHS 2003, the questionnaire did not include a question on whether the household owned a mobile telephone (as they were not as common a telecommunications device as they are today). In these cases, for the second year, as in the case of Mozambique DHS 2011, we kept the telephone information from both the landline and mobile phone questions (as opposed to excluding the information on whether the household owns a mobile phone), as we believe the changes in phone ownership are best reflected with the inclusion of all available information on telephone devices because individuals may own a mobile phone instead of, rather than in addition to, a landline.

6.3 Principles for subnational disaggregation

The principle for subnational disaggregation using harmonised datasets builds on the principles discussed in Alkire, Kanagaratnam and Suppa (2022c) for standardised datasets. The decision whether a country qualifies for a harmonised subnational disaggregation was determined by three criteria. These criteria were (1) the sample was representative at the subnational level across harmonised surveys; (2) the subnational unit definitions are comparable across harmonised surveys; and (3) the sample size after the treatment of missing data was reasonably high across harmonised surveys.

The first criterion for disaggregation is that the survey report must establish that the sample is representative at the subnational level following the survey metadata on sample design. Four countries –

Armenia, Bosnia and Herzegovina, Burkina Faso and Yemen – have surveys in one or both of the years that did not satisfy this principle according to their survey reports. Hence, these four countries are excluded from subnational analysis; while the remaining 80 countries met this principle.

The second criterion required subnational units to be comparable across harmonised surveys. In two countries – Morocco and Sudan – the subnational regions have changed boundaries or have been split into new regions over the years. We exclude subnational disaggregations for both these countries where changes in the subnational unit definitions between time periods are incomparable.

Besides these cases, a number of countries had regional changes between the time points that did not violate the principle of comparability, and we were therefore able to harmonise and obtain subnational estimates for these countries. To ensure comparable estimates are derived across time periods, where possible, regions were aggregated to recreate the region(s) presented in the survey with the more limited regional classification. For instance, in the cases of India DHS 2019-2021 and DHS 2015-2016, we aggregated regions of Andhra Pradesh and Telangana to recreate the Andhra Pradesh region; as well as aggregated the regions of Punjab and Chandigarh to recreate Punjab presented in the DHS 2005-2006. Similarly, we aggregated regions of Jammu and Kashmir and Ladakh in the most recent survey to recreate the Jammu and Kashmir region that is present in DHS 2015-2016 and 2005-2006.

In a few exceptional cases, a different number of regions were surveyed across survey years due to accessibility, physical security, or cost issues. For example, India DHS 2015-16 and 2019-2021 surveyed additional regions (union territories) that are not available in the earlier survey – DHS 2005-2006. This presented a problem for the estimation of trends over time as we aimed to preserve the national estimates while ensuring that subnational estimates are comparable between the two times. Our approach was to estimate national poverty using all available regions in both years (even if some were not present earlier) in order to preserve the weighting scheme for obtaining the national estimates. Subnational estimates utilise the individual regional weights, and, in cases where additional regions were surveyed in one year compared to those in the other, our analysis omits the extra region(s) in its estimation of the regional results, but the weights and sample are retained for national analyses.

The third and final criterion emphasises that the sample size after the treatment of missing data must be reasonably high at the national and subnational levels. For borderline cases, bias analyses are conducted to exclude those cases where the sample reduction leads to statistically significant bias. We specify the third criterion in three ways.

First, the national sample size for all surveys must be at least 85 percent of the original sample after missing data is treated. This is because a lower sample size may affect accurate comparability across subnational estimations. Following this specific criterion, we identified two datasets representing two countries that

did not meet this cutoff. In the Mexico ENSANUT 2020 dataset, we retained 75 percent of the weighted sample for estimation after dropping observations that had missing data in any of the 10 global MPI indicators. For Montenegro MICS 2018, the weighted retained sample at the national level was 80 percent.

Second, every subnational region in a country must have a retained sample size of at least 75 percent of the original sample. A smaller sample creates a problem of representativeness for that particular subnational region, which may distort the subnational comparisons. Our analyses indicate that a total of three subnational regions across these two countries fall short with respect to this sub-criterion. In the Montenegro MICS 2018 dataset, the region of Centre recorded a sample drop of 27 percent. The sample drop in two of the four major region in Mexico ENSANUT 2020 – Mexico City and Sur – was 30 percent and 26 percent, respectively.

Third, a bias analysis test is carried out for each region whose sample size is lower than 75 percent and whose national sample size is lower than 85 percent of the original. We identify the major cause of the sample reduction (in this case, nutrition for Mexico and a combination of nutrition and child mortality for Montenegro) and divide the entire sample into two groups based on this cause and check the headcount ratios of the other indicators across these two groups. Suppose there is a systematic and statistically significant difference (at a significance level of 1%) between the headcount ratios across these two groups. In that case, that region does not satisfy the bias analysis test. If a region with a large population share (more than 20 percent) within a country does not pass the test, we exclude the country from our subnational analysis.

Following this sub-criterion, we carried out the bias test for the three subnational regions with a low retained sample. The results for the region of Centre indicate that the likelihood of being deprived in child mortality is not the same for those who are missing the nutrition indicator and those who are not missing this indicator. Those without a missing nutrition indicator are systematically more likely to be deprived in child mortality. Similar results was observed when the bias test was implemented between nutrition and cooking fuel indicators in the case of Mexico City and Sur. This suggests that the sampling structure would need to be revised to assure representativity. In addition, the region of Sur accounts for 31 percent of the population in Mexico and the population share in Mexico City is 21 percent. In the case of Montenegro, some 55 percent of the population live in the region of Centre. Following the bias observed for the Mexico ENSANUT 2020 and Montenegro MICS 2018 datasets, and that these are regions with high share of population, we exclude all harmonised datasets for Mexico and Montenegro from the subnational analysis.

In summary, 76 countries with 810 regions satisfy all three criteria and are thus used to estimate changes in poverty over time at the subnational level.

7. Country-specific considerations

This section details the country-specific harmonised decisions concerning indicator availability and data treatment for each country with updated survey.

[Dominican Republic](#) The most recent survey for this country is MICS 2019. This survey is harmonised with two earlier surveys, MICS 2014 and DHS 2007. For harmonisation purposes, we remove all data on nutrition to accord with the MICS 2014 data and re-weight the indicators to assure equal weighting among the three dimensions. Drinking water obtained from tanker truck and cart are harmonised as improved following the most recent survey. The initial survey does not include information on whether the household owns an animal cart, and likewise the harmonised assets indicator does not include this item despite the availability of this information in later surveys. At the subnational level, we estimated MPI and its partial indices for 10 planning regions of the country since the samples across all three harmonised data sets are representative at this level.

[Ecuador](#) The most recent survey for this country is ENSANUT 2018. This survey is harmonised with an earlier survey, ENSNAUT 2013-2014 since the sampling frame between both surveys are comparable. These are national surveys that is open access. A unique element of these national datasets is that all household members in the sample were eligible for anthropometric measurement. Following the principles of the global MPI, we use all available data on nutrition, up to the age of 70 years (840 months in age) to construct the nutrition indicator. For harmonisation purposes, we have removed the birth history information from the recent survey to match the 2013-2014 ECV data set, which did not include a birth history questionnaire. So, the harmonised child mortality indicator considers a household deprived if there is any child who died in the household. Drinking water obtained from tanker truck and cart are harmonised as improved following the most recent survey. The surveys do not include information on whether the household owns an animal cart, and likewise the assets indicator does not include this item across both surveys. In addition, the most recent survey does not include information on whether the household owns a radio, bicycle, or motorbike; therefore, we remove these asset items from the harmonised assets indicator. The harmonised MPI estimates are disaggregated by 24 provinces.

[Gambia](#) The most recent survey for this country is DHS 2019-2020. This survey is harmonised with three earlier surveys, MICS 2018, DHS 2013 and MICS 2005-2006. The DHS data sets have anthropometric information from children aged under 5 years and women aged 15 to 49 years; however, for harmonisation purposes, we only use the anthropometric information from children, to accord with the 2018 and 2005-2006 MICS data sets. For harmonisation purposes, we have removed the birth history information from the most recent three surveys to match the 2005-2006 data set, which did not include a birth history questionnaire. So, the harmonised child mortality indicator considers a household deprived if there is any

child who died in the household. Drinking water obtained from tanker truck and cart are harmonised as improved following the most recent survey. Bottled water is considered as an improved source of drinking water over time. The 2005-2006 data sets do not include information on whether the household owns a computer; likewise, the harmonised over time assets indicator does not include this item. At the subnational level, we estimated MPI and its partial indices for eight Local Government Areas (LGAs) of the country since the samples across all four harmonised data sets are representative at this level.

[Honduras](#) The most recent survey for this country is MICS 2019. This survey is harmonised with two earlier DHS surveys, 2005-2006 and 2011-2012. The DHS data sets has anthropometric information from women 15-49 years, and children aged under 5 years; however, for harmonisation purposes, we only use the anthropometric information from children, to accord with the current MICS data set. Drinking water obtained from tanker truck and cart are harmonised as improved following the most recent survey. Bottled water is considered as an improved source of drinking water over time. The DHS surveys do not include information on whether the household has access to electricity, so it is therefore not included in the asset indicator for harmonisation purposes. The 2019 survey has four additional departments compared to the earlier DHS surveys. This is because larger departments in earlier years have been divided into smaller regions at present day. For harmonisation purposes, we re-grouped the 20 departments in the 2019 survey to match the 16 departments in the earlier DHS data sets. Specifically, the cities of Distrito Central and San Pedro Sula was merged into the departments of Francisco Morazán and Cortés respectively. In addition, the departments of Gracias a Dios and Islas de la Bahía was merged into the departments of Intibucá and Lempira respectively.

[India](#) The most recent survey for this country is DHS 2019-2021. This survey is harmonised with two earlier surveys, DHS 2005-2006 and DHS 2015-2016. The older surveys listed the 'flush to don't know where' response to be an unimproved sanitation facility, we harmonised this facility to be improved to match the more recent classification in the 2019-2021 data. Likewise, drinking water obtained from tanker truck and cart are harmonised as improved following the most recent survey. Bottled water is considered as an improved source of drinking water over time. The sample of the two most recent datasets include the union territories of Andaman and Nicobar; Dadra and Nagar Haveli; Daman and Diu; Lakshadweep; and Puducherry. These areas were not sampled in DHS 2005-2006. The harmonised region variable excludes these union territories. For harmonisation purposes, we also regroup the state of Telangana with the state of Andhra Pradesh, the state of Chandigarh with the state of Punjab, and the union territory of Ladakh with the state of Jammu and Kashmir to accord with the subnational categories of the DHS 2005-2006 survey. We present the harmonised MPI results and its partial indices by 29 Indian states.

[Malawi](#) The most recent survey for this country is MICS 2019-2020. This survey is harmonised with two earlier DHS surveys, 2010 and 2015-2016. The DHS data sets has anthropometric information from women 15-49 years, and children aged under 5 years; however, for harmonisation purposes, we only use the anthropometric information from children, to accord with the current MICS data set. Drinking water obtained from tanker truck and cart are harmonised as improved following the most recent survey. Bottled water is considered as an improved source of drinking water over time. The earlier data from 2010 does not include information on whether the household owns a computer, so it is therefore not included in the asset indicator for harmonisation purposes. The 2010 DHS survey is representative for 27 districts of the country, while the 2015-2016 and 2019 surveys are representative for 28 districts. This is because the districts of Nkhata Bay and Likoma in the recent surveys was previously a single district. For the purpose of comparability over time, we group these two regions in the 2015-2016 and 2019 surveys so it is comparable with the 2010 survey.

[Mauritania](#) The most recent survey for this country is DHS 2019-2021. This survey is harmonised with two earlier MICS surveys, 2011 and 2015. For harmonisation purposes, we only use the anthropometric information from children, to accord with the MICS data sets. The category Koranic education was harmonised as deprived across all survey years while constructing the harmonised years of schooling indicator. Drinking water obtained from tanker truck and cart are harmonised as improved following the most recent survey.

[Mexico](#) The most recent survey for this country is ENSANUT 2020. This survey is harmonised with two earlier ENSANUT surveys, 2016 and 2012. These are national surveys that is open access. There is difference in sample design of between the most recent survey to the earlier surveys, but the estimates defined on geographic regions (rural localities, and urban localities) are comparable because the sampling is probabilistic and the survey questions are comparable (Shamah-Levy, Romero-Martinez, Barrientos-Gutierrez and others, 2021, p.28). Drinking water obtained from tanker truck and cart are harmonised as improved following the most recent survey. The surveys do not include information on whether the household owns a bicycle or an animal cart, and likewise the assets indicator does not include these item across all three surveys.

[Peru](#) The most recent survey for this country is ENDES 2019. This survey is harmonised with the 2018 ENDES and 2012 DHS surveys. These are national surveys that is open access. Anthropometric measurement was collected from all children under 5 years across the three surveys. In addition anthropometric measurement was also collected from women aged 12 to 49 years in the ENDES surveys, while in the DHS survey, data collection covered women aged 15 to 49 years. The harmonised nutrition indicator only consider data from children and women aged 15 to 49. Similarly, child mortality information

was provided by women aged 12 to 49 in the ENDES surveys while DHS covered women aged 15 to 49 years. The harmonised child mortality indicator across the three surveys only considers data from women aged 15 to 49.

[Rwanda](#) The most recent survey for this country is DHS 2019-2020. This survey is harmonised with two earlier DHS surveys, 2014-2015 and 2010. Across all three DHS surveys, anthropometric measurements were collected from women aged 15-49 years and children under 5 years living in a subsample of households; with an exception in the 2014-2015 and 2010 surveys that also collected this data from a subsample of men aged 15 to 59. However, for harmonisation purposes, we only include nutrition information from women and children in the harmonised nutrition indicator across the three survey periods. Drinking water obtained from tanker truck and cart are harmonised as improved following the most recent survey.

[Viet Nam](#) The most recent survey for this country is MICS 2020-2021. This survey is harmonised with an earlier survey, MICS 2013-2014. Drinking water obtained from tanker truck and cart are harmonised as improved following the most recent survey. The information on non-drinking water is no longer considered to determine the quality of bottled water. As such, we consider bottled water as improved source of drinking water across the survey years. The initial survey does not include information on whether the household owns an animal cart, and likewise the harmonised assets indicator does not include this item despite the availability of this information in most recent survey.

Concluding remarks

The global MPI 2022 includes harmonised levels and changes over time estimates for 84 countries. We estimate changes in MPI and its partial indices by age groups for all countries, rural-urban areas for 83 countries (excluding Trinidad and Tobago due to lack of data on rural-urban area in earlier survey) and by 810 subnational regions across 76 countries (excluding 8 countries due to constraints in sample representation, incomparability across regional units over time or bias in regional estimates).

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