Multidimensional Child Poverty in Rwanda

MODA

Report

National Institute of Statistics of Rwanda

Multidimensional Child Poverty in Rwanda

November 2022

The report of Multidimensional Child Poverty in Rwanda is produced by the National Institute of Statistics of Rwanda (NISR) in partnership with UNICEF Rwanda.

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Thank you

Murangwa Yusuf

Director General, NISR

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List of acronyms

DHS	: Demographic and Health Survey
ECE	: Early childhood education
EICV	: Integrated Household Living Conditions Survey or Enquête Intégrale sur les Conditions de Vie des ménages
IYCF	: Infant and Young Child Feeding (IYCF)
MODA	: Multidimensional Overlapping Deprivation Analysis
NISR	: National Institute of Statistics of Rwanda
SDG	: Sustainable Development Goals
SPRI	: Social Policy Research Institute
UNICEF	: United Nations Children's Fund
WCAR	: West and Central Africa
WHO	: World Health Organization

Executive summary

The present Multidimensional Overlapping Deprivation Analysis (MODA) report is a follow-up to the 2018 study[1] to measure Rwanda's multidimensional poverty situation among children under 5 years of age[2] using the Demographic and Health Survey 2019/2020. The study also includes a trend analysis in child poverty based on evidence from DHS 2014/15 and DHS 2019/20.[3] The analytical results presented in this report are based on UNICEF's MODA methodology, measuring child well-being in terms of the following dimensions: nutrition, health, development (cognitive), child protection, water, sanitation and housing. Considering the life-cycle approach, the results are disaggregated into two age groups (0-23 months and 24-59 months) to better reflect the needs of children and their development at different stages of childhood. A child is considered to be multidimensionally poor in Rwanda if he/she suffers simultaneously from deprivation in at least three dimensions of wellbeing.

The analysis shows that multidimensional poverty affected 65.8% of all children in the country in 2019/20. The disaggregation of results by age groups indicates that 70.3% of children aged 0-23 months and 62.6% of children aged 24-59 months are multidimensionally poor. Major disparities are observed between children living in rural and urban areas, with 70.4% of rural children being multidimensionally poor as compared to 43.4% of urban children. At the regional level, the highest child poverty rate is found among children living in the Western province (72.1 per cent). Kigali shows the lowest proportion of multidimensionally poor children (44.3 per cent). In addition, the education level of the household head and/or the mother has an important influence on the deprivation levels of children. A higher proportion of children with a lower educated household head/mother suffer from

[1] National Institute of Statistics in Rwanda (NISR) and UNICEF Rwanda (2018). Multidimensional Child Poverty in Rwanda: A Multiple Overlapping Deprivation Analysis (MODA). Available at: https://www.unicef.org/esa/sites/unicef.org.esa/files/2018-09/UNICEF-Rwanda-2018-Child-Poverty.pdf

[2] The current study focus only on children aged below 5 years. Upon availability of new EICV data, the same study will be conducted for children aged 5-17 years.

[3] A slightly different set of indicators has been used for the trend analysis to allow comparison between the 2014/15 and 2019/20 Demographic and Health Surveys (see Annex II of the main report). The deprivation and multidimensional poverty rates used in the trend analysis therefore deviate from the other sections.

multidimensional poverty. Moreover, nearly seven out of ten stunted children (68.7 per cent) are multidimensionally poor compared to 46.3 per cent of non-stunted children. Underweight children are more likely to experience multidimensional poverty in comparison to those who are not underweight (70.1 per cent and 57.8 per cent). No significant differences are observed based on the gender of the child.

Regarding the trend analysis, it is observed that Rwanda made progress in reducing the multidimensional child poverty rate from 55.3% in 2014 to 49.3%[4] in 2019/20. The intensity of deprivation has also slightly decreased over time from 61.6% to 60.6%, indicating that children experienced deprivations in a lower number of dimensions in 2019/20 compared to 2014/15. However, there are some exceptions such as in the Health dimension (children aged 0-23) and Development dimension (children aged 24-59) where an increase in deprivation has been observed.

Based on these findings, four sets of recommendations have been formulated:

1) To adopt a holistic approach for policies targeting children;

2) To target the most vulnerable children (i.e. rural children);

3) To address vulnerabilities in the sectors recording the highest levels of deprivations; and

4) To maintain those existing policies aiming at improving the situation of children when they are yielding good results.

[4] Note that the rate differs from the rest of the report because a slightly different set of indicators was used in the 2018 child poverty study.

Chapter 1. Introduction

1.1. Background and Context

Over the last decade, Rwanda has shown considerable progress in monitoring and improving child well-being at the national level. The country's strong economic growth accompanied by significant improvements in living standards led to a two-thirds drop in child mortality[5] and near-universal primary school enrolment[6]. However, like most countries in the world, Rwanda has not been spared by the COVID-19 crisis. Given that the COVID pandemic is likely to reverse the progress in child poverty, it is now more important than ever to continue monitoring the situation of children.

In 2018, Rwanda published its first comprehensive report[7] on child poverty assessing the deprivation rates in different dimensions of child well-being using data from the Demographic and Health Survey 2013/14 (for children under 5 years) and the Integrated Household Living Condition Survey 2013/14 (for children aged 5-17 years). The present Multidimensional Overlapping Deprivation Analysis (MODA) is a follow-up to measure the country's progress in addressing multidimensional poverty for children aged under 5 years using the Demographic and Health Survey 2019/2020.

This report aims to apply a holistic approach while identifying the most vulnerable children, through the analysis of various dimensions of children's wellbeing (Nutrition, Health, Child development, Child protection, Water, Sanitation and Housing). Some of the deprivations affecting children can have irreversible effects leading to the eventual productivity loss and social exclusion of children throughout their lifetime. Alleviating the intensity and severity of child poverty across multiple

[5] According to the Demographic and Health Survey 2019-20, under-five mortality declined from 196 deaths per 1,000 live births in 2000 to 45 deaths per 1,000 live births in 2019-20.
[6] In 2018, Rwanda achieved a net primary school enrollment of 94.8 per cent. Available at: https://data.worldbank.org/indicator/SE.PRM.NENR?locations=RW
[7] National Institute of Statistics in Rwanda (NISR) and UNICEF Rwanda (2018). Multidimensional Child Poverty in Rwanda: A Multiple Overlapping Deprivation Analysis (MODA). Available at: https://www.unicef.org/esa/sites/unicef.org.esa/files/2018-09/UNICEF-Rwanda-2018-Child-Poverty.pdf

dimensions will contribute significantly towards Rwanda's future economic growth and overall productivity.

1.2. Purpose of MODA Report

According to the first MODA report of 2018, 39 per cent of children (0-17 years) in Rwanda were identified as multidimensionally poor. Therefore, it is essential to build an understanding of the evolution of child poverty in order to guide and adjust policies and programmes to improve child well-being. The same methodology, that is, UNICEF's Multiple Overlapping Deprivation Analysis (MODA) was used to quantify child poverty in the present report. The main objective of this analysis is to monitor the country's gains in Sustainable Development Goal 1 (i.e. ending poverty in all its forms everywhere) for children younger than 5 years. Through the appropriate design of policies and programmes based the results, the ultimate aim is that by 2030, child poverty rates are reduced to half as required by the SDG framework.[8] As new data are collected, there can be further follow-up studies to track progress, and policies and financing framework for poverty reduction need to be designed accordingly to address the areas in which Rwandese children are deprived in.

1.3. Report Structure

The remaining sections of the report are organised as follows: Chapter 2 presents the methodology, data, and limitations of the study; Chapter 3 presents the key findings with regards to single deprivation, multiple deprivations and deprivation overlap analyses, disaggregated by age group (for children aged 0-23 months and 24-59 months) and Chapter 4 summarises the main conclusions and provides policy recommendations.

[8] United Nations. Available at : https://sdgs.un.org/goals

Chapter 2: Methodology

2.1. The Multidimensional Child Poverty in Rwanda, MODA

This study employs UNICEF's MODA methodology (Neubourg et al., 2013) to quantify and measure child poverty in Rwanda. It is a methodological tool specifically designed to capture multidimensional poverty among children. The MODA methodology integrates elements of the traditional income-based measures of poverty, such as the Global Study on Child Poverty and Disparities (Gordon et al., 2003), and the Oxford Poverty and Human Development Initiative (OPHI) Multidimensional Poverty Index (Alkire and Foster, 2011). However, while the traditional methodologies integrate a holistic approach to measuring poverty at the level of the household, and concentrate on monetary measurements, the MODA methodology adopts a broader definition of well-being, at the level of the child, by focusing on multiple dimensions that are crucial for the long-term child development in a specific country context. Understanding the complex features of child poverty is key to developing child-sensitive policy responses that ensure a maximum impact on children and society (Neubourg et al. 2018).

The MODA methodology puts the child at the centre of the analysis. While children have specific needs, they are not the decision-makers in the household.[9] This fact may lead them to face specific deprivations even when their households are not monetary poor. MODA recognizes that a child's experience of deprivation is multi-faceted and interrelated and that, as such, multiple, overlapping deprivations are more likely to occur, and with more serious adverse effects in socio-economically disadvantaged groups. The overlapping deprivation analysis ultimately contributes to identifying the most vulnerable children, faced with a higher number of deprivations, and understanding the interrelations between their deprivations in multiple sectors.

The MODA distinguishes four key elements:

[9] De Neubourg, De Milliano, and Plavgo 2014.

1. It is child-centred. The child is the unit of analysis rather than the household since children experience deprivations and poverty differently from adults;
2. It adopts a life-cycle approach (Figure 1), analysing age groups to reflect children's specific needs across their childhood;
3. It employs an overlapping deprivation analysis, which enhances knowledge of sector-by-sector approaches, indicating the simultaneous experience of the multiple facets of child poverty and highlighting the deprivations severity levels;
4. It measures the prevalence and depth of deprivations each child experiences simultaneously, identifying the most vulnerable children. Thus, it supports the focus on equity because it allows concentrating on highly deprived groups and creating profiles of child deprivation.

The MODA method has already been extensively applied to a series of countries in the region and globally. A National-MODA (N-MODA) analysis has been conducted in Rwanda using the 2019 DHS data to follow up on the first 2018 MODA study. The N-MODA applies the MODA methodology fitting the national context and using high-quality survey data with customized choices of age groups, dimensions and thresholds of deprivation. The N-MODA aim is to: (i) capture national values and objectives concerning child development; (ii) explore the profile of deprived children, to locate them both geographically and socially;[10] (iii) improve the understanding of how the various deprivations by sector overlap to inform which deprivations may need to be addressed simultaneously; (iv) inform equity-based public policy responses to child deprivation; and (v) indicate deprivation coincidences that need further theoretical and empirical elaboration.

[10] Profiling is the basis for the equity analysis, showing differences between geographical regions, area of residence, parents' socio-economic situation and other variables.

2.2. Data and sample

This study uses empirical evidence from the Rwanda Demographic and Health Survey (DHS) 2019/20. The data were collected in 2019/20 by the National Institute of Statistics Rwanda (NISR). The survey draws on a national representative sample of 13,000 households in the country. The DHS 2019/20 response rate was 100.0 per cent.

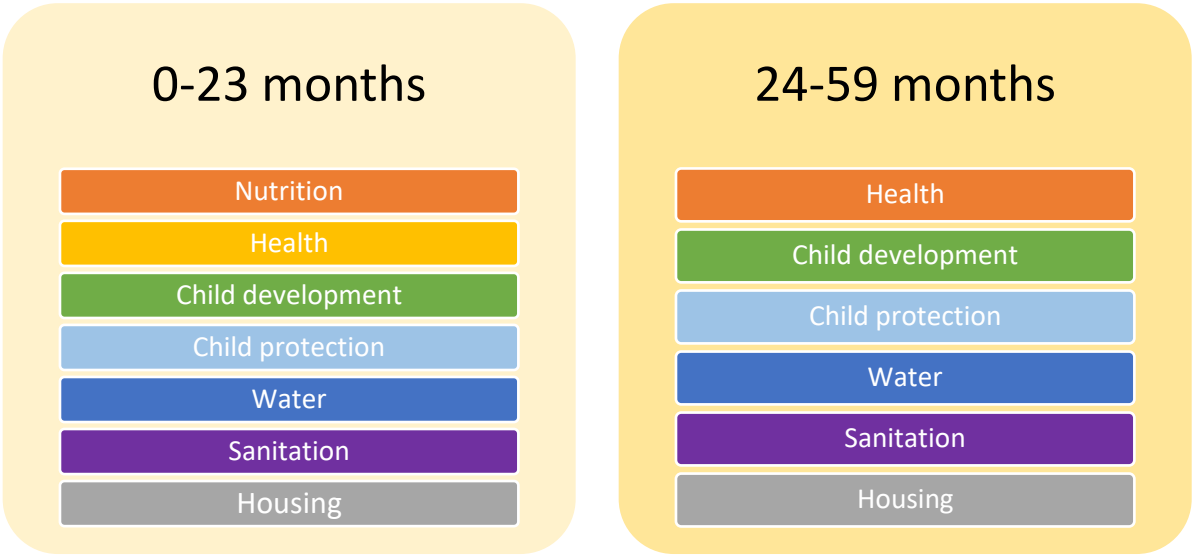
Besides the data quality, the main reasons for choosing this dataset are: (i) this is the most recent nationally representative survey available; (ii) the richness of indicators pertaining specifically to children under 5 and their vulnerabilities. The DHS 2019/20 data covers various aspects of child well-being, including nutrition, health, child development, child protection, water, sanitation and housing, making it appropriate for Rwanda's child deprivation analysis.

2.3. Selected parameters

The selection of indicators and dimensions for this study is dependent on the DHS 2019/20 dataset. The choice of indicators and dimensions also relies on the Convention on the Rights of the Child (CRC), and the Sustainable Development Goals (SDG) as a guiding framework to measure multidimensional child poverty. The final selection of dimensions and indicators for this study was done in common agreement with the NISR and UNICEF.

Following the life-cycle approach, the dimensions, indicators, and thresholds used were defined by age group to capture the specific needs of children concerning their developmental stage. Thus, children's deprivations were identified by age group: 0-23 months and 24-59 months. The selected dimensions for each age group are presented in Table 1 below.

Table 1. List of Dimensions for each age group using DHS 2019-20



Each dimension is measured by a set of indicators (see Table 2).[11] The MODA uses the union approach to aggregate indicators into dimensions. The union approach implies that when a child is deprived in at least one indicator in a dimension, the child is therefore deprived in that dimension. All indicators have equal weights in the dimension, as it is assumed that children's needs are equally important in the measurement of well-being that is captured by the dimension. Similarly, each dimension is equally important for children, as they are all relevant for their development.

Table 2. Dimensions, indicators and age groups for N-MODA Rwanda using DHS 2019-20, children aged 0-4 years

		Age groups	
Dimension	Indicator	0-23 months	24-59 months
Nutrition	Exclusive breastfeeding	X (0-5 months)	
	Infant and Young Child Feeding	X (6-23 months)	
Health	Skilled birth attendance	X	X
	Vaccination	X	X
	Mosquito nets	X	X
	Health insurance	X	X

[11] The full description of the thresholds that have been used in this study are included in Annex 1.

Dimension	Indicator	Age groups	
		0-23 months	24-59 months
Child Development	Early childhood education (ECE) attendance		X (3-4 years)
	Availability of toys and/or books		X
	Adult-child interaction		X (3-4 years)
Child Protection	Birth registration	X	X
	Adult-care	X	X
Water	Drinking water source	X	X
	Distance to water	X	X
Sanitation	Toilet type	X	X
	Cleanliness of toilet facility	X	X
Housing	Overcrowding	X	X
	Access to electricity	X	X
	Indoor pollution from solid cooking fuel	X	X

Source: Calculation based on Rwanda DHS 2019-20

The dimensions of nutrition, health, child development, and child protection include information related directly to the child. The dimensions of sanitation, water and housing record the household level data. Because of data constraints and relevance, some dimensions may not apply for both age groups. For example, the dimension of nutrition applies only for children aged 0-23 months, while child development is measured only for those aged 24-59 months. At the same time, the dimensions of health, child protection, water, sanitation and housing cover children in all age groups.

For the trend analysis, a slightly different set of indicators have been used for comparability between the 2014/15 and 2019/20 Demographic and Health Surveys (see Annex II). Because of the different indicators used, the deprivation and multidimensional poverty rate used in the trend analysis differs from the other sections of the results chapter.

At the multidimensional level, the MODA uses the cut-off approach, where a deprivation threshold k (with $0 < k \leq d$) determines if the child is multidimensionally poor or not. For analysing multidimensional poverty in Rwanda, the deprivation threshold for determining child deprivation was set at k=3 by consensus through a technical workshop with relevant stakeholders held in November 2021 in Kigali, i.e. a child with three or more dimension-deprivations is identified as multidimensionally poor. The choice for setting the threshold at k=3 was also based on the threshold set by other sub-Saharan African countries, namely Zimbabwe, South Africa, Burundi, Ghana, Guinea and Benin and the regional MODA study carried out by the regional office of UNICEF in West and Central Africa (UNICEF WCAR, 2020).

Numerous profiling variables were selected to define child vulnerability across all dimensions. This analysis can more clearly map child deprivation and facilitate designing the most suitable social protection responses to support those who need it the most. The selection of profiling variables was mainly conditioned by data availability.

2.4. Analytical approach

The MODA applies four steps in the analysis of multidimensional child poverty.

The single deprivation, also known as sector specific analysis, details the proportion of children deprived in each indicator and in each dimension. It provides a generic overview of deprivations as reflected in each indicator and dimension across the four age groups. The single deprivation analysis also includes profiling indicators such as gender, region and urban-rural location to reveal child vulnerabilities at these specific levels.

The deprivation count is the analytical step that presents the distribution of deprivations across dimensions. The deprivation count explores the depth of vulnerability for each age group, and is also performed in relation to the profiling variables.

The multidimensional deprivation overlap is the step that measures different deprivations that children experience simultaneously. For the two youngest age groups, the combination of deprivations may range between no deprivation to a maximum of seven deprivations. For the age group 5-14 years, the range of deprivations is zero to six, while for children in the oldest age group, the range of deprivations that children may experience at a time is zero to five.

The last step of the MODA is the analysis of multiple deprivation indices and include the *headcount ratio,* which is the incidence of multiple deprivation in various dimensions; the *average intensity,* which counts the number of deprivations that a child has as a percentage of all measured deprivations; and the *adjusted deprivation headcount* that calculates both the incidence and the depth of poverty.

The study also analyses the characteristics of multidimensionally poor children in order to identify the most vulnerable ones. A chi-squared test is carried out to assess whether the difference between the categories of children analysed are significant (a star (*) denotes that there is a significant difference).

The step-by-step analytical approach of MODA is detailed in the technical note by Neubourg and colleagues (2013). Furthermore, Annex III incorporates all the formulas used throughout the MODA analysis.

2.5. Limitations and data constraints

This study is constrained in its empirical and conceptual scale by a number of limitations. The analysisis dependent on the availability of measurements within the DHS 2019/20 data. The survey includes only a limited number of indicators that are collected specifically on children. Although household level indicators are relevant, they do not always capture the needs of children, especially when there is more than one child in the household, and when children are of different age and gender.

Some key dimensions of children's well-being such as nutrition could not be captured for all age groups because of unavailability of data in the DHS6 survey. A total of 7 dimensions were included for children aged 0-23 months and 6 dimensions

for those aged 24-59 months. Since the poverty status of a child is defined by whether he/she is deprived in at least 3 dimensions, younger children have more chances of being poor since more dimensions are used to measure their well-being. The percentage of poor children for the older age groups is thus underestimated.

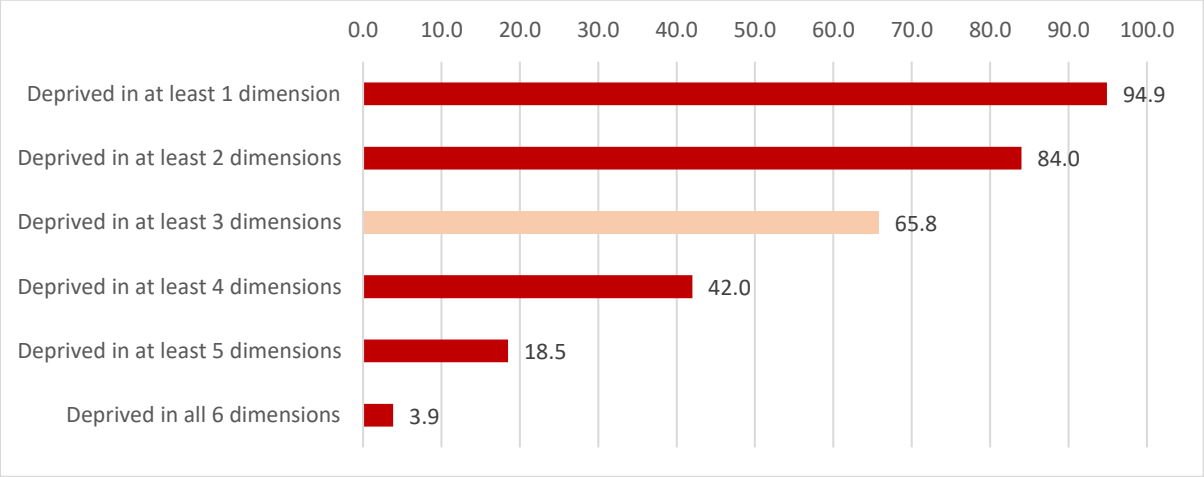
A number of indicators could also not be included and clustered in dimensions of well-being following the sampling of children in DHS data. For instance, physical access to health care facilities, food diversity and frequency for children aged 24-59 months, quality of drinking water are not available for all children aged under 5 years, which renders the inclusion of these indicators in dimensions problematic.

Chapter 3. Results

3.1. Multidimensional child poverty among children under five

Figure 1 presents the multidimensional poverty rates for each potential deprivation threshold in Rwanda. The majority of children in Rwanda (94.9 per cent) is deprived in at least one dimension of their well-being. This study considers a child to be multidimensionally poor if he or she is simultaneously deprived in at least 3 dimensions. Subsequently, nearly two out of three children under five (65.8 per cent) face multidimensionally poverty. Around 3.9 percent of children are deprived in all 6 dimensions at the same time.

Figure 1. Multidimensional deprivation headcount ratio (H) (%) at the national level for each threshold, 0-4 years



Source: Calculation based on Rwanda DHS 2019-20

The indices for multidimensional child poverty using a threshold of three deprivations are shown in Table 3. The multidimensional deprivation headcount (H) calculates the incidence of multidimensionally poor children in Rwanda. As mentioned above, 65.8 per cent of children under five experience deprivation in at least three dimensions simultaneously. Secondly, the average intensity among multidimensionally poor children (A) presents the average number of deprivations faced by multidimensionally deprived children in absolute numbers. On average, the multidimensionally poor children in Rwanda are deprived in 4.0 dimensions at the same time. Finally, the adjusted multidimensional deprivation headcount (M0) takes

into account both the prevalence and intensity of deprivation in an index ranging from 0 to 1. Although this index cannot be interpreted on its own, M0 can be used to compare population groups and geographical regions, with 0 representing no deprivation and 1 a higher level of deprivation among children. In Rwanda, the M0 stands at 0.44 at the national level. Rural areas indicate higher deprivation levels, with a M0 of 0.47 as compared to 0.27 in urban areas. At the provincial level, Kigali is better off with an M0 of 0.28 while the West is doing worst with an M0 of 0.48.

Table 3. Multidimensional deprivation indices at the national, rural, urban and regional level when using a threshold of K=3, 0-4 years

	Multidimensional deprivation headcount (H)*, %	Average no. of deprivations among the deprived (A)	Adjusted multidimensional deprivation headcount (M0)
National	65.8	4.0	0.44
Rural	70.4	4.0	0.47
Urban	43.4	3.8	0.27
East	69.4	4.0	0.47
North	66.8	4.0	0.44
West	72.1	4.0	0.48
South	67.4	4.0	0.44
Kigali	44.3	3.8	0.28

Source: Calculation based on Rwanda DHS 2019-20

3.2. Sectoral analysis by age group

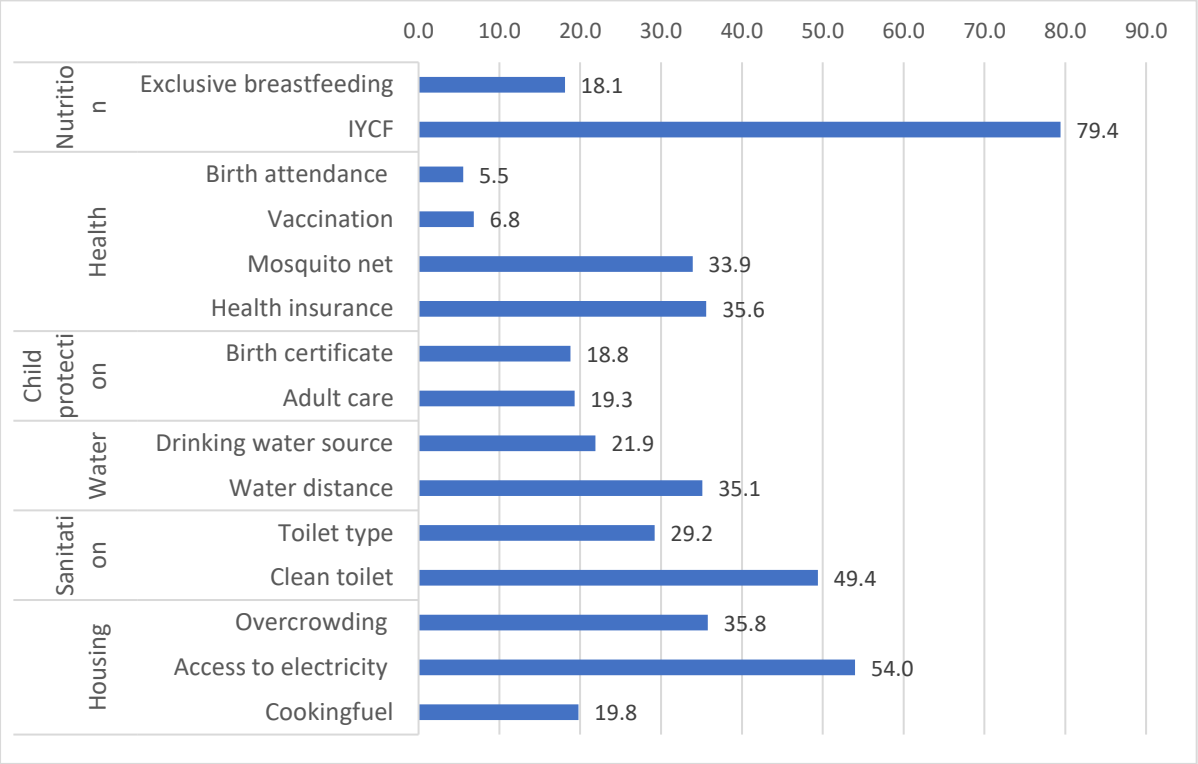
3.2.1. Children aged 0-23 months

Among children aged 6-23 months, 79.4 per cent do not meet the WHO requirements on Infant and Young Child Feeding (IYCF) with regards to meal frequency and meal diversity while 18.1 per cent of children under 6 months are not exclusively breastfed. In addition, approximately half of the children this age live in a household which does not have access to electricity and/or a clean toilet[12] (54.0 per

[12] A clean toilet is dry without flies, urine or excreta.

cent and 49.4 per cent respectively). The *skilled birth attendance* indicator presents the lowest deprivation rate of 5.5 per cent.

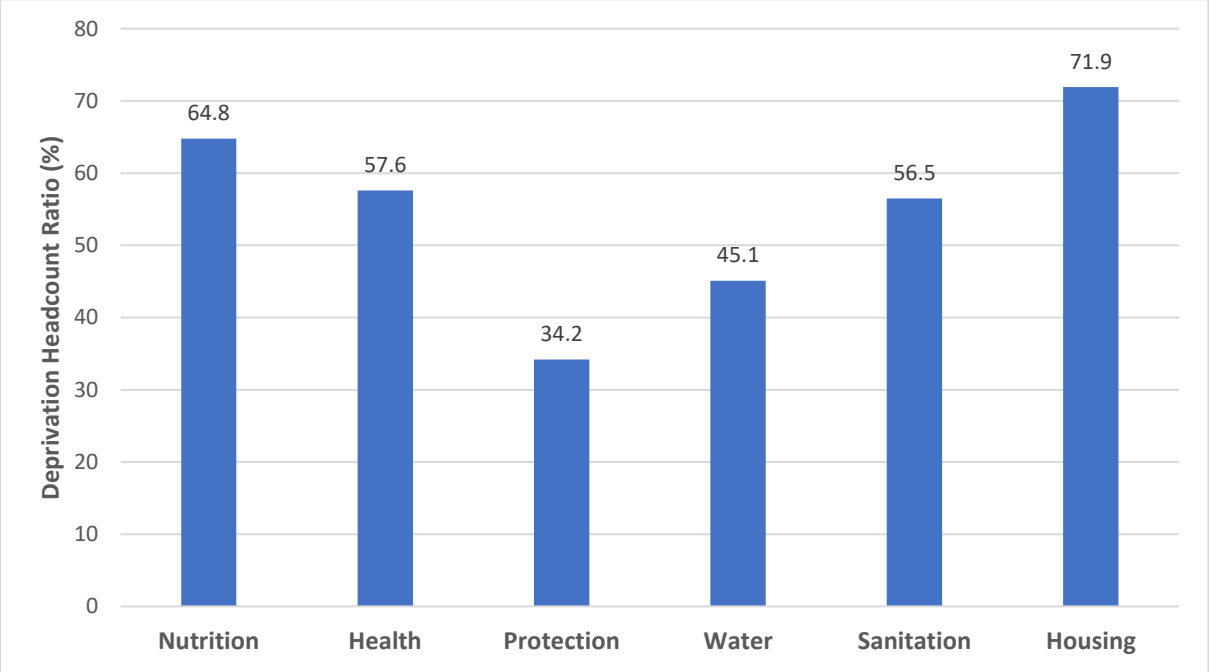
Figure 2. Deprivation headcount ratio (%) by each indicator at the national level, 0-23 months



Source: Calculation based on Rwanda DHS 2019-20

The MODA methodology uses the union approach to aggregate indicators into dimensions. A child is defined as deprived in a dimension if he or she experiences deprivation in at least one of its indicators. For example, a child is deprived in Housing when suffering from deprivation in at least one of the following indicators: *overcrowding*, *access to electricity* and *cooking fuel*. The highest deprivation levels are found in the Housing and Nutrition dimensions with rates of 71.9 per cent and 64.8 per cent respectively. The high deprivation level in the Nutrition dimension is driven by the indicators *exclusive breastfeeding (0-5 months)* and *infant and young child feeding (IYCF) (6-24 months)*. More than half (57.6 per cent) of the children of this age group suffer from deprivation in the Health dimension, consisting of the indicators *birth attendance*, *vaccination*, *mosquito net* and *health insurance*. Protection, on the other hand, yields the lowest deprivation rate of 34.2 per cent.

Figure 3. Deprivation headcount ratio (%) by each dimension at the national level, 0-23 months

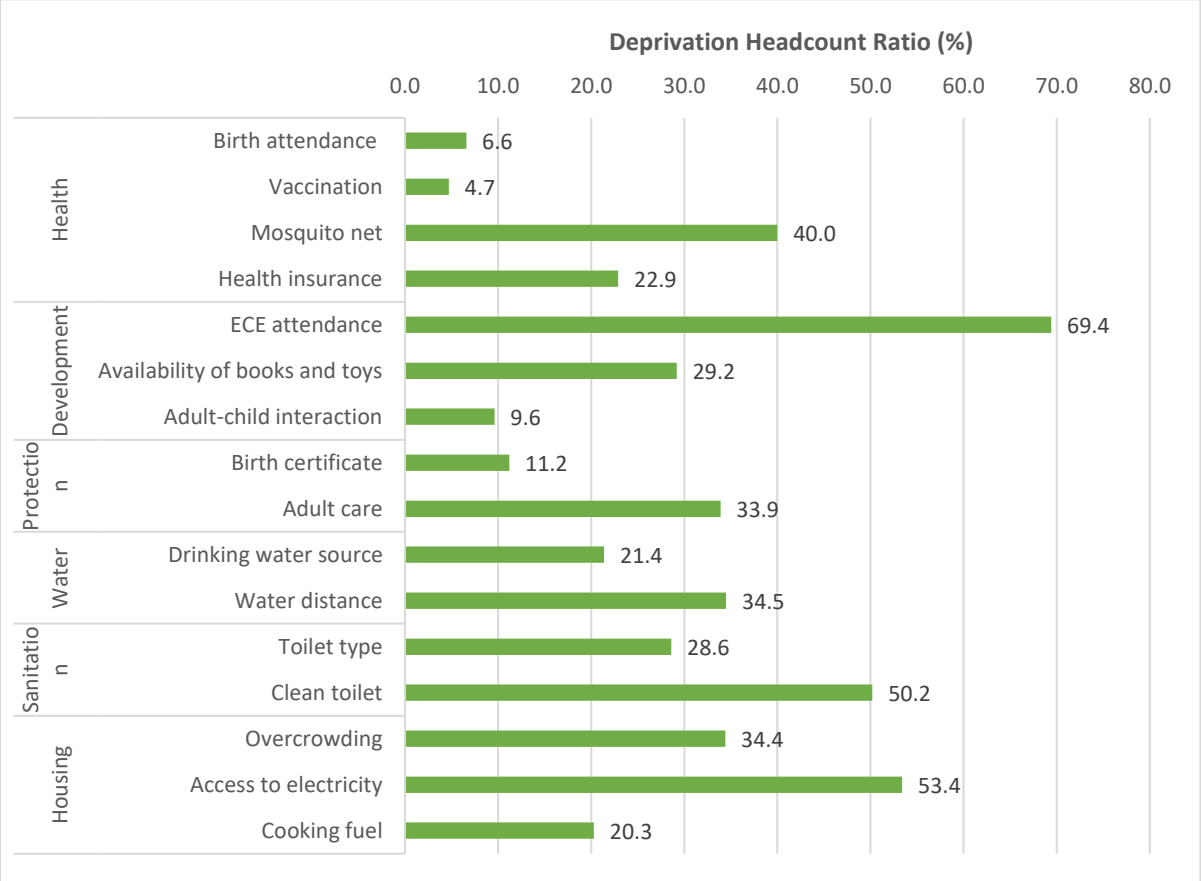


Source: Calculation based on Rwanda DHS 2019-20

3.2.2. Children aged 24-59 months

Among children aged 24-59 months, the highest deprivation level is found for the indicator *Early Childhood Education (ECE) attendance*, with 69.4 per cent of these children not attending any early childhood education or development programme. Furthermore, 53.4 per cent of the children live in households with no access to electricity. Half of the children live in households where toilet facilities are not dry and clean. Almost all children received skilled attendance at birth and are fully immunized with deprivation rates of 6.6 per cent and 4.7 per cent respectively.

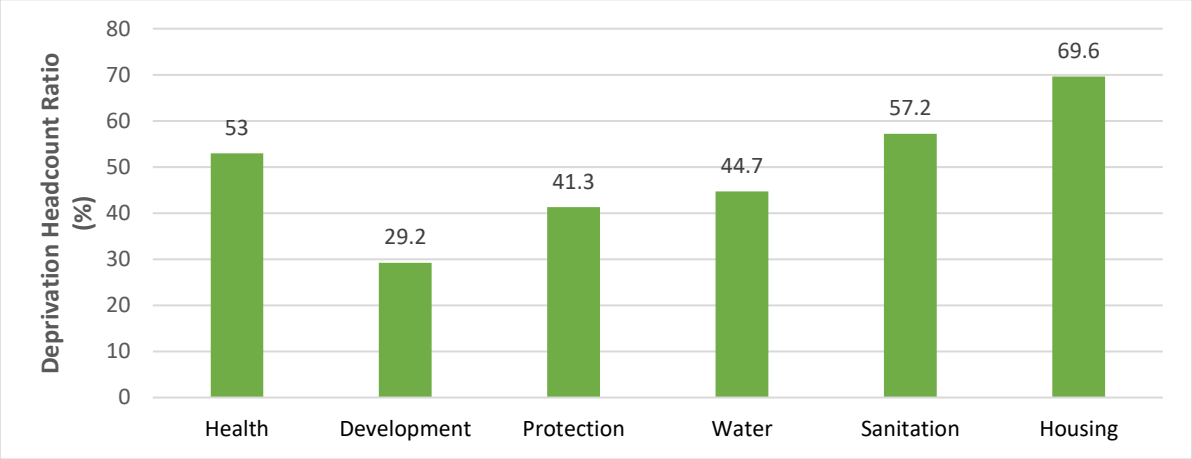
Figure 4. Deprivation headcount ratio (%) by each indicator at the national level, 24-59 months



Source: Calculation based on Rwanda DHS 2019-20

Figure 5 presents the deprivation levels by each dimension for children aged 24-59 months. Approximately seven out of ten children (69.6 per cent) are deprived in the Housing dimension. The dimension of Sanitation and Health have a deprivation rate of 57.2 per cent and 53.0 per cent respectively. Almost three out of ten children are deprived in the dimension of Development (29.2 per cent).

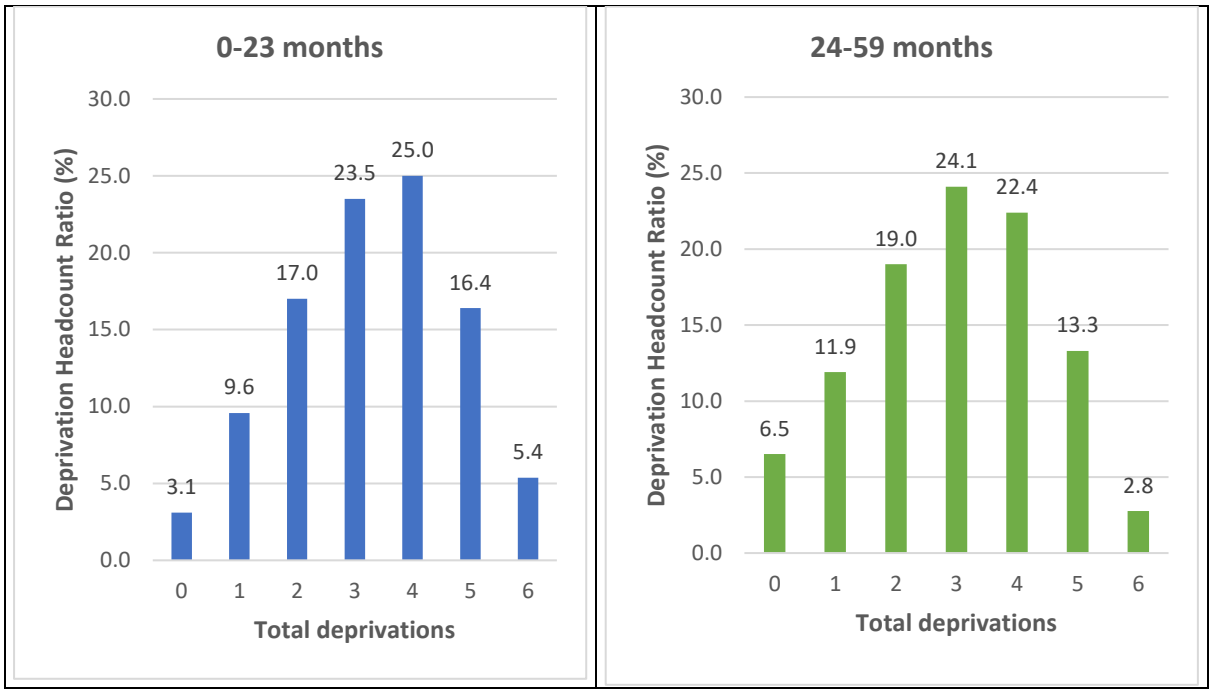
Figure 5. Deprivation headcount ratio (%) by each dimension at the national level, 24-59 months



3.3. Multidimensional child poverty

Figure 6 shows the distribution of deprivations by age group, indicating the percentage of children facing exactly 0, 1, 2, 3, …, 6 deprivations respectively. Only a small proportion of children (3.1 per cent for 0-23 months and 6.5 per cent for 24-59 months) are not deprived in any of the dimensions analysed; while the majority suffers from multiple deprivations. For both age groups, more than half of the children face 2-4 deprivations simultaneously (65.5 per cent). Around 5.4 per cent of children aged 0-23 months and 2.8 per cent of children aged 24-59 months experience deprivation in all six dimensions at the same time.

Figure 6. Deprivation distribution at the national level by age group



Source: Calculation based on Rwanda DHS 2019-20

3.3.1. Multidimensional indices H, A and M0

At national level, 70.3 per cent of children aged 0-23 months and 62.6 per cent of children aged 24-59 months are multidimensionally poor, that is, they are deprived in at least 3 dimensions of well-being. On average, those multidimensionally poor children face 4.1 and 3.9 deprivations respectively out of the total number of dimensions. Both the incidence and intensity of deprivation being higher in rural as compared to urban areas lead to a higher index of multidimensional deprivation, M0, for rural children, indicating that they are worse off.

Table 4. Multidimensional Indices H, A, M0 at national, urban and rural level using threshold of K=3

		Multidimensional deprivation headcount (H)*, %	Average intensity among the deprived (A); %	Average intensity among the deprived (A); in absolute numbers	Adjusted multidimensional deprivation headcount (M0)
0-23 months	*National*	70.3	67.5	4.1	0.48
	Urban	49.4	63.9	4.1	0.32

		Multidimensional deprivation headcount (H)*, %	Average intensity among the deprived (A); %	Average intensity among the deprived (A); in absolute numbers	Adjusted multidimensional deprivation headcount (M0)
	Rural	74.4	68.0	3.8	0.51
24-59 months	*National*	62.6	65.3	3.9	0.41
	Urban	39.5	62.0	3.9	0.25
	Rural	67.6	65.7	3.7	0.44

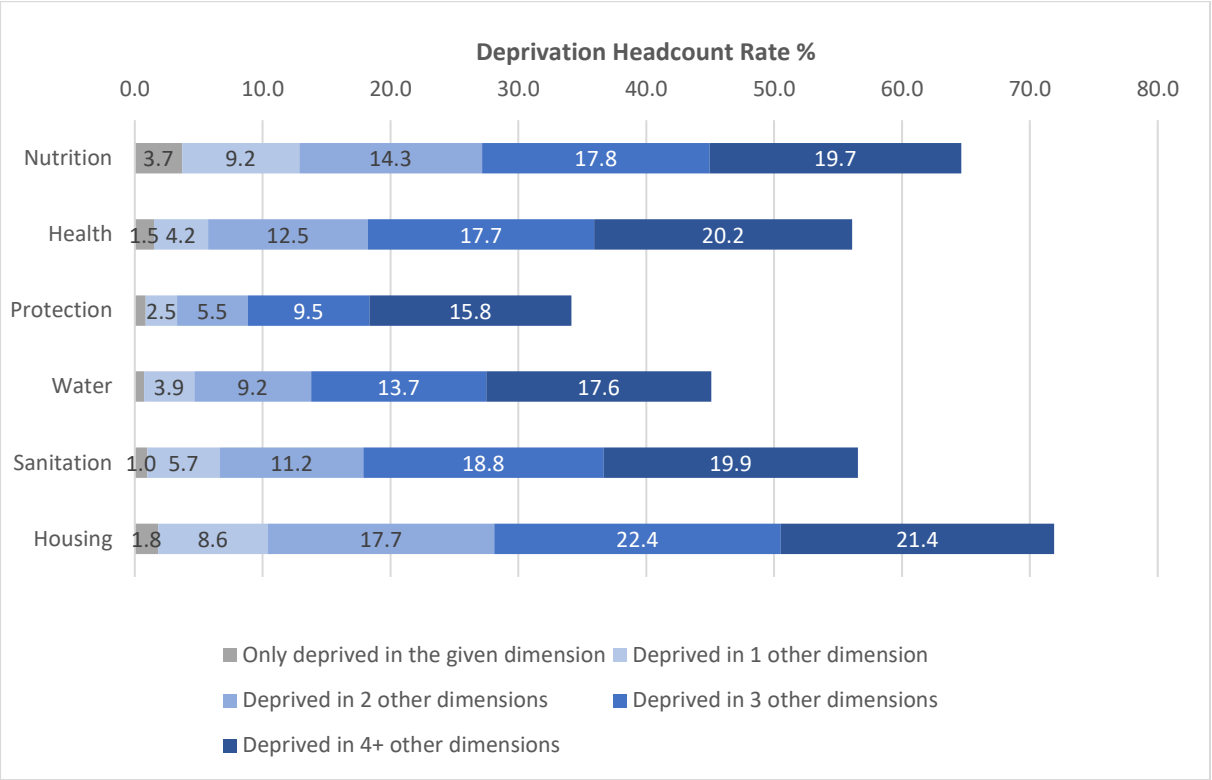
Source: Calculation based on Rwanda DHS 2019-20

3.3.2. Overlap analysis

a. Overlap by each dimension

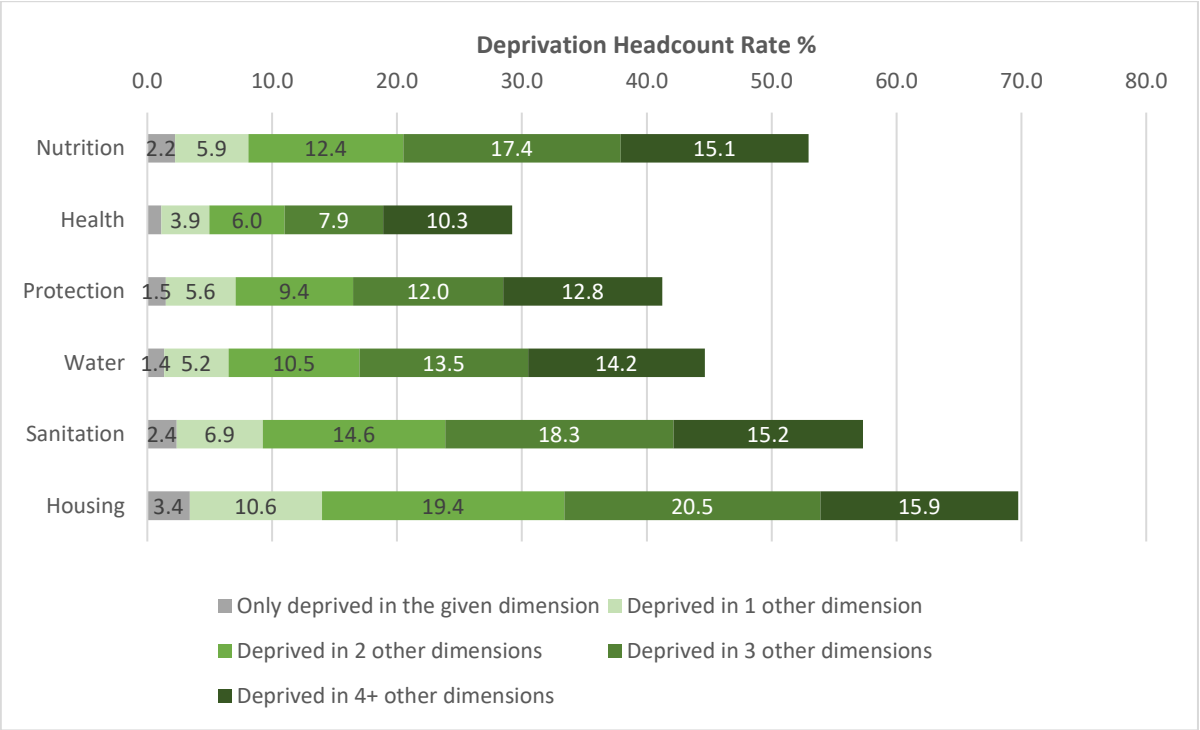
The overlap by each dimension confirms that there is a very small percentage of children deprived in only one dimension at a time, irrespective of the nature of the dimension (see Figure 7 and 8). For example, 64.8 per cent of children aged 0-23 months are deprived in the Nutrition dimension. Among those children, up to 19.7 per cent experience deprivations in 4 or more other dimensions of well-being while 2.2 per cent are deprived in Nutrition only (Figure 7). Similar results are observed for all dimensions and both of the age groups.

Figure 7. Overlap by each dimension, 0-23 months



Source: Calculation based on Rwanda DHS 2019-20

Figure 8. Overlap by each dimension, 24-59 months



Source: Calculation based on Rwanda DHS 2019-20

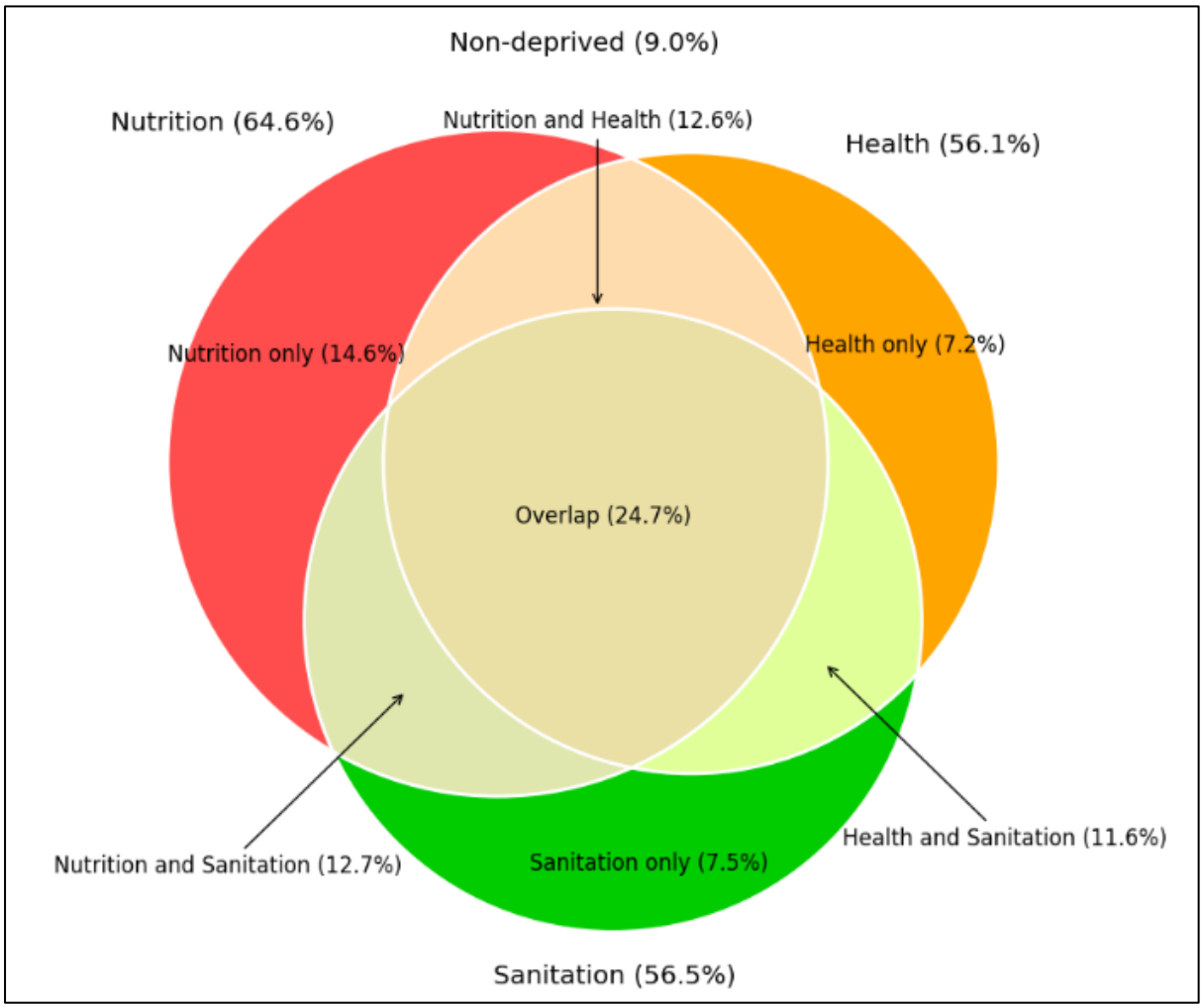
b. Three-way overlap

In order to design multi-sectorial policies, it is important to assess which deprivations overlap for children in each age group. In this section, the overlap between combinations of three deprivations is analyzed. All possible combinations of deprivation overlap of three dimensions are presented in Annex III. For brevity, only one example for each age group in the form of a Venn Diagram is shown here. The Venn Diagram provides the following information: (1) deprivation rates for each dimension separately; (2) deprivation overlap between any two dimensions; (3) deprivation overlap between all dimensions; and (4) the proportion of children that are not deprived in any of the included dimensions.

Figure 9 displays the deprivation overlap between the dimensions of Nutrition, Health and Sanitation, among children aged 0-23 months. It is found that 24.7 per cent of all children in this age group are simultaneously deprived in all three aforementioned dimensions, while very few children are deprived in only one dimension (14.6 per cent in Nutrition, 7.2per cent in Health and 7.5 per cent in Sanitation). This implies that in terms of policy making, targeting these three areas of vulnerability simultaneously would impact a large proportion of children in this age cohort. An example of such policy for children aged 0-23 months could be a

package consisting of food items, health services and improvements to existing toilet facilities of the beneficiary household.

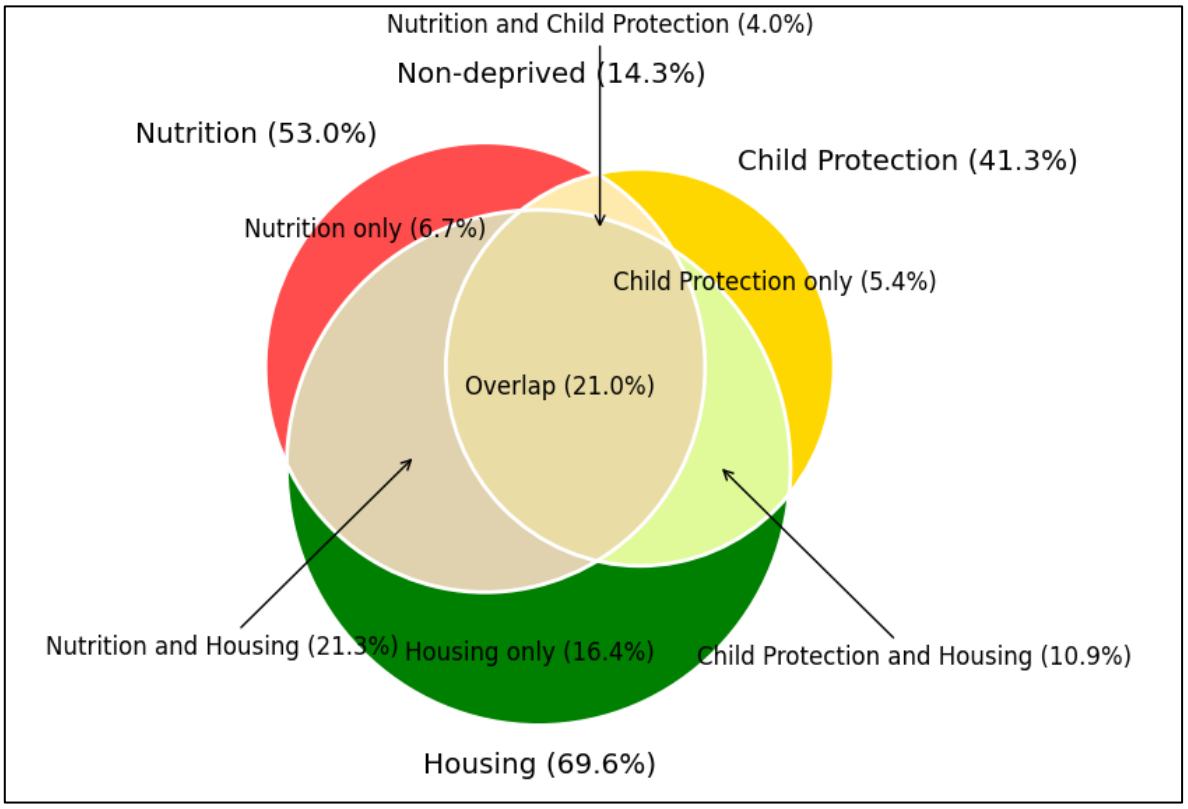
Figure 9. Three-way overlap between the dimensions Nutrition, Health & Sanitation, 0-23 months



Source: Calculation based on Rwanda DHS 2019-20

For children aged 24-59 months, the overlap between the dimensions of Nutrition, Child Protection and Housing is taken as an example (Figure 10). It is again observed that the deprivation levels experienced in only one of the dimensions are relatively low. Around 21.0 per cent of children in this age group are deprived in all three dimensions simultaneously while 21.3 per cent face deprivation in the Nutrition and Housing dimensions. Policies addressing issues of nutrition, child protection and housing at the same time will be highly beneficial and will contribute to reducing poverty intensity for this age group.

Figure 10. Three-way overlap between the dimensions Nutrition, Child Protection & Housing, 24-59 months



Source: Calculation based on Rwanda DHS 2019-20

3.4. Profile of the multidimensionally poor children

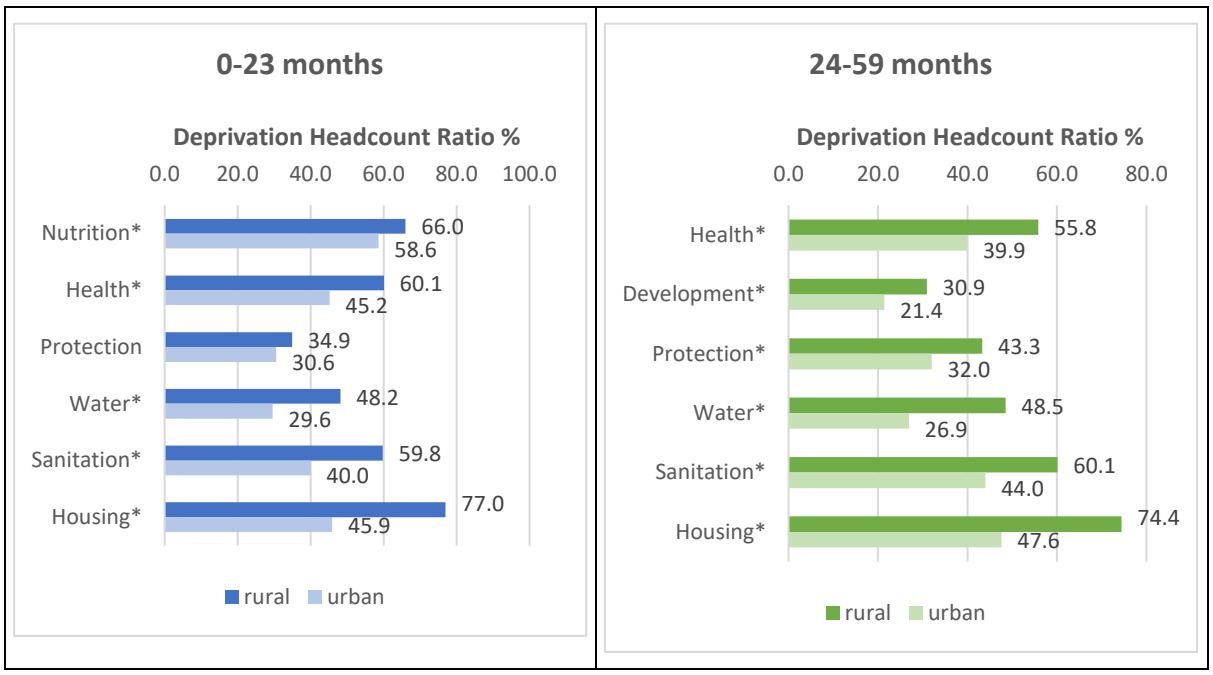
The following section identifies the various geographical, household and individual characteristics of the most deprived children in Rwanda to better inform and design policies and programmes.

3.4.1. Sectoral deprivation analysis

a. Area of residence

Figure 9 presents the deprivation rates by dimension and area of residence for each age group. Children living in rural areas show higher deprivation levels than children living in urban areas for all dimensions analysed. The data show that 77.0 per cent of children aged 0-23 months living in rural areas experience deprivation in the Housing dimension compared to 45.9 per cent of children living in urban areas. Moreover, all differences observed are statistically significant.

Figure 11. Deprivation headcount ratio (%) by dimension and area of residence, for each age group



Source: Calculation based on Rwanda DHS 2019-20. Note: * p<0.05 in Chi-squared test of independence.

b. Province of residence

At the regional level, it is found that children living in the City of Kigali have the lowest level of deprivation in most dimensions with deprivation rates ranging from 21.2 per cent to 59.7 per cent across the various dimensions and age groups (Table 4 and Table 5). However, Kigali presents the highest deprivation level in terms of Child protection for children aged 0-23 months (38.9 per cent). The Northern and Eastern provinces, on the other hand, are worst off in comparison with other provinces with regards to Nutrition, Health, Water and Sanitation. Children aged 24-59 months living in the Western province show the highest deprivation level in the Development dimension (37.1 per cent).

Table 5. Deprivation headcount ratio (%) by each dimension at the provincial level, 0-23 months

	Nutrition*	Health*	Protection	Water*	Sanitation*	Housing*
East	67.8	60.8	31.6	53.4	54.3	72.1
North	71.3	53.4	30.3	42.2	64.1	74.4
West	64.0	63.9	36.7	45.9	62.8	78.7
South	60.6	53.3	34.1	46.6	58.1	77.9
Kigali	59.7	51.4	38.9	28.0	39.2	47.2

Source: Calculation based on Rwanda DHS 2019-20. Note: * p<0.05 in Chi-squared test of independence.

Table 6. Deprivation headcount ratio (%) by each dimension at the provincial level 24-59 months

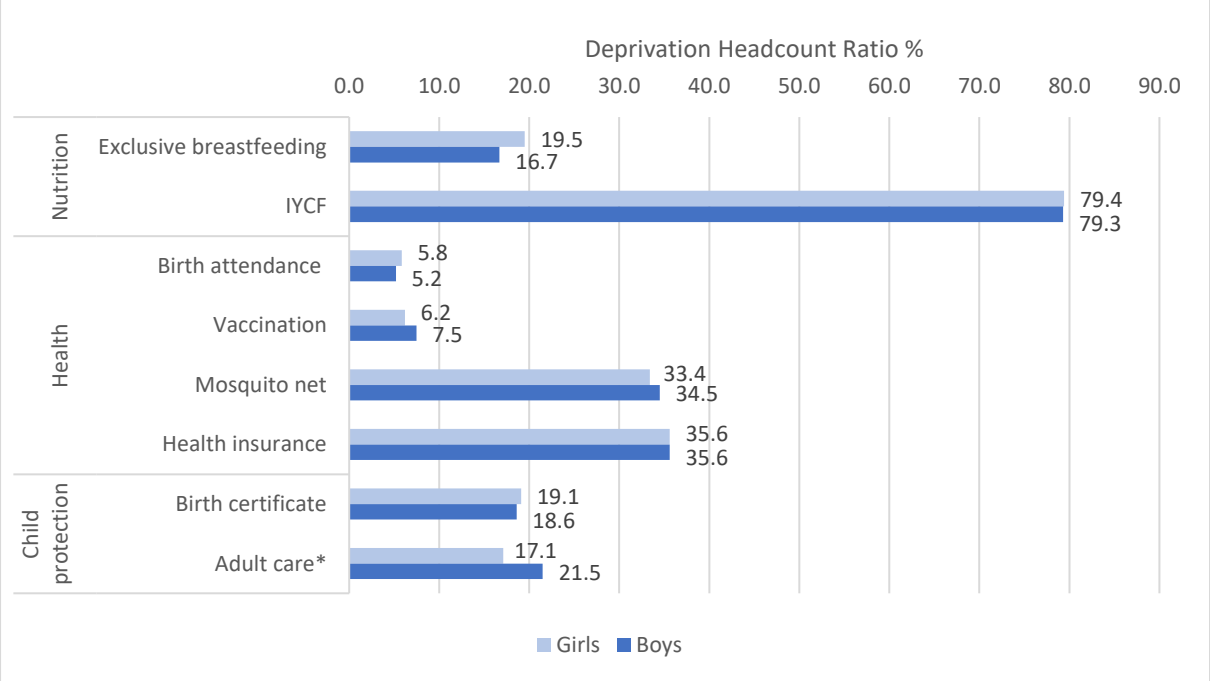
	Health*	Development*	Protection*	Water*	Sanitation*	Housing*
East	61.4	27.3	37.3	58.1	56.4	69.4
North	49.2	31.1	44.7	41.8	63.1	74.1
West	56.7	37.1	44.4	45.3	62.2	73.3
South	52.2	25.8	44.8	43.6	57.3	76.9
Kigali	36.4	21.2	34.1	23.5	43.0	47.8

Source: Calculation based on Rwanda DHS 2019-20

c. Gender of the child

This study does not observe any significant differences in terms of deprivation by dimension based on the gender of the child. However, at the indicator level, the difference between boys and girls with regards to the indicators *adult care* is statistically significant for children aged 0-23 months. A higher proportion of boys this age are left alone or left in the care of another child (<10 years old) in comparison to girls (21.5 per cent versus 17.1 per cent) (see Figure 12). Similar results are found for the older age group, although the results are not statistically significant.

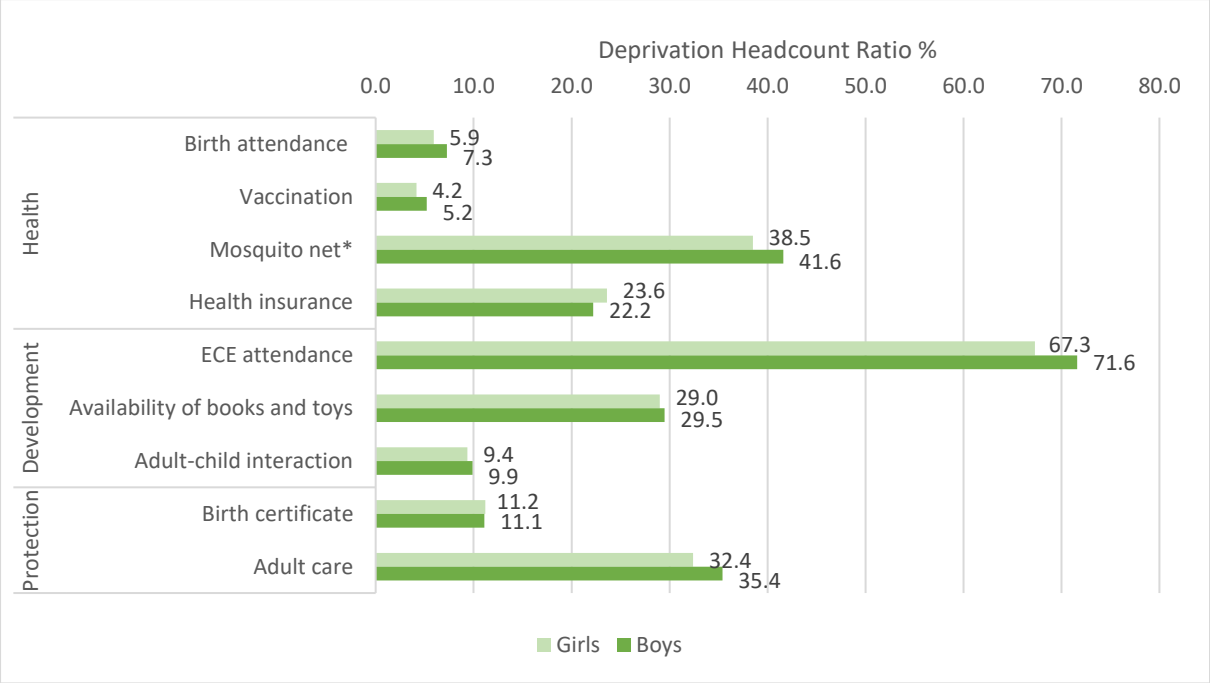
Figure 12. Deprivation headcount ratio (%) by indicator and gender of the child, 0-23 months



Source: Calculation based on Rwanda DHS 2019-20. Note: * p<0.05 in Chi-squared test of independence.

In addition, Figure 13 presents the deprivation rates for each indicator at the individual level for children aged 24-59 months by gender. Around four out of ten (41.6 per cent) boys this age did not sleep under a mosquito net during the night prior to the survey opposed to 38.5 per cent of girls. While the difference is not statistically significant, boys aged 24-59 months also show a higher deprivation rate in terms of ECE attendance than girls (71.6 per cent versus 67.3 per cent).

Figure 13. Deprivation headcount ratio (%) by indicator and gender of the child, 24-59 months

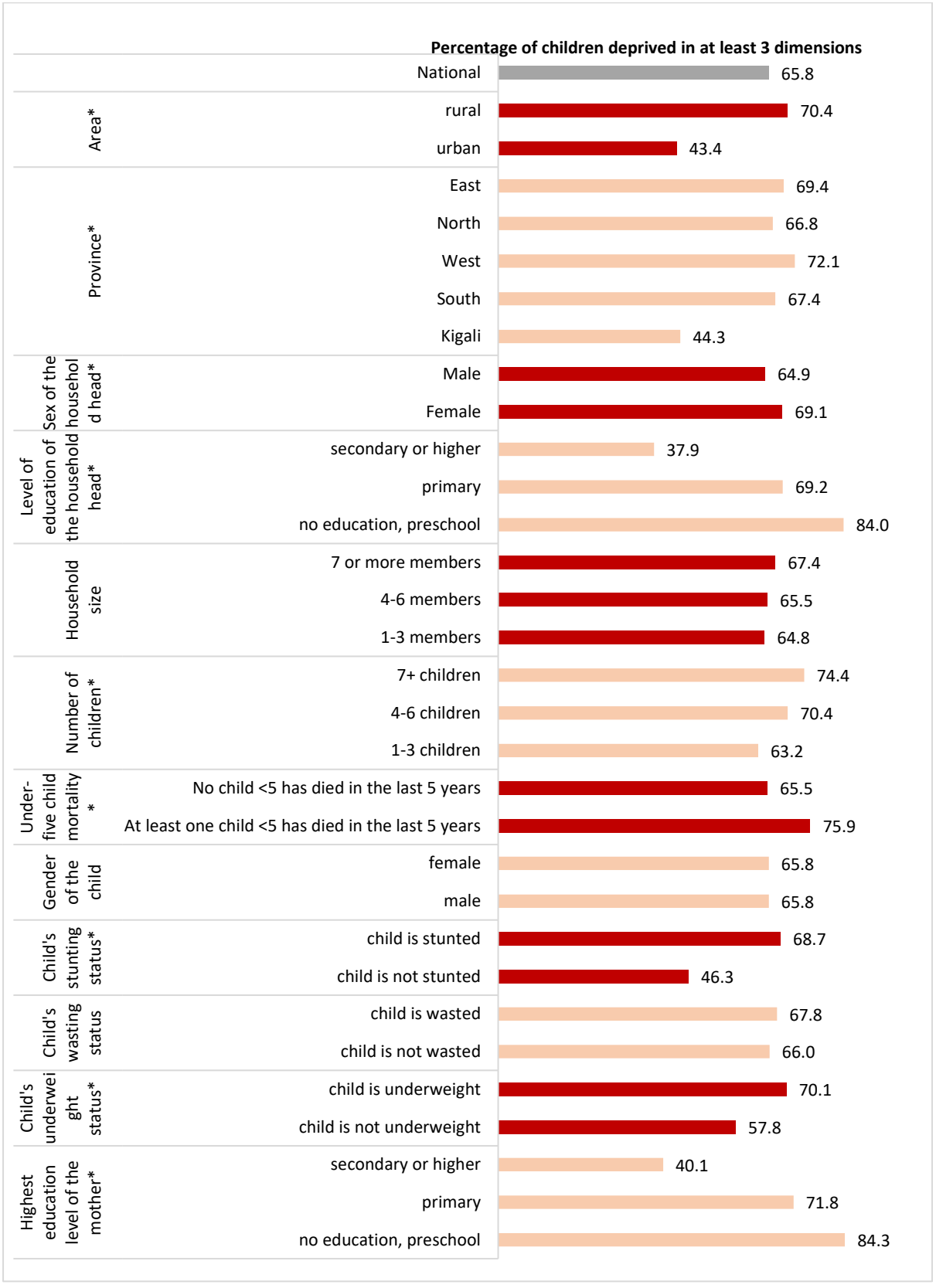


Source: Calculation based on Rwanda DHS 2019-20. Note: * p<0.05 in Chi-squared test of independence.

3.4.2. Profile of the multidimensionally poor children

Figure 14 displays the proportion of multidimensionally poor children (i.e. deprived in at least 3 dimensions at the same time) according to their characteristics.

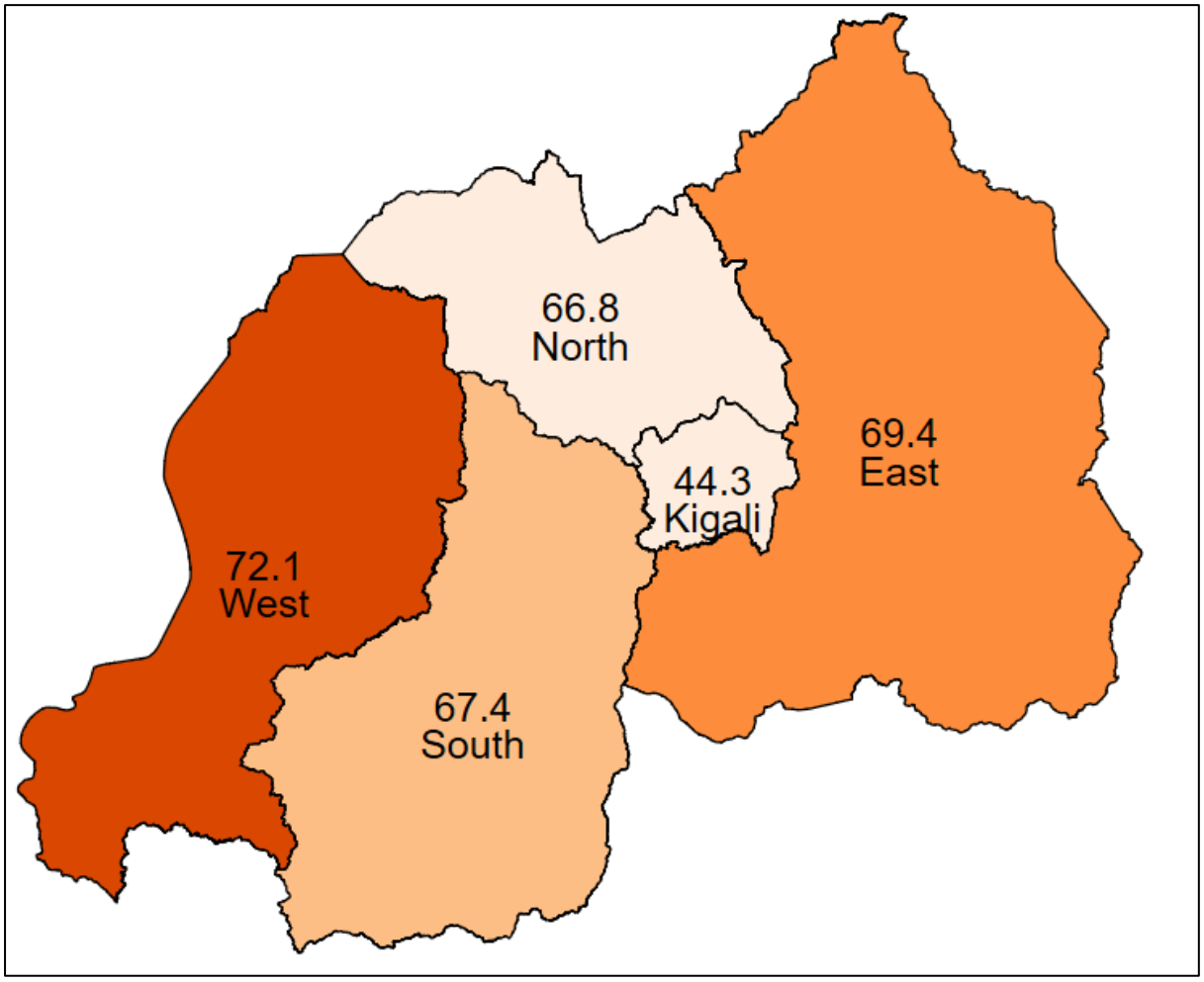
Figure 14. Percentage of multidimensionally poor children disaggregated by their characteristics



Source: Calculation based on Rwanda DHS 2019-20. Note: * p<0.05 in Chi-squared test of independence.

At the geographical level, seven out of ten children living in rural areas (70.4 per cent) are multidimensionally poor compared to four out of then children in urban areas (43.4 per cent). At the regional level, the highest multidimensional deprivation rate is found among children in the Western province (72.1 per cent). Kigali has the lowest proportion of multidimensionally poor children (44.3 per cent) (see Figure 15).

Figure 15. Percentage of multidimensionally poor children disaggregated by provinces



Source: Calculation based on Rwanda DHS 2019-20.

Furthermore, children living in households with a larger number of household members and/or children tend to have higher multidimensionally deprivation rates than those living households with fewer members and/or children. For example, 74.4 per cent of children living in households with seven or more children are multidimensionally poor compared to 63.2 per cent of children living in households with one to three children. Furthermore, children living in households where at least

one child under five has died in the last five years are more likely to be multidimensionally poor than children living in households where there was no case of under-five child mortality (75.9 per cent versus 65.5 per cent).

The education level of the household head and/or the mother has an important influence on the deprivation levels of children. The higher the education level, the lower the multidimensional deprivation levels experienced. More than twice as many children whose mother has no education are multidimensionally poor in comparison to children whose mother achieved secondary or higher education levels (84.3 per cent versus 40.1 per cent).

No significant differences are observed based on the gender of the child. In addition, nearly seven out of ten stunted children (68.7 per cent) are multidimensionally poor compared to 46.3 per cent of non-stunted children. Underweight children show higher multidimensional deprivation levels than children who are not underweight (70.1 per cent and 57.8 per cent).

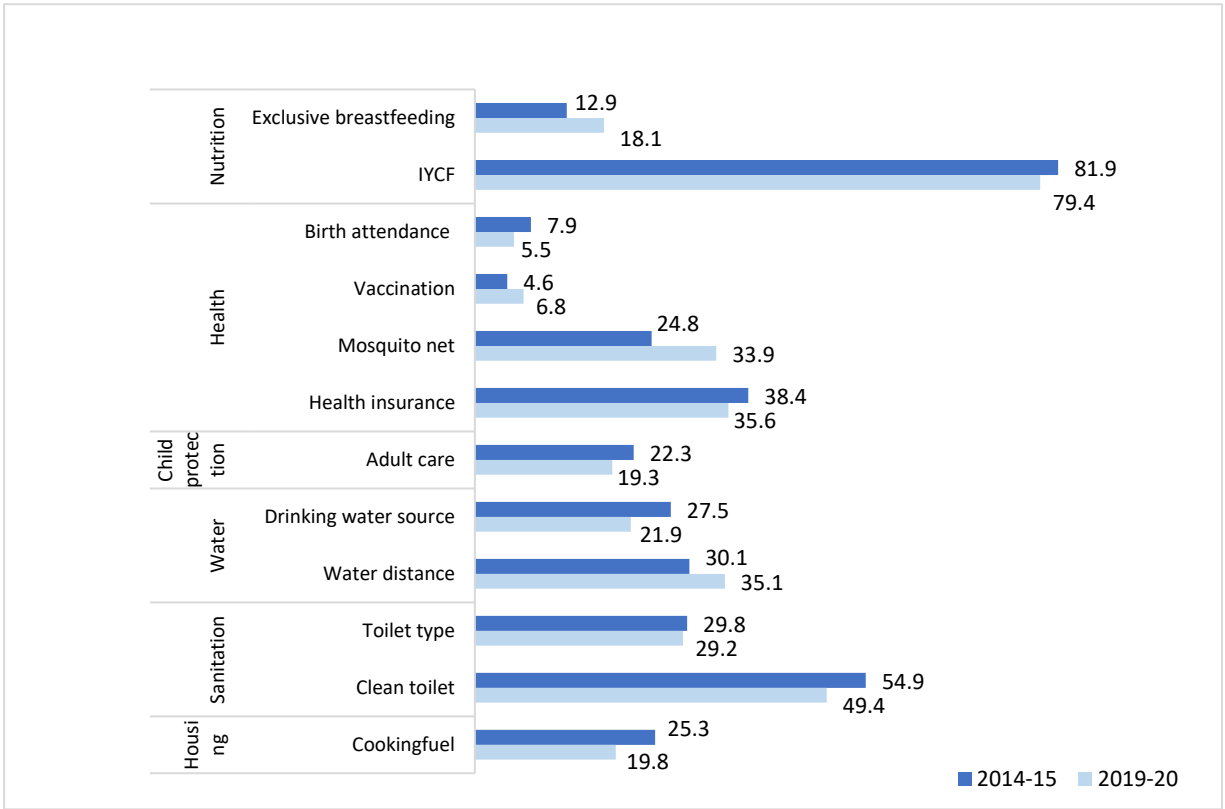
Chapter 4. Trend analysis

4.1. Sectoral analysis

4.1.1. Children aged 0-23 months

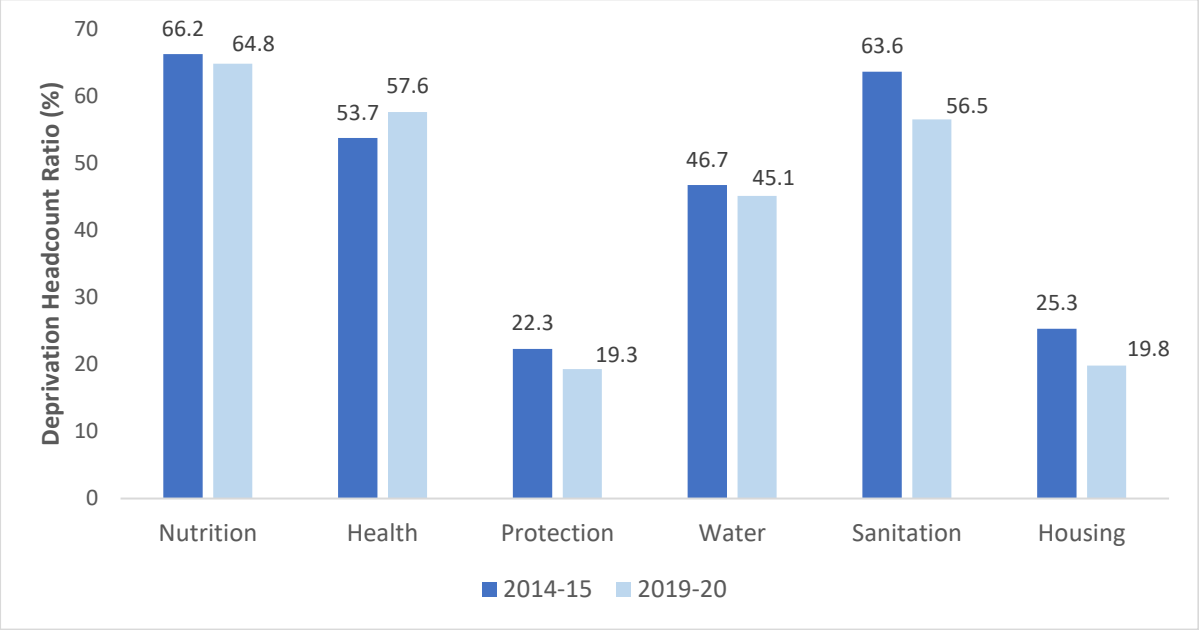
Over the last 5 years, the deprivation rates have slightly changed for almost all indicators for children 0-23 months. The indicators of *infant and young child feeding (IYCF)*, *birth attendance*, *health insurance*, *adult care*, *drinking water source*, *toilet type*, *cleanliness of toilet* and *cooking fuel* have recorded an improvement whereas the deprivation rates for the indicators of *exclusive breastfeeding*, *vaccination*, *mosquito nets* and *water distance* did increase (see Figure 16). At the dimensional level, there has been a decrease in the deprivation rates for all dimensions with the exception of Health where an increase of around 4 per cent is recorded (see Figure 17). The most considerable decrease in deprivation is observed for the dimension of Sanitation, from 63.6 per cent in 2014/15 to 56.5 per cent in 2019/20.

Figure 16. Trend analysis. Deprivation headcount ratio (%) by each indicator at the national level, 0-23 months



Source: Calculation based on Rwanda DHS 2014-15 and DHS 2019-20

Figure 17. Trend analysis. Deprivation headcount ratio (%) by each dimension at the national level, 0-23 months

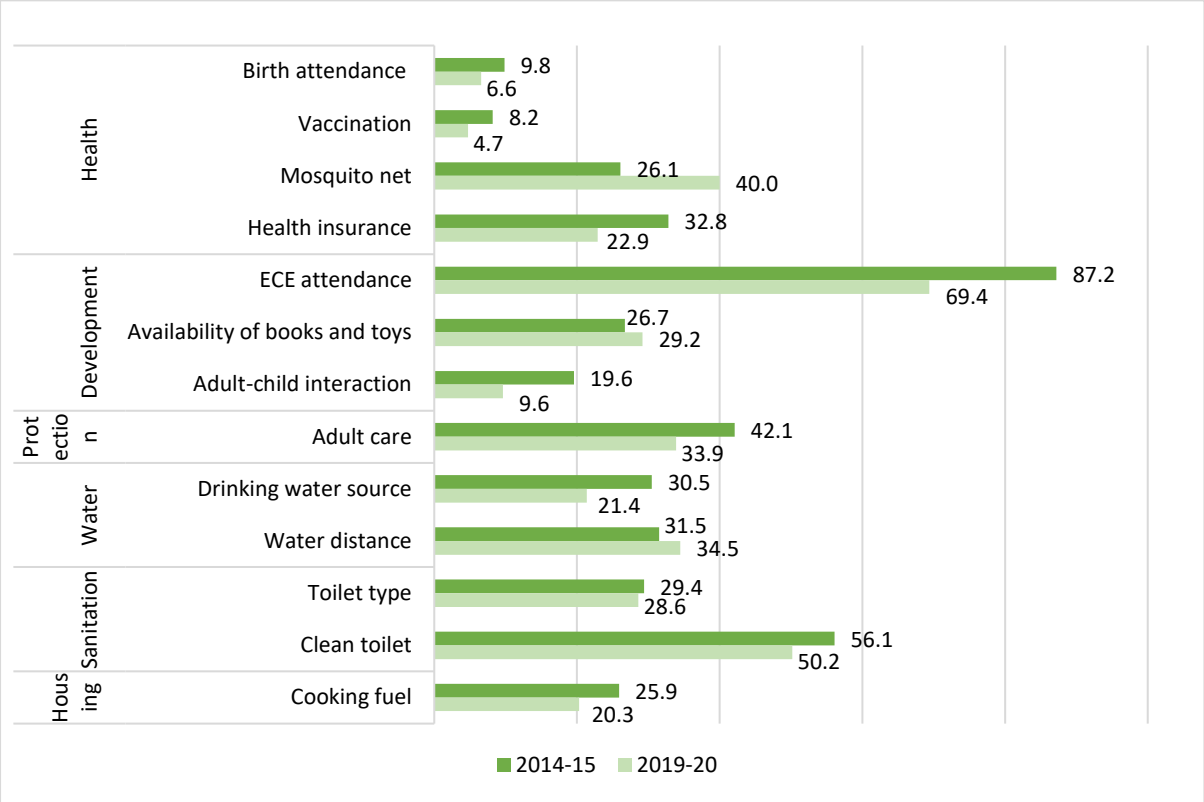


Source: Calculation based on Rwanda DHS 2014-15 and DHS 2019-20

4.1.2.Children aged 24-59 months

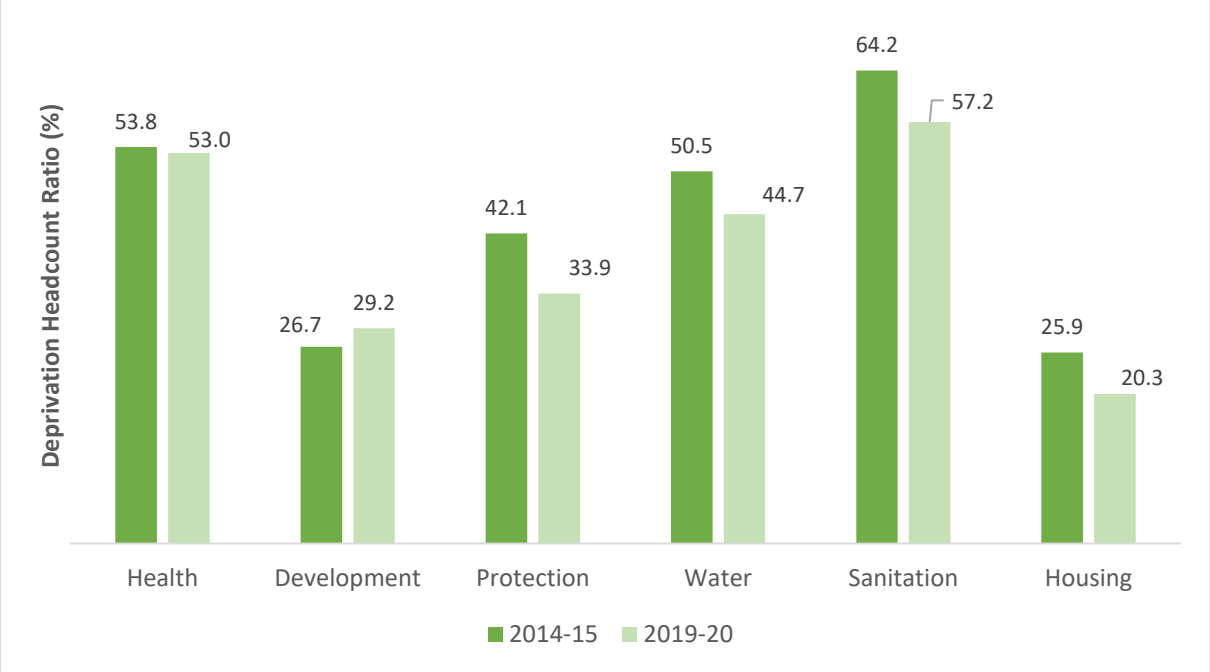
For children aged 24-59 months, most indicators show a decrease in deprivation levels between 2014/15 and 2019/20 (see Figure 18). However, an increase in deprivation is observed for the indicators *mosquito net*, *availability of toys and books* and *water distance*. After aggregating the indicators into dimensions, only the dimension of Development presents a slight increase in deprivation, from 26.7 per cent to 29.2 per cent (see Figure 19). All the other dimensions recorded a decrease in deprivation, the highest being the Protection and Sanitation dimensions.

Figure 18. Trend analysis - Deprivation headcount ratio (%) by each indicator at the national level, 24-59 months



Source: Calculation based on Rwanda DHS 2014-15 and DHS 2019-20

Figure 19. Trend analysis - Deprivation headcount ratio (%) by each dimension at the national level, 24-59 months



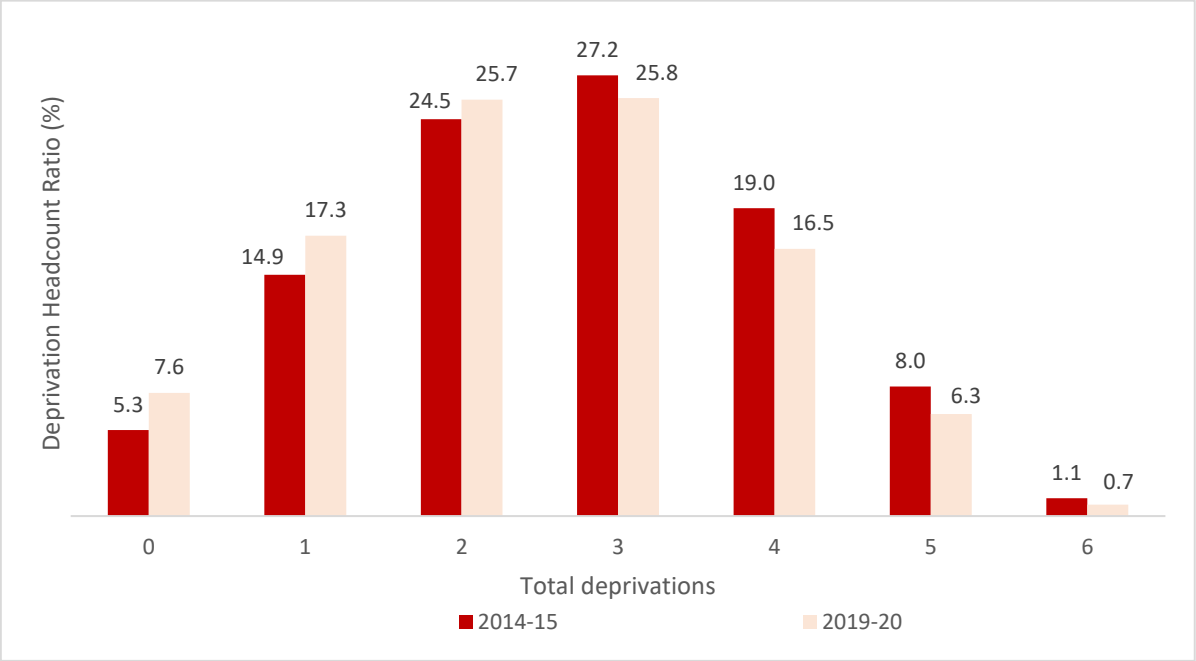
Source: Calculation based on Rwanda DHS 2014-15 and DHS 2019-20

4.2. Multidimensional analysis

4.2.1.Deprivation distribution

Between 2014/15 and 2019/20, the number of children (0-4 years) suffering from 4, 5 or 6 deprivations simultaneously declined from 28.1 per cent to 23.5 per cent (see Figure 20). On the other hand, a higher proportion of children are deprived in 0,1 or 2 deprivations in 2019/20.

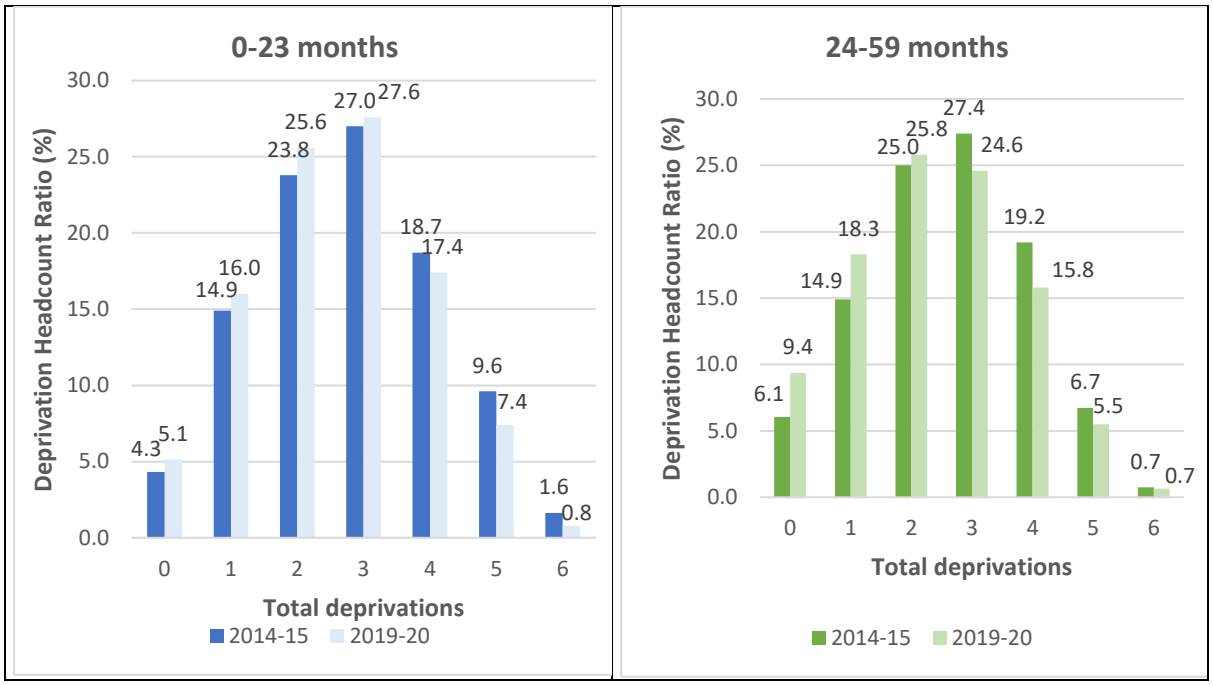
Figure 20. Trend analysis - Deprivation distribution at the national for all children 0-4 years



Source: Calculation based on Rwanda DHS 2014-15 and DHS 2019-20

Figure 21 disaggregates the deprivation distribution results for each age group. The number of children having 0 deprivations increased from 4.3 per cent to 5.1 per cent for children aged 0-23 months and from 6.1 per cent to 9.4 per cent for those aged 24-59 years. The proportion of children experiencing fewer number of deprivations increased while the proportion suffering from a higher number of deprivations decreased.

Figure 21. Trend analysis - Deprivation distribution at the national level by age group



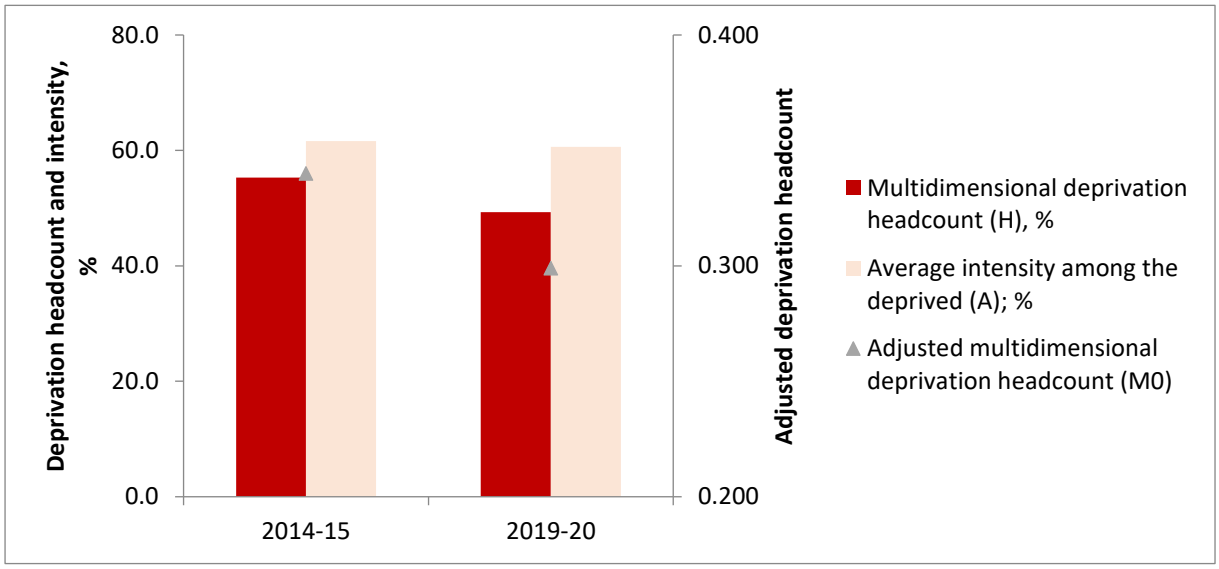
Source: Calculation based on Rwanda DHS 2014-15 and DHS 2019-20

4.2.2. Multidimensional indices H, A and M0

The multidimensional deprivation incidence among children under five reduced from 55.3 per cent in 2014/15 to 49.3 per cent in 2019/20 (see Figure 22).

The intensity of deprivation has also slightly decreased over time from 61.6% to 60.6%, indicating that children experienced deprivations in a lower number of dimensions in 2019/20 compared to 2014/15. In general, the multidimensional index (combination of incidence and intensity) decreased from 0.34 to 0.30.

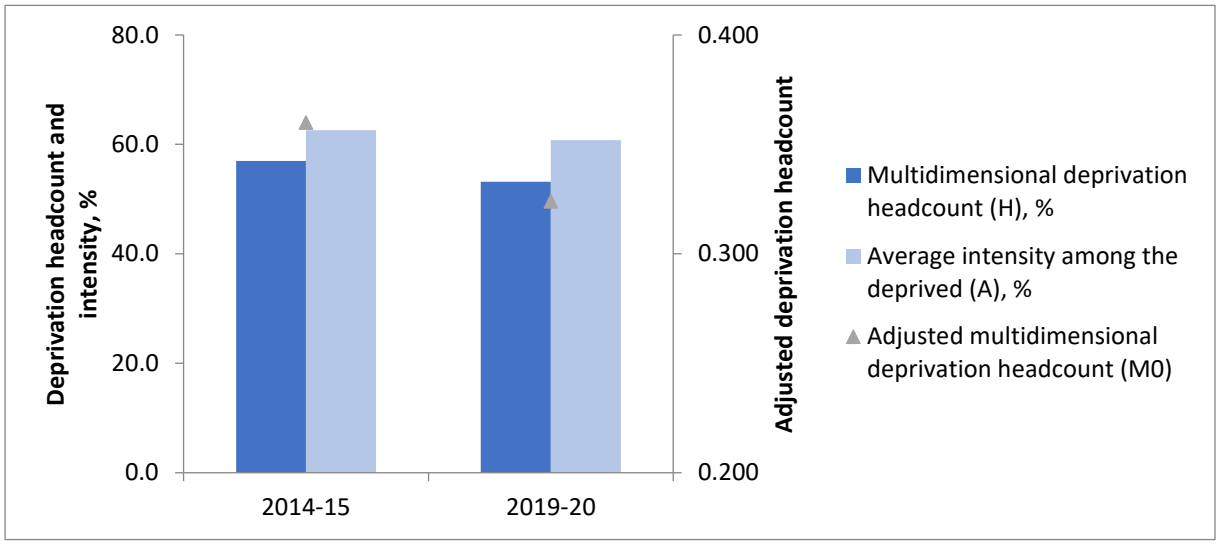
Figure 22. Trend analysis - Multidimensional deprivation indices at the national level when using a threshold of K=3, 0-4 years



Source: Calculation based on Rwanda DHS 2014-15 and DHS 2019-20

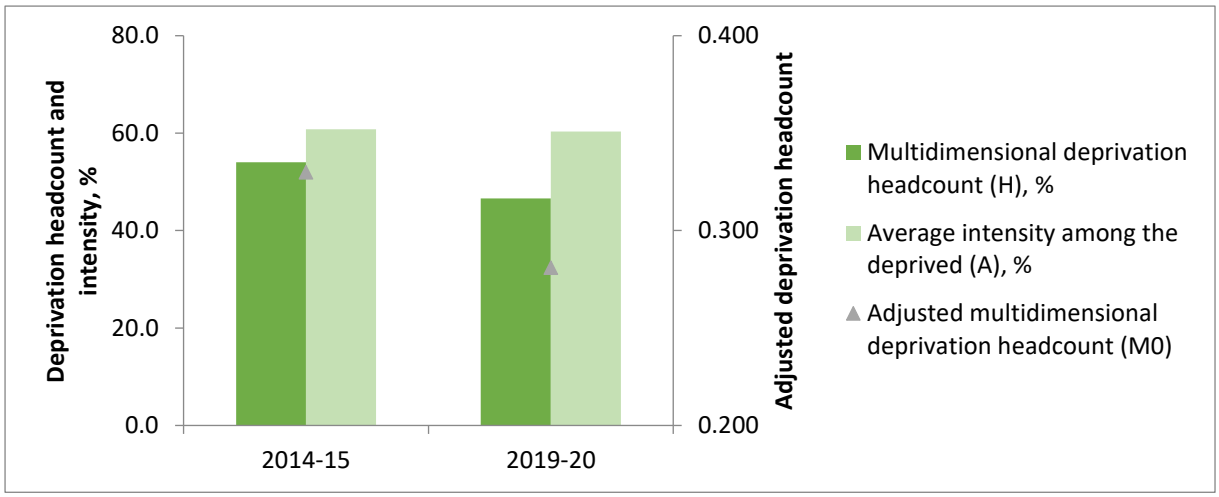
The percentage of multidimensionally poor children fell from 57.0 per cent in 2014/15 to 53.2 per cent in 2019/20 for children 0-23 months and from 54.0 per cent to 46.6 per cent for those aged 24-59 months (see Figure 23 and Figure 24). Moreover, the average intensity of deprivation amongst the multidimensionally poor decreased from 62.2 per cent to 60.8 per cent for children aged 0-23 months and from 60.8 per cent to 60.2 per cent for children aged 24-59 months. The decline in both the headcount and the intensity of deprivations shows an improved overall index of multidimensional poverty (M0) for both age groups.

Figure 23. Trend analysis - Multidimensional deprivation indices at the national level when using a threshold of K=3, 0-23 months



Source: Calculation based on Rwanda DHS 2014-15 and DHS 2019-20

Figure 24. Trend analysis - Multidimensional deprivation indices at the national level when using a threshold of K=3, 24-59 months



Source: Calculation based on Rwanda DHS 2014-15 and DHS 2019-20

Chapter 5. Conclusion and recommendations

This report provides a comprehensive analysis for the measurement and monitoring of child poverty in Rwanda as per target 1.2 of the Sustainable Development Goal 1 on "End Poverty in all its form". It is a follow-up to the first MODA Report in 2018 in Rwanda to measure the country's progress by using the new Demographic and Health Survey 2019/2020. The analysis employs the Multiple Overlapping Deprivation Analysis (MODA) methodology and contextualizes the selection of parameters to the current situation in Rwanda. Given that children's needs and rights differ based on various phases of their lifecycle, the analysis is further disaggregated into two age groups: 0-23 months and 24-59 months. Multidimensional child poverty has been measured using seven dimensions of children's well-being: Nutrition, Health, Child Development, Child Protection, Water, Sanitation and Housing. The majority of children in Rwanda (94.9 per cent) suffer from deprivation in at least one of the aforementioned dimensions. A child is considered multidimensionally poor if he/she is simultaneously deprived in at least three dimensions of their well-being. Subsequently, multidimensional poverty affects 65.8 per cent of children under five in the country. The multidimensionally poor children suffer, on average, from 4 deprivations at the same time. The depth of vulnerability varies across dimensions and age groups. The single deprivation analysis (analysis by sector) shows that the dimensions of Housing (all age groups), Nutrition (0-23 months), Health (all age groups) and Sanitation (all age groups) yield the highest deprivation rates.

Overall, the percentage of multidimensionally poor children fell from 57.0 per cent in 2014/15 to 53.2 per cent in 2019/20 for children 0-23 months and from 54.0 per cent to 46.6 per cent for those aged 24-59 months. Furthermore, the average number of deprivations (intensity of deprivation) amongst the multidimensionally poor diminished by 0.1 for both age groups. The decrease in both the headcount and the intensity of deprivation results in an improved overall index of multidimensional poverty (M0). However, it is found that Rwandese children tend to

face overlapping deprivations – for example, almost one in every four children aged 0-23 months are simultaneously deprived in Nutrition, Health and Sanitation.

Based on the findings of the study, four sets of recommendations are formulated:

1. Adopt a holistic approach for policies targeting children. In Rwanda, the majority of children tend to suffer from multiple deprivations at the same time. In order to significantly and effectively reduce vulnerabilities amongst the children, there is a need to adopt an integrated framework with multi-sectoral solutions to plan, budget and monitor policy actions. Such approaches will lead to considerable decrease in the severity or depth of poverty and are also more efficient and cost-effective.
2. Target the most vulnerable children. The study highlights that children bearing some specific characteristics tend to have a higher incidence of multidimensional poverty than other children. Particular attention should be given to rural children, children residing in the Western province, those living in households where the head/mother has low levels of education, those living in households with previous cases of child mortality, households with many members/children, and stunted and underweight children.
3. Address vulnerabilities in the sectors recording the highest level of deprivations, more specifically the dimensions of Housing, Nutrition, Health and Sanitation. However, in the medium and long term, all vulnerabilities of the children should be addressed. While deprivations in some dimensions can be reduced by providing monetary or in-kind resources to households (e.g. nutrition), others have to be addressed by improving the services available in the communities (e.g. physical access to schools, water and sanitation facilities). Social protection programmes with a "cash plus" component are examples of such interventions13 , as they integrate complementary services targeting sectoral vulnerabilities.
4. Maintain policies aiming at improving the situation of children. As shown by the trend analysis, there have been some improvements in several dimensions

of children's well-being between 2014/15 and 2019/20. Policies pertaining to those sectors should be maintained and enhanced since they are yielding good results.

References

1) Alkire, S., and J. Foster. 2011. Counting and multidimensional poverty measurement. Journal of Public Economics 95 (7–8). Elsevier: 476–487.
2) Alkire, S., and M. E. Santos. 2010. Acute Multidimensional Poverty: A New Index for Developing Countries. OPHI Working Paper 38. University of Oxford.
3) Claeson, M. and R. Waldman (2000). The Evolution of Child Health Programmes in Developing Countries: from Targeting Diseases to Targeting People. Bulletin of the World Health Organization 78: 1234-1245.
4) De Neubourg, C., M. De Milliano, and I. Plavgo. 2014. Lost (in) Dimensions: Consolidating progress in multidimensional poverty research. UNICEF, Office of research Working Paper. WP 2014 - 4. Florence: UNICEF Office of Research-Innocenti.
5) De Neubourg, C., V. Cebotari, and J. Karpati. 2021. Handbook on Social Protection Systems. Available at https://www.e-elgar.com/shop/gbp/handbook-on-social-protection-systems-9781839109102.html
6) Gordon, D., Nandy, S., Pantazis, C., Townsend, P., & Pemberton, S. A. (2003). Child poverty in the developing world. Policy Press.
7) National Institute of Statistics in Rwanda (NISR) and UNICEF Rwanda (2018). Multidimensional Child Poverty in Rwanda: A Multiple Overlapping Deprivation Analysis (MODA). Available at: https://www.unicef.org/esa/sites/unicef.org.esa/files/2018-09/UNICEF-Rwanda-2018-Child-Poverty.pdf
8) United Nations. 1989. Convention on the Rights of the Child. Available at https://www.ohchr.org/en/professionalinterest/pages/crc.aspx
9) United Nations. 1995. World Summit for Social Development 1995. Available at https://www.un.org/development/desa/dspd/world-summit-for-social-development-1995.html
10) United Nations. n.d. THE 17 GOALS | Sustainable Development. Available at https://sdgs.un.org/goals

List of Annexures

Annex I: List of indicators, dimensions and thresholds used for measuring multidimensional child poverty

Table A.1: Dimensions, indicators and age groups for N-MODA Rwanda using DHS 2019/2020, children aged 0-4 years

Dimension	Indicator	Deprivation Threshold (child is deprived if …)	0-23 months	24-59 months
Nutrition	Exclusive breastfeeding	0-5 months: Child is not exclusively breastfed.	X	
	Infant and Young Child Feeding	6-23 months: Child is not meeting WHO requirements for minimum acceptable diet (meal frequency and diversity) WHO requirement for minimum meal frequency is defined as: 2 times for breastfed infants 6–8 months 3 times for breastfed children 9–23 months 4 times for non-breastfed children 6–23 months WHO requirement for dietary diversity refers to the child receiving 4+ of the following food groups: 1. grains, roots and tubers 2. legumes and nuts 3. dairy products (milk, yogurt, cheese) 4. flesh foods (meat, fish, poultry and liver/organ meats) 5. eggs 6. vitamin A rich fruits and vegetables 7. other fruits and vegetables	X	

Health	Skilled birth attendance	0-4 years: Child is assisted by nobody or by an unskilled birth attendant during birth. Skilled birth attendants: doctor, nurse, midwife. Unskilled birth attendants: traditional birth attendant, community health worker, relative or friend, no one, other.	X	X
	Vaccination	0-4 years: Child has not received all basic vaccinations on time (WHO) Vaccination & age at which vaccination should be given: BCG (at birth) DPT 1 (2 months) DPT 2 (4 months) DPT 3 (6 months) Polio 1 (2 months) Polio 2 (4 months) Polio 3 (6 months) Pneumococcal conjugate 1 (between 2-35 months) Pneumococcal conjugate 2 (between 4-35 months) Pneumococcal conjugate 3 (between 12-35 months) Measles, Mumps , Rubella (between 12-35 months)	X	X
	Mosquito nets	0-4 years: Child lives in a household where no child under five slept under a mosquito net the night before the survey	X	X
	Health insurance	0-4 years: Child lives in a household which has no insurance coverage	X	X
Child Development	Early childhood education (ECE) attendance	3-4 years: Child is not attending an Early childhood education or pre-school programme.		X (3-4 years)

	Availability of toys and/or books	2-4 years: Child has no toys (homemade or bought from shops) or books to play with.		X
	Adult-child interaction	3-4 years: No household member does any one of the following activities at least once a week with the child: read books, told stories, sang songs, took outside, played with, etc.		X (3-4 years)
Child Protection	Birth registration	0-4 years: Child is not registered or does not have a birth certificate.	X	X
	Inadequate care	0-4 years: Child is left alone or left with another child under 10 years old for more than one hour during the last week.	X	X
Water	Drinking water source	0-4 years: Child lives in a household where the main source of drinking water is unimproved (WHO). *Improved*: piped water into dwelling, piped water into yard/plot, public tab/standpipe, tube well or borehole, protected dug well, protected spring, rainwater) *Unimproved*: unprotected well, unprotected spring, tanker truck, cart with small tank, surface water (River/Lake/Pond/Stream/ Irrigation Channel), other	X	X
	Distance to water	0-4 years: Child lives in a household where the distance to the nearest water source is more than 500 m for rural areas or more than 200 m for urban areas.	X	X
Sanitation	Toilet type	0-4 years: Child lives in a household which usually uses unimproved toilet facility. *Improved*: toilet facility, flush to piped sewer system, flush to septic tank, flush to pit latrine, flush but don't know where, ventilated improved pit latrine, pit latrine	X	X

		with a slab, composting toilet *Unimproved*: flush to somewhere else, pit latrine without slab or open pit, no facility, bush or field bucket toilet, hanging toilet or hanging latrine, other		
	Cleanliness of toilet facility	0-4 years: Child lives in a household where toilet facilities are not dry and clean (with urine or excreta, with flies).	X	X
Housing	Overcrowding	0-4 years: Child lives in a household that has on average more than three people per sleeping room.	X	X
	Access to electricity	0-4 years: Child lives in a household without electricity.	X	X
	Indoor pollution from solid cooking fuel	0-4 years: Child lives in a household which uses solid cooking fuel and cooking is done inside the house. Solid fuels: coal, lignite, charcoal, wood, straw, shrubs, grass, agricultural crop, animal dung, other. Low-emission or no-emission fuels: kerosene, biogas, natural gas, liquefied petroleum gas, electricity. Note: There is no indoor pollution if food cooked in a separate building or outdoors.	X	X

Annex II: List of indicators, dimensions and thresholds used for measuring multidimensional child poverty for the trend analysis

Table A.2: Dimensions, indicators and age groups for N-MODA Rwanda for the trend analysis using DHS 2014/2015 and DHS 2019/2020, children aged 0-4 years

Dimension	Indicator	Deprivation Threshold (child is deprived if …)	0-23 months	24-59 months
Nutrition	Exclusive breastfeeding	0-5 months: Child is not exclusively breastfed.	X	
	Infant and Young Child Feeding	6-23 months: Child is not meeting WHO requirements for minimum acceptable diet (meal frequency and diversity) WHO requirement for minimum meal frequency is defined as: 2 times for breastfed infants 6–8 months 3 times for breastfed children 9–23 months 4 times for non-breastfed children 6–23 months WHO requirement for dietary diversity refers to the child receiving 4+ of the following food groups: 1. grains, roots and tubers 2. legumes and nuts 3. dairy products (milk, yogurt, cheese) 4. flesh foods (meat, fish, poultry and liver/organ meats) 5. eggs 6. vitamin A rich fruits and vegetables 7. other fruits and vegetables	X	

Health	Skilled birth attendance	0-4 years: Child is assisted by nobody or by an unskilled birth attendant during birth. Skilled birth attendants: doctor, nurse, midwife. Unskilled birth attendants: traditional birth attendant, community health worker, relative or friend, no one, other.	X	X
	Vaccination	0-4 years: Child has not received all basic vaccinations on time (WHO) Vaccination & age at which vaccination should be given: BCG (at birth) DPT 1 (2 months) DPT 2 (4 months) DPT 3 (6 months) Polio 1 (2 months) Polio 2 (4 months) Polio 3 (6 months) Pneumococcal conjugate 1 (between 2-35 months) Pneumococcal conjugate 2 (between 4-35 months) Pneumococcal conjugate 3 (between 12-35 months) Measles, Mumps , Rubella (between 12-35 months)	X	X
	Mosquito nets	0-4 years: Child lives in a household where no child under five slept under a mosquito net the night before the survey	X	X
	Health insurance	0-4 years: Child lives in a household which has no insurance coverage	X	X
Child Development	Early childhood education (ECE) attendance	3-4 years: Child is not attending an Early childhood education or pre-school programme.		X (3-4 years)

	Availability of toys and/or books	2-4 years: Child has no toys (homemade or bought from shops) or books to play with.		X
	Adult-child interaction	3-4 years: No household member does any one of the following activities at least once a week with the child: read books, told stories, sang songs, took outside, played with, etc.		X (3-4 years)
Child Protection	Inadequate care	0-4 years: Child is left alone or left with another child under 10 years old for more than one hour during the last week.	X	X
Water	Drinking water source	0-4 years: Child lives in a household where the main source of drinking water is unimproved (WHO). *Improved*: piped water into dwelling, piped water into yard/plot, public tab/standpipe, tube well or borehole, protected dug well, protected spring, rainwater) *Unimproved*: unprotected well, unprotected spring, tanker truck, cart with small tank, surface water (River/Lake/Pond/Stream/ Irrigation Channel), other	X	X
	Distance to water	0-4 years: Child lives in a household where the distance to the nearest water source is more than 500 m for rural areas or more than 200 m for urban areas.	X	X
Sanitation	Toilet type	0-4 years: Child lives in a household which usually uses unimproved toilet facility. *Improved*: toilet facility, flush to piped sewer system, flush to septic tank, flush to pit latrine, flush but don't know where, ventilated improved pit latrine, pit latrine with a slab, composting toilet *Unimproved*: flush to somewhere else, pit	X	X

		latrine without slab or open pit, no facility, bush or field bucket toilet, hanging toilet or hanging latrine, other		
	Cleanliness of toilet facility	0-4 years: Child lives in a household where toilet facilities are not dry and clean (with urine or excreta, with flies).	X	X
Housing	Indoor pollution from solid cooking fuel	0-4 years: Child lives in a household which uses solid cooking fuel and cooking is done inside the house. Solid fuels: coal, lignite, charcoal, wood, straw, shrubs, grass, agricultural crop, animal dung, other. Low-emission or no-emission fuels: kerosene, biogas, natural gas, liquefied petroleum gas, electricity. Note: There is no indoor pollution if food cooked in a separate building or outdoors.	X	X

Annex III: Technical information on MODA analysis

This annex includes the formulas used in the MODA analysis.

1. Single sector analyses: Child deprivation headcount ratio for each indicator and dimension

The formula below is used to calculate the deprivation headcount results by dimension or indicator.

$$h_{j,r} = \frac{q_{j,r}}{n_r}$$

$$q_{j,r} = \sum_{i=1}^{n_r} y_j$$

where

$h_{j,r}$ - headcount ratio of children deprived in dimension *j* of the reference population *r;*
q_j - number of deprived children in dimension *j* of the reference population *r;*
n_r - total number of children in the reference population *r;*
y_j - deprivation status of child *i* in dimension *j,* with $y_j = 1$ if $x_j < Z_j$ (deprivation) and $y_j = 0$ if $x_j \geq Z_j$ (no deprivation);
x_j - value of dimension *j* for child *i;*
Z_j - threshold of the dimension *j.*

2. Multidimensional analyses: Deprivation distribution

The deprivation distribution provides the proportion of children deprived in 0,1,2,3,...,X dimensions, where the total number of deprivations is counted for each child. The following formula is used to calculate the distribution at the national level:

$$D_i = \sum_{j=1}^{d} y_j$$

where
D_i – total number of dimensions each child *i* is deprived in; with $y_j = 1$ if child *i* is deprived in the dimension *j*; $y_j = 0$ if child *i* is not deprived in dimension *j*.

Note: for each of the age groups, the dimensions and their quantity may differ, hence the counting of deprivations and the calculated headcounts cannot be compared across the different age groups.

3. Multiple Overlapping Deprivation Analysis

3.1. Multidimensional child deprivation headcount ratio (H)

H presents the proportion of children who are multidimensionally poor, out of the total number of children.

$$H = \frac{q_K}{n_a}$$

$$q_K = \sum_{i=1}^{n} y_K$$

where

H - multidimensional child deprivation headcount ratio according to cut-off point K in age group a;
q_K - number of children affected by at least K deprivations in the age group a;
n_a - total number of children in the age group a;
y_K - deprivation status of a child i depending on the cut-off point K;
D_i - number of deprivations each child i experiences;
K - cut-off point.

3.2. Average number of deprivations among the deprived (A)

A indicates the average intensity of deprivation experienced by children who are identified as multidimensionally poor. This measure can be computed in absolute number or in percentages.

$$A = \frac{\sum_1^{q_K} c_K}{q_K \times d}$$

where

A - average intensity of multidimensional deprivation according to the cut-off point K for the age group a;
q_K - number of children affected by at least K deprivations in the age group a;

3.3. Adjusted multidimensional deprivation headcount (M0)

M0 is an index, ranging from 0 to 1, based on the multiplication of the deprivation incidence and intensity. M0 cannot be interpreted on its own and is used to compare different population groups. The lower the index, the better off a population group is.

$$M_0 = H * A = \frac{\sum_1^{q_K} c_K}{n_a * d}$$

where

M_0 - adjusted multidimensional child deprivation headcount ratio among children affected by at least *K* deprivations in age group *a;*
c_K - number of deprivations each multidimensionally deprived child *i* experiences, with $c_K = D_i * y_K$.

Annex IV: Three-way overlap between all combinations of dimensions by age group

Table A.3.1: Three-way overlap between all combinations of dimensions, children aged 0-23 months

Combination of three dimensions	Overlap between all dimensions	Overlap between first two dimensions	Overlap between first and third dimensions	Overlap between second and third dimensions	Deprivation in only first dimension	Deprivation in only second dimension	Deprivation in only third dimension	Deprived in none of the three dimensions
Water, Sanitation, Housing	24.0%	4.3%	12.3%	21.4%	4.6%	6.9%	14.2%	12.4%
Protection, Sanitation, Housing	18.9%	3.0%	8.1%	26.4%	4.1%	8.2%	18.4%	12.8%
Protection, Water, Housing	14.7%	2.5%	12.4%	21.6%	4.6%	6.4%	23.2%	14.6%
Protection, Water, Sanitation	11.8%	5.4%	10.1%	16.4%	6.9%	11.5%	18.2%	19.7%
Health, Sanitation, Housing	31.0%	5.3%	14.3%	14.4%	5.5%	5.8%	12.3%	11.4%
Health, Water, Housing	23.3%	4.0%	22.0%	13.0%	6.9%	4.8%	13.6%	12.4%
Health, Water, Sanitation	18.7%	8.6%	17.6%	9.5%	11.2%	8.3%	10.7%	15.4%
Health, Protection, Housing	18.8%	3.4%	26.5%	8.3%	7.5%	3.7%	18.4%	13.5%
Health, Protection, Sanitation	15.2%	7.0%	21.1%	6.7%	12.8%	5.3%	13.5%	18.4%
Health, Protection, Water	11.5%	10.7%	15.8%	5.7%	18.2%	6.3%	12.2%	19.7%
Nutrition, Sanitation, Housing	30.3%	7.1%	17.7%	15.0%	9.5%	4.0%	8.8%	7.4%
Nutrition, Water, Housing	24.5%	5.7%	23.5%	11.8%	11.0%	3.2%	12.1%	8.3%
Nutrition, Water, Sanitation	18.9%	11.3%	18.6%	9.4%	15.9%	5.6%	9.7%	10.7%
Nutrition, Protection, Housing	18.2%	4.2%	29.9%	8.9%	12.4%	2.9%	14.9%	8.6%
Nutrition, Protection, Sanitation	14.6%	7.7%	22.8%	7.3%	19.5%	4.5%	11.8%	11.7%
Nutrition, Protection, Water	11.4%	11.0%	18.8%	5.8%	23.5%	6.0%	9.1%	14.4%
Nutrition, Health, Housing	30.8%	6.5%	17.2%	14.4%	10.1%	4.3%	9.4%	7.1%
Nutrition, Health, Sanitation	24.7%	12.6%	12.7%	11.6%	14.6%	7.2%	7.5%	9.0%
Nutrition, Health, Water	18.7%	18.7%	11.5%	8.6%	15.8%	10.2%	6.3%	10.2%
Nutrition, Health, Protection	15.3%	22.0%	7.0%	6.9%	20.3%	11.9%	5.0%	11.6%

Table A.3.2: Three-way overlap between all combinations of dimensions, children aged 24-59 months

Combination of three dimensions	Overlap between all dimensions	Overlap between first two dimensions	Overlap between first and third dimensions	Overlap between second and third dimensions	Deprivation in only first dimension	Deprivation in only second dimension	Deprivation in only third dimension	Deprived in none of the three dimensions
Water, Sanitation, Housing	24.4%	4.8%	11.2%	20.2%	4.3%	7.9%	13.8%	13.4%
Protection, Sanitation, Housing	21.2%	5.0%	10.7%	23.4%	4.4%	7.7%	14.4%	13.3%
Protection, Water, Housing	16.7%	3.7%	15.2%	18.9%	5.7%	5.4%	18.9%	15.6%
Protection, Water, Sanitation	14.1%	6.3%	12.1%	15.0%	8.8%	9.2%	16.0%	18.4%
Health, Sanitation, Housing	15.5%	3.5%	7.0%	29.1%	3.2%	9.1%	18.1%	14.6%
Health, Water, Housing	11.9%	2.4%	10.7%	23.7%	4.3%	6.7%	23.4%	17.0%
Health, Water, Sanitation	9.9%	4.3%	9.2%	19.2%	5.8%	11.2%	18.9%	21.4%
Health, Protection, Housing	8.9%	2.1%	13.6%	23.0%	4.6%	7.4%	24.1%	16.3%
Health, Protection, Sanitation	7.7%	3.2%	11.4%	18.5%	6.9%	11.8%	19.6%	20.8%
Health, Protection, Water	6.0%	4.9%	8.2%	14.4%	10.1%	16.0%	16.0%	24.4%
Nutrition, Sanitation, Housing	29.8%	5.3%	12.4%	14.7%	5.4%	7.3%	12.6%	12.3%
Nutrition, Water, Housing	23.0%	3.6%	19.3%	12.6%	7.1%	5.5%	14.8%	14.2%
Nutrition, Water, Sanitation	19.0%	7.6%	16.2%	10.1%	10.2%	7.9%	12.0%	17.0%
Nutrition, Protection, Housing	21.0%	4.0%	21.3%	10.9%	6.7%	5.4%	16.4%	14.3%
Nutrition, Protection, Sanitation	17.5%	7.5%	17.7%	8.7%	10.3%	7.6%	13.3%	17.4%
Nutrition, Protection, Water	12.9%	12.1%	13.7%	7.5%	14.3%	8.8%	10.6%	20.1%
Nutrition, Health, Housing	14.6%	2.3%	27.7%	7.9%	8.4%	4.4%	19.4%	15.3%
Nutrition, Health, Sanitation	12.1%	4.8%	23.1%	7.0%	13.0%	5.3%	15.1%	19.6%
Nutrition, Health, Water	8.9%	8.0%	17.7%	5.3%	18.4%	7.0%	12.7%	22.0%
Nutrition, Health, Protection	7.3%	9.6%	17.7%	3.6%	18.4%	8.7%	12.7%	22.0%

Annex V: Profile of multidimensionally poor children disaggregated by their characteristics

Table A.4.1: Percentage of multidimensionally poor children disaggregated by their characteristics

	Profile variable	*Multidimensional poverty rate*
	National	65.8
Area*	rural	70.4
	urban	43.4
Province*	East	69.4
	North	66.8
	West	72.1
	South	67.4
	Kigali	44.3
Sex of the household head*	Male	64.9
	Female	69.1
Level of education of the household head*	secondary or higher	37.9
	primary	69.2
	no education, preschool	84.0
Household size	7 or more members	67.4
	4-6 members	65.5
	1-3 members	64.8
Number of children*	7+ children	74.4
	4-6 children	70.4
	1-3 children	63.2
Under-five child mortality*	No child <5 has died in the last 5 years	65.5
	At least one child <5 has died in the last 5 years	75.9
Gender of the child	female	65.8
	male	65.8
Child's stunting status*	child is stunted	68.7
	child is not stunted	46.3
Child's wasting status	child is wasted	67.8
	child is not wasted	66.0
Child's underweight status*	child is underweight	70.1
	child is not underweight	57.8

Highest education level of the mother*	secondary or higher	40.1
	primary	71.8
	no education, preschool	84.3

Annex VI: Deprivation by each dimension and province for each age group

Figure A.5.1. Deprivation by each dimension and province, 0-23 months

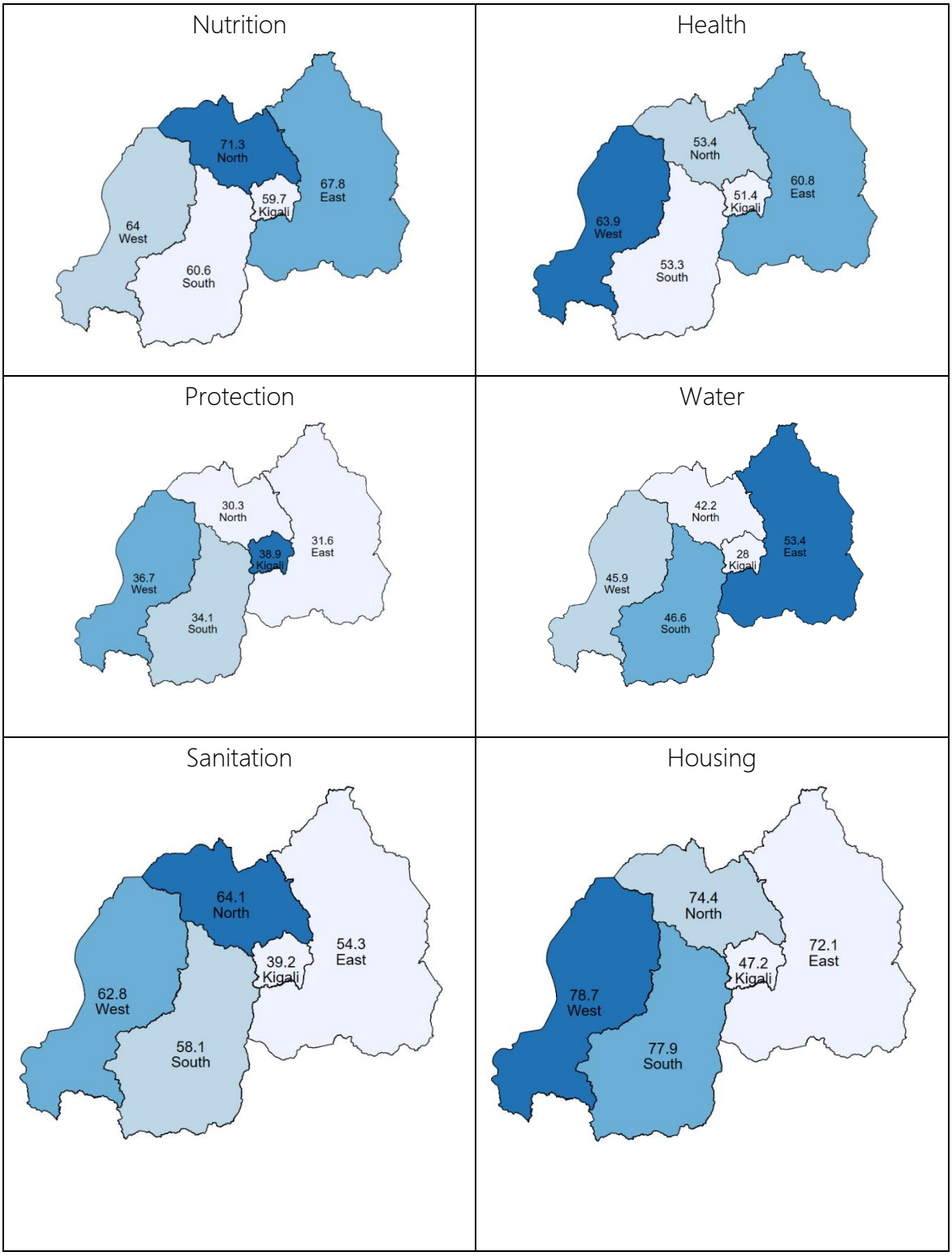


Figure A.5.2. Deprivation by each dimension and province, 24-59 months