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MULTIDIMENSIONAL CHILD POVERTY IN NORTH MACEDONIA

Reimagining how to measure and tackle child poverty

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Reimagining how to measure and tackle child poverty

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December, 2021

ACRONYMS

AF	**Alkire-Foster**
HH	**Household**
MD	**Multidimensional**
MICS	**Multiple Indicator Cluster Survey**
MODA	**Multiple Overlapping Deprivation Analysis**
MPI	**Multidimensional Poverty Index**
OPHI	**Oxford Poverty and Human Development Initiative**
UN CRC	**United Nation's Convention on the Rights of the Child**
UNDP	**United Nations Development Programme**
UNICEF	**United Nations Children's Fund**
WHO	**World Health Organization**

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EXECUTIVE SUMMARY

The success of governments' policy actions to end child poverty largely depends on governments' understanding of complexity of child poverty. There are two basic reasons. Firstly, the current one-dimensional (income) approach fails to capture this complexity due to its simplistic assumptions: it assumes a strong link between income and child well-being and rights and an equal sharing of resources within a household, and it represents "a means to an end" approach. Secondly, child poverty differs from adult poverty. Namely, children are more exposed to poverty and if trapped in poverty since birth are more likely to remain poor. Moreover, children have different basic human needs dependent on accessibility to basic infrastructure and public services, have no control over the household's resources and do not share equally the household's fortunes and misfortunes. Therefore, the traditional indirect (income) approach for measuring poverty has been recently complemented with direct multidimensional measures which take into account the diverse basic needs people have and the rights they should enjoy. Although not perfect, the multidimensional approach sheds light on other aspects of poverty and enables policymakers to adopt appropriate policies and investments to tackle the measured aspects.

This policy study aims to describe the multidimensionality of child poverty vis-a-vis sets of demographic and locational indicators; and to produce the first multidimensional child poverty index in North Macedonia and exemplify its analytic and policy value.

The Alkire-Foster method was used in developing two age-specific (0-4 years and 5-17 years) child multidimensional poverty indices (MPIs) by leveraging secondary data from Multiple Indicator Cluster Survey (MICS) 2018/2019 for North Macedonia and North Macedonia Roma Settlements. Child MPI reflects both the incidence (headcount ratio, H) and the intensity of multidimensional poverty (average number of deprivations by the poor, A) and expressed as the product of both (adjusted headcount ratio, M). The method is flexible in designing the indices allowing for different variations in the set of indicators, cutoffs and weights. Moreover, it allows data to be broken down by subgroups and dimensions. To uncover the most prevalent deprivations as well as the most deprived child groups in North Macedonia, multiple deprivation analysis has been conducted, while logit and tobit regression analysis was used to identify the most important risk factors of multidimensional child poverty in North Macedonia.

Each age-specific MPI shows different incidence- and intensity-patterns as the cutoff point increases. At higher levels of intensity of multidimensional poverty, younger children experience higher incidence of multidimensional poverty, while older children are prone to experience poverty in many aspects. The group disaggregation shows that: firstly, urban, Roma, monetarily poorest or households headed by less-educated adults take higher share of multidimensionally poor children; secondly, rural child poverty requires much wider approach targeting several dimensions, while urban child poverty could be significantly reduced by addressing education and material deprivations; thirdly, there are no significant gender differences; and fourthly, Roma children regardless of their age are heavily deprived. At least every third Roma child is multidimensionally poor. The regional analysis uncovers four regions having significantly higher incidence of poverty: Southeast, East, Skopje and Polog, of which the first two have the highest incidence regardless of the child age-group. Additionally, regarding the most important risk factors, the parents' and child's education significantly contribute to multidimensional child poverty reduction. Finally, the dimensional breakdown identifies the lack of education and skills, economic hardships, lack of love and care, home violence and lack of leisure activities as leading contributors to multidimensional child poverty in the country.

This policy study provides general and specific recommendations for policymakers to prepare well-designed and targeted policy actions. Generally, it recommends institutionalizing the assessment of multidimensional child poverty and embedding the poverty measures in the relevant strategic documents, prioritizing policies and plans to address inequalities and to reach the most vulnerable children, and reforming the education system to enable every child to develop appropriate skills during the education process.

1. INTRODUCTION

North Macedonia was identified among the global leaders in poverty reduction according to the latest report on multidimensional poverty (United Nations Development Programme and Oxford Poverty and Human Development Initiative, 2020). The country succeeded to reduce the share of the population living in extreme poverty from 1.1 percent in 2005 to 0.2 percent in 2011, experiencing more than 20 percent relative annualized poverty reduction (Alkire et al. 2020; UNDP and OPHI, 2020). Yet, the report shows that children are more exposed to poverty and the eradication of child poverty progresses more slowly compared to the reduction of adult poverty. Available data emphasize the differences between adult and child poverty and differential causes and effects behind them.

UNICEF (2008) reveals that 32.4 percent of children lived under the poverty line in 2005, experiencing deprivations in areas such as education and health, and experiencing increased child labor. Over the years, the child poverty rate in North Macedonia has decreased, nonetheless it remains rather high. According to the latest Laeken indicators of the State Statistical Office, the child poverty rate in North Macedonia stood at 27.8 percent in 2019. Households with two parents and three or more children have remained most exposed to risk of poverty (45.3 percent). The United Nations Common Country Analysis for North Macedonia (2020) finds that children living in poorer households, children living in large households, children living in rural areas as well as Roma children are at a higher risk of being left behind, facing limited access to education and to health

services. Such findings resonate with previous research on the effectiveness of social benefits in reducing monetary (child) poverty (e.g. World Bank, 2018; UNICEF, 2013), and expand the consideration to multiple dimensions of poverty, including non-monetary aspects of child poverty. However, the multiple facets of child poverty have not been rigorously investigated in North Macedonia, although global literature on these issues abounds (e.g. Ferrone and Milliano, 2018).

Since the adoption of United Nation's Convention on the Rights of the Child (UN CRC) significant progress has been made in measuring child poverty. The unidimensional (monetary) approaches have been supplemented with multidimensional (non-monetary) approaches (e.g., Gordon et al. 2003; Roelen and Gassmann 2008). The multidimensional measures offer more thorough understanding of child poverty in terms of exposure to multiple deprivations, more complex and flexible analysis and a more precise identification of the most deprived children. Despite important measurement advancements, considerable differences exist not only between unidimensional and multidimensional measures (e.g., Roelen, 2018; Qi and Wu, 2019), but also within multidimensional approaches (e.g., Hjelm et al., 2016). Recently, the Alkire-Foster multidimensional method (Alkire and Foster, 2011) has been largely adopted in measuring child poverty (Alkire and Roche, 2011; Roche, 2013; Trani et al., 2013; García and Ritterbusch, 2015; Qi and Wu, 2015; Vaz, 2015; Pinilla-Roncancio and Silva, 2018; Pinilla-Roncancio et al., 2020) in addition to the UNICEF's Multiple Overlapping Deprivation Analysis (MODA) (de Neubourg et al., 2012a). [1] Both approaches provide certain advantages in measuring child poverty with respect to its conceptualization and identification. Within the Western Balkan, the child poverty has been analyzed in Serbia (UNICEF 2015a), Kosovo (UNICEF, 2015b), Bosnia and Herzegovina (Chzhen and Ferrone, 2017) and Montenegro (UNICEF, 2021),[2] however similar analysis is lacking for North Macedonia.

The overarching goal of this study is to establish sound and thorough empirical evidence on the multidimensional child poverty in North Macedonia. The specific objectives are: i) to describe the multidimensionality of child poverty vis-a-vis sets of demographic and locational indicators; and ii) to produce the first multidimensional child poverty index in North Macedonia and exemplify its analytical and policy value.

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[1] MODA is conceptually different from Alkire-Foster method (specifically, Multidimensional Poverty Index – MPI) due to the use of child-specific and age-specific indicators and dimensions (Chzhen and Ferrone, 2017). However, the recent application of MPI to child-level data shows the possibility of calculating MPI with child-specific indicators and dimensions (e.g., Pinilla-Roncancio et al., 2020) and developing age-specific MPIs (e.g., Alkire and Roche, 2011). Alternatively, the household MPI has been upgraded to account for intra-household differences (see, Alkire et al., 2019).

[2] MODA was used in all studies, except for Serbia.

The study uses the Alkire-Foster method in developing two age-specific (0-4 years and 5-17 years) child multidimensional poverty indices (MPIs) by leveraging secondary data from the Multiple Indicator Cluster Survey (MICS) 2018/2019 for North Macedonia and North Macedonia Roma Settlements.[3] The method is flexible in designing the indices allowing for different variations in the set of indicators, cutoffs and weights. Moreover, it allows data to be divided by subgroups and dimensions. To uncover the most prevalent deprivations as well as the most deprived child groups in North Macedonia, single and multiple deprivation analyses were conducted, while logit and tobit regression analyses were used to identify the most important risk factors of multidimensional child poverty in North Macedonia.

The study represents the first attempt for measuring multidimensional child poverty in North Macedonia and adds to the UNICEF's collection of studies on multidimensional child poverty in the Western Balkan (UNICEF, 2015a; UNICEF, 2015b; Chzhen and Ferrone, 2017; UNICEF, 2021). Additionally, it belongs to the series of studies which adopt the Alkire-Foster method to devise child MPIs (Alkire and Roche, 2011; Roche, 2013; Trani et al., 2013; García and Ritterbusch, 2015; Qi and Wu, 2015; Vaz, 2015; Pinilla-Roncancio and Silva, 2018; Pinilla-Roncancio et al., 2020). This study develops two age-specific child MPIs by consulting different sources to build the list of dimensions (such as human rights conventions, national legislation, national strategies/plans and participatory processes), peculiar to the Macedonian context. Moreover, it provides novel country-specific evidence regarding the most important risk factors of multidimensional child poverty adding to the literature on determinants of child poverty (Qi and Wu 2016; Leu et al. 2016; Pinilla-Roncancio and Silva 2018; Pinilla-Roncancio et al. 2020; UNICEF 2021). Finally, the study recommends general and dimension-specific policy actions for policymakers to address children's concerns and reduce multidimensional child poverty.

The study is structured as follows: Section 2 highlights the differences between child and adult poverty, as well as between unidimensional and multidimensional measures of poverty and reviews the literature on drivers of multidimensional child poverty; Section 3 examines the building blocks of multidimensional child poverty in North Macedonia and presents a single deprivation analysis; Section 4 presents the design and calculation of the age-specific child MPIs and exhibits a multiple deprivation analysis; Section 5 puts forward concluding remarks and policy recommendations.

[3] The MICS 2018/2019 for North Macedonia and North Macedonia Roma Settlements covers different aspects of child well-being including health, nutrition, access to water and sanitation, child development, literacy and education, child protection and access to information among others, making it very appropriate for the child deprivation analysis. For more details, see here.

2. BACKGROUND DISCUSSION

Poverty eradication is incorporated in the Sustainable Development Goals (SDGs) and the development of internationally comparable measures would facilitate the achievement of the goal (Alkire et al. 2017). Therefore, the traditional indirect (income) approach for measuring poverty has been recently complemented with direct multidimensional measures which take into account the diverse basic needs people have and the rights they should enjoy (Alkire and Santos, 2014). Although not perfect, the multidimensional approach sheds light on other aspects of poverty and enables policymakers to adopt appropriate policies and investments to tackle the measured aspects (Alkire and Sumner, 2013).

The latest report on multidimensional poverty produced by Oxford Poverty and Human Development Initiative (OPHI) and the United Nations Development Programme (UNDP) reveals sound evidence of widespread poverty. In the developing world, around 1.3 billion people live in poverty and the majority of them reside in middle-income countries. Half of the multidimensionally poor are children under the age of 18. Moreover, one third of the developing countries did not achieve significant reduction in multidimensional child poverty (UNDP and OPHI, 2020). Besides the significant progress in establishing regional (e.g., Santos and Villatoro, 2018) or global poverty measures (e.g., Alkire and Jahan, 2018), the complexity of the poverty construct requires certain adjustments of current measures to capture specific types of poverty, including child poverty.

WHAT MAKES CHILD POVERTY DIFFERENT FROM ADULT POVERTY?

Drawing from Sen's capability framework, Biggeri et al. (2006) argue that children possess age-specific capabilities, directly or indirectly constrained by the parents' capabilities and decisions, however children's capabilities have intrinsic value, are interdependent and pave the way for future development.[4] Moreover, the UN CRC puts the child in the spotlight and defines four general principles aligned with the child's well-being: nondiscrimination, the best interest of the child, survival and development, and the child's perspective (Ben-Arieh, 2008). Based on the UN CRC, Gordon et al. (2003) established the building blocks of multidimensional child poverty measurement distinguishing it from adult poverty for several reasons: firstly, children are more exposed to poverty (e.g., Roelen and Gassmann, 2008; Qi and Wu, 2019); secondly, children trapped in poverty since birth are more likely to remain poor (e.g., Roelen and Gassmann, 2008); thirdly, children have different basic human needs dependent on accessibility to basic infrastructure and public services (e.g., Roelen and Gassmann, 2008; Roelen and Camfield, 2013; Qi and Wu, 2016); fourthly, children have no control over the household's resources and do not share equally the household's fortunes and misfortunes (e.g., Gordon et al. 2003; Roelen and Camfield, 2013; Vaz, 2015); finally, researchers need to use standard definitions and measures for child poverty (e.g., Roelen and Gassmann, 2008). Consequently, child-centered approaches to measure poverty become more prevalent as data availability increases (e.g., Leu et al. 2016).

WHY ARE UNIDIMENSIONAL (MONETARY) MEASURES OF CHILD POVERTY NOT ENOUGH?

The unidimensional income poverty measure retains its popularity due to its simplicity and minimal data requirements. The identification of the poor relies on setting an income poverty threshold and classifying households as poor if their disposable income falls under the threshold. However, the income approach has several drawbacks due to the simplistic assumptions upon which it is based. Firstly, it assumes a strong link between income and child well-being and rights treating the child as a sovereign economic agent and a consumer (de Neubourg et al. 2012b; Trani et al. 2013; Qi and Wu, 2015). Secondly, it assumes equal sharing of resources within a household meaning that household resources are sufficient (or not) to cover the needs of all household members (Gordon et al. 2003; de Neubourg et al. 2012b; Leu et al. 2016).

[4] Sen (1993) defines capability as *"… the capability of a person reflects the alternative combinations of functionings the person can achieve, and from which he or she can choose one collection."* While the functionings may span from elementary (e.g., adequate nutrition) to more complex (e.g., social inclusion), the poverty would relate to some basic capabilities whose set is context-dependent.

Thirdly, the child poverty does not depend only on family income, but also on goods and services with supply-constrained markets, for example, access to clean water and education may not be provided by public authorities (Gordon et al. 2003; de Neubourg et al. 2012b). Finally, the income approach represents "a means to an end" denoting that the possession of monetary resources (means) enables conversion to goods and services sufficient to cover the basic needs (ends) (Alkire and Santos, 2014; Roelen, 2017).

Recent research substantiates the mismatch between unidimensional and multidimensional child poverty measures. Roelen (2018) finds that this mismatch is significant and depends on measurement errors and individualistic and structural factors. Moreover, Kim (2019) discovers that there is an important overlap between monetary and multidimensional poverty, however the transition from poor to non-poor child in monetary terms does not necessarily mean a transition in multidimensional terms. Additionally, Qi and Wu (2019) argue that children's access to basic facilities and services is not reflected in income poverty measures. Finally, Alkire et al. (2020) emphasize the need for triangulation of monetary and non-monetary poverty measures to better capture countries' poverty profiles and trends.

WHAT ARE THE ADVANTAGES/DISADVANTAGES OF MULTIDIMENSIONAL MEASUREMENT OF CHILD POVERTY?

To date, three alternative approaches have been developed for measuring multidimensional child poverty: the Bristol Deprivation approach (Gordon et al. 2003), Alkire-Foster method (Alkire and Foster, 2011) and multidimensional overlapping deprivation analysis – MODA (UNICEF).[5] While any subsequent method provides different improvements in understanding child poverty, they share common advantages. Firstly, they recognize the multidimensionality of child poverty and provide simple representation in different dimensions (Roelen and Gassmann, 2008). Secondly, they could be easily adapted with either more or fewer dimensions depending on data availability (Roelen and Gassmann, 2008), while still allowing for greater consensus (García and Ritterbusch, 2015). Thirdly, they could secure cross-country comparability of child poverty (García and Ritterbusch, 2015). Finally, they offer possibilities for analyzing deprivation overlaps and identifying the poorest of the poor (Roelen and Gassmann, 2008; Pinilla-Roncancio and Silva, 2018). Despite their positive sides, the multidimensional measures have certain drawbacks. Firstly, the chosen dimensions reflect complex concepts of well-being and capabilities and the process of inclusion of dimensions and indicators is normative and subjective, creating possibilities for misinterpretation (Roelen, 2017).

[5] Qi and Wu (2019) provide brief history of the development of multidimensional measures of child poverty.

Secondly, since they rely on surveys, the data constraints may restrict inclusion of certain vulnerable groups, may limit in-depth analysis of deprivation overlaps and may cause biased deprivation analysis due to the existence of age-specific poverty dimensions not available for all age groups of children (Roelen and Gassmann, 2008).

WHAT RISK FACTORS DRIVE MULTIDIMENSIONAL CHILD POVERTY?

The recent evolvement of multidimensional poverty measures facilitated research on determinants of multidimensional poverty (e.g., Chen et al. 2019), however only few studies examined the drivers of multidimensional child poverty. For instance, Qi and Wu (2016) find that in China child deprivation depends largely on institutional and structural factors. On the other side, Leu et al. (2016) show that in Taiwan child deprivation and social exclusion is driven by family characteristics and economic situation. Moreover, Pinilla-Roncancio and Silva (2018) discover that children's individualistic factors such as gender and disabilities, play a crucial role in addition to household characteristics to increase the probability of being multidimensionally deprived in Angola. Differently, Pinilla-Roncancio et al. (2020) argue that parents' deprivations greatly influence children's deprivations in Colombia. Finally, UNICEF (2021) finds that household head's education level and gender determine child poverty in Montenegro. Evidently, the data and comparability constraints of multidimensional measures restrict the research on determinants of multidimensional child poverty to separate national studies. Despite the lack of systematic (cross-country) evidence, the previous literature identifies that child poverty is determined not only by child- and parent-specific characteristics but also by environmental characteristics. Thus, the salience of certain structural and individualistic (child and parent) factors would be informative for delivering targeted policy decisions.

3. SINGLE DEPRIVATION ANALYSIS

3.1. IDENTIFICATION OF DIMENSIONS AND INDICATORS

The selection of dimensions and indicators is the essential phase in measuring multidimensional child poverty. It is based on the purpose of the measure, the space of measurement and the unit of analysis (Santos, 2019). Moreover, the selected dimensions and indicators for measuring national poverty should reflect a wider consensus and country-specific priorities. Therefore, the researchers consult different sources to build the list of dimensions such as human rights conventions, national legislations, national strategies/plans, participatory processes or experts' views (Santos, 2019). This study aims is to build a comprehensive measure of multidimensional child poverty incorporating an extended list of domains that are based on a broader consensus and are attributable to the Macedonian context.

The identification of dimensions enjoying general agreement was primarily based on reflecting on relevant literature. The Bristol Deprivation approach dimensions are dominantly used in the multidimensional child poverty literature (e.g., Alkire and Roche, 2011; Roche, 2013; García and Ritterbusch, 2015; Qi and Wu, 2015; Qi and Wu, 2016; Qi and Wu, 2019; UNICEF, 2021). Gordon et al. (2003) produced the Bristol Deprivation approach by relying on children's basic rights (articulated in the United Nation's Convention on the Rights of

the Child (CRC)). The approach includes seven dimensions: *food, safe drinking water, sanitation facilities, health, shelter, education and information*. While the extent of deprivation in these dimensions – which cover children's basic needs – may span from mild to severe, such needs are dynamic and should be amended with other domains to also reflect children's current priorities.

Additionally, to account for the national context regarding child poverty, the national legislation and national strategies/plans that relate to children's rights were considered, as well as a previous child-centered qualitative study focused on Macedonian children. Table 1 summarizes the consulted sources and covered dimensions. UNICEF (2008) provides a critical overview of the national legislation in North Macedonia with respect to the children's rights. The Law on Child Protection pertains to the care and upbringing of pre-school-age children through rest and recreation (*leisure*) and other issues of protection, as well as prohibiting any abuse of children (*safety*). Similarly, the Family Law prohibits any kind of violence between family members (*safety*) and the Law on Social Protection regulates the state's obligation to provide social care and protection, especially for socially excluded groups (*social exclusion*). Child labor (*freedom from exploitation*) is prohibited according to the Constitution and the Labor Code. The Laws on Child Protection and on Primary Education provide legal framework for equal access to education for all children in the country (*education*). Finally, according to the Law on Health Insurance, children's healthcare is based on their parents' healthcare coverage (*health*). Despite the broad coverage of children's issues in the national legislation, UNICEF (2008) concludes that their implementation is problematic.

Table 1: Dimensions and Sources

Dimensions	UN Convention on Rights of the Child (Gordon et al 2003)	National legislation (UNICEF, 2008)	National strategies/ plans	Participatory process (UNICEF, 2008)
Food/Nutrition	■			■
Water	■			
Sanitation	■			
Health	■	■	■	■
Shelter/Housing	■			■
Education	■	■	■	■
Information	■			■
Basic social services	■			
Love and care				■
Safety		■	■	■
Social exclusion		■	■	■
Freedom from exploitation		■	■	
Leisure		■	■	■
Material situation				■

Data constraints and statistical validity

Note: National legislation: Law on Child Protection, Family Law, Labor Code, Law on Social Protection, Law on Primary Education, Law on Health Insurance; National strategies/plans: National Youth Strategy 2016-2025, National Strategy for Reduction of Poverty and Social Exclusion 2010-2020, National Strategy for Prevention and Protection of Children from Violence (2020-2025) and its Action Plan (2020-2022), Strategic Plan 2021-2023 (Ministry of Labor and Social Policy).

Children's rights are covered in several national strategies and plans. The National Strategy (2020-2025) and Action Plan (2020-2022) for Prevention and Protection of Children from Violence (Ministry of Labor and Social Policy, 2019) envisions antidiscrimination and participation for every child (social exclusion), protection from violence (safety) and freedom from exploitation. Also, the National Strategy for Reduction of Poverty and Social Exclusion 2010-2020 (Ministry of Labor and Social Policy, 2013) and the National Youth Strategy 2016-2025 (Agency for Youth and Sports, 2016) promote youth social inclusion (social exclusion) and equal access to education and healthcare for every child (education and health). Further, in addition to the previous domains, the Strategic Plan of Ministry of Labor and Social policy 2021-2023 (Ministry of Labor and Social Policy, 2020) secures vacation for children at social risk (leisure). Finally, UNICEF (2008) examined the Macedonian children's perceptions of poverty and found that children felt deprived if they lacked food, money, clothes

(material situation), home (shelter), books (information), schooling (education), bike (material situation), computer (information) and soccer ball (material situation). Children share similar feelings also when they are socially excluded (social exclusion). The family and friendship (love and care) and health worries (health) received high priority from the Macedonian children, while the school (education), material well-being (material situation), games and play (leisure) and other issues are important for their perception of happiness.

3.2. DESCRIPTION OF MULTIDIMENSIONALITY OF CHILD POVERTY

After identifying the relevant dimensions for the Macedonian context, this study uses UNICEF's MICS 2018-2019 for North Macedonia and North Macedonia Roma Settlements to devise indicators for child deprivation measurement in each dimension. MICS 2018-2019 allows for measurement of all considered dimensions in Table 1, except Social exclusion for which no adequate measurement could be constructed from the available data. The covered dimensions include: *Nutrition, Water and sanitation, Health, Housing (Shelter), Education, Information, Basic social services, Love and care, Safety, Freedom from exploitation, Leisure and Material situation*. Despite the high coverage, some dimensions/indicators are specific for certain child age-groups and are restricted by data availability. In this section, indicators are derived in each dimension and the raw headcount ratio is calculated for each indicator. When calculating the raw headcount ratios, the data were weighed with MICS individual sample weights using the following rule: if an indicator refers to the 0-59 months age-group (or within the range), then the weights are adjusted for households with children less than 5 years old; if an indicator refers to the 5-17 years age-group (or within the range), then the weights are adjusted for households with children between 5 and 17 years old; and if an indicator refers to the 0-17 years age-group (or within the range) then MICS individual sample weights are used. To analyze the distribution of each deprivation across different groups, several groupings were considered with respect to urban/rural location, sex, ethnicity,[6] wealth index quintile, household head's education and number of children in the household.

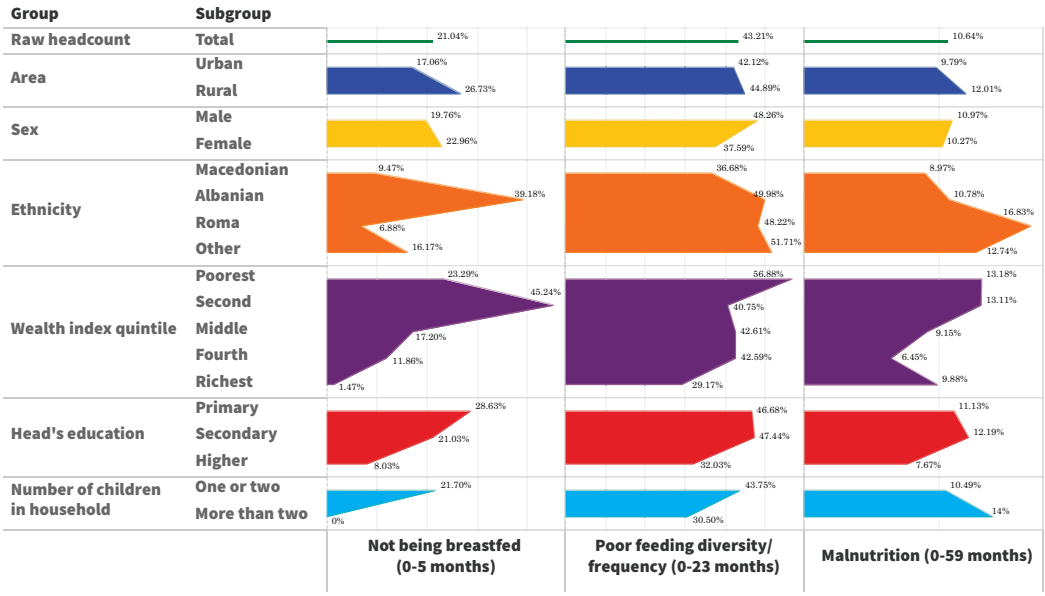
3.2.1. Nutrition

Participatory studies show that food issues come first on the priority list for children experiencing poverty and are significantly associated with ultra-poverty (e.g., Roelen and Camfield, 2013). Malnutrition does not arise only from insufficient food consumption but also from poor food quality, poor dietary diversity and feeding frequency. Individual dietary preferences play

[6] We assume that the child's ethnicity corresponds to the ethnicity of the household head.

an important role in shaping food consumption for older children (UNICEFF, 2021), and limited role for infants and very young children. Hence the limited access to food of younger children should better capture the child deprivation. To measure the child food deprivation, three indicators are used relevant for separate child age groups: (1) Child aged up to 5 months is not being breastfed; (2) Child aged up to 23 months has never been breastfed or ate less than 4 types of food out of 14 [7] or ate solid or semi-solid food less than 3 times a day/night; (3) Child aged up to 59 months is more than two standard deviations below the international reference population for stunting (height for age), wasting (weight for height), or underweight (weight for age) according to the WHO Child Growth Reference Study.

Figure 1: Raw headcount ratio: breastfeeding, diet frequency and diversity, and malnutrition (stunting, wasting or underweight)



Source: Authors' calculations based on MICS 2018-2019

Figure 1 shows the raw headcount ratio for the selected indicators exhibiting the deprivation in nutrition. Regarding the nutrition of infants, 21.04 percent of infants of breastfeeding-age are not being breastfed. The absence of breastfeeding is higher among rural households (26.73 percent), Albanians (39.18 percent) and households with more than two children (21.7 percent).

[7] The 14 types of food include: fortified baby food (gerber, hero, cerelac, nestum, etc.); grains; pumpkin, carrots, squash etc. that are yellow or orange inside; white potatoes, white yams, manioc, cassava etc. any other foods; green leafy vegetables; ripe mangoes, papayas etc. any other vitamin-A-rich fruits; other fruits and vegetables; liver, kidney, heart or other organ meat; meat such as beef, pork, lamb, goat, chicken, duck; eggs; fresh and dried fish or shellfish; beans, peas, lentils or nuts or any food made from these; cheese or other food made from milk; other solid, semi-solid or soft food.

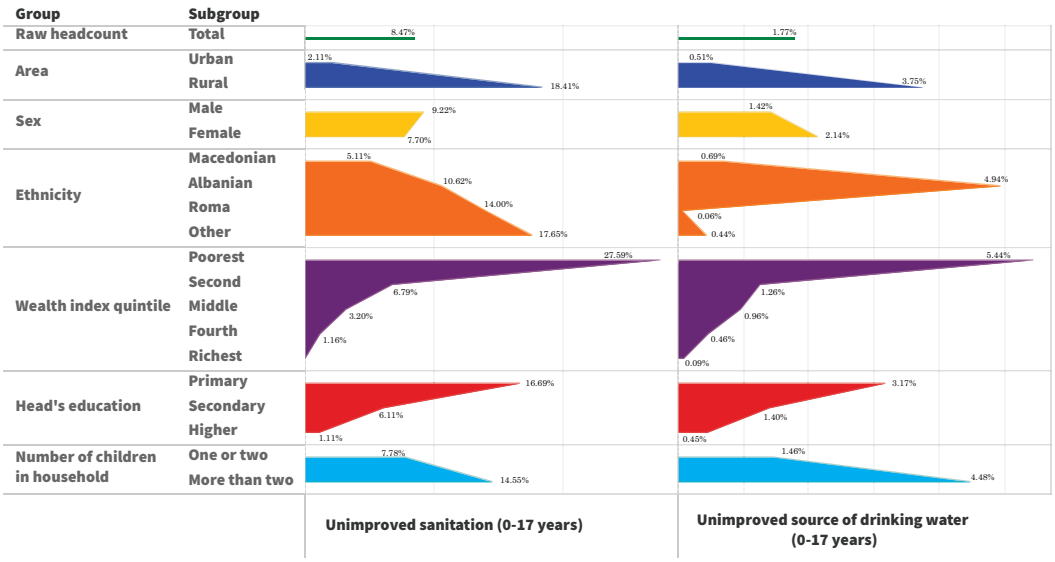
Additionally, poor-breastfed children come from poor families mainly belonging to the poorest (23.3 percent) and second wealth index quintile (45.2 percent) or families having a head with primary (28.6 percent) or secondary education (21 percent). The percentage of poorly fed children is 43.21 without significant variation between urban and rural households. Poor dietary frequency and diversity is prevalent for boys, ethnicities other than Macedonian, poorest and more-than-two-children families, however without large differences among the groups in each classification. Finally, similar patterns evolve in the last indicator highlighting the malnutrition as an anthropometric failure below two standard deviations from the reference population. 10.64 percent of children aged up to 5 years are underweight, stunted or wasted. The percentage rises to 16.83 among Roma children. Poorest families (13.18 percent), families with less educated heads (12 percent) and families with more than two children (14 percent) have more underweight, stunted or wasted children.[8] To summarize, the insufficient feeding and poor dietary practices arise as an important issue regarding child poverty in North Macedonia capturing significant percentage of children, especially among ethnic minorities, poorest families and families with more than two children.

3.2.2. Water and sanitation

Water and sanitation facilities are tightly linked with children's health and malnutrition state (Gordon et al. 2003). Poor sanitation and unsafe sources of water could induce serious childhood illnesses. Additionally, greater distances from water and sanitation facilities exacerbate the quality of living conditions of children considering that children often help to collect and carry water. The greater the distance from the source, the more limited is the quantity of water for collecting and carrying. To capture the deprivation in water and sanitation, two indicators constructed from household level data are used: (1) Child lives in a household that has access to the following toilet facilities: flush to pit latrine/ open drain/somewhere else; pit latrine; composting toilet; bucket; hanging toilet; no facility/bush/field; other, or toilet facility is shared; (2) Child lives in a household whose main source of drinking water is unprotected dug well, unprotected spring, rainwater, tanker-truck, cart with small tank or surface water; or whose source of water is more than 30 minutes away.

[8]Child wasting refers to a child who is too thin for his or her height.

Figure 2: Raw headcount ratio: unimproved sanitation and unimproved source of drinking water



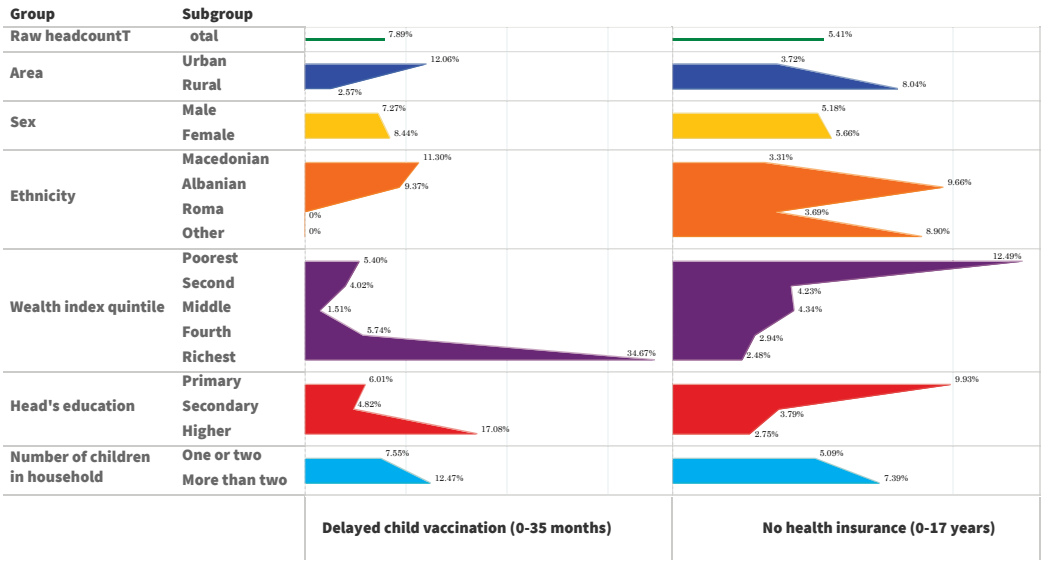
Source: Authors' calculations based on MICS 2018-2019

The percentage of children living in households deprived in Water and sanitation is presented in Figure 2. 8.47 percent of children live in households with poor sanitation facilities. Unimproved sanitation is present more among rural (18.41 percent) and poorest households (27.59 percent). Also, Roma (14 percent) and the group of other ethnicities (17.65 percent) use poor sanitation facilities disproportionately. The value of the second deprivation indicator in this category portrays a more positive situation regarding child poverty. The percentage of children exposed to unimproved source of drinking water is only 1.77. While the water deprivation is rather low, the raw headcount ratio achieves 3.75 percent, 4.94 percent, 5.44 percent and 4.48 percent among rural, Albanian, poor (poorest wealth index quintile) and households with more than two children, respectively. In conclusion, poor sanitation facilities seem to contribute more to the child deprivation comparing to the poor drinking water facilities. Significant differences exist within water and sanitation categories and water and sanitation deprivation especially prevails among rural, ethnic minorities and larger households.

3.2.3. Health

Medical care is perceived as a high-level necessity for children together with housing and clothing (e.g., Leu et al. 2016). Early child health protection is important for reduction of child morbidity and support of future child development. The lack of parents' awareness of the importance of timely vaccination may significantly expose child health to various dangerous illnesses. UNICEF (2021) highlights the parental hesitancy towards child vaccination in Montenegro due to potential side-effects – despite the very low likelihood of their occurrence. Additionally, administrative procedures and paperwork may constrain the access to health services for households. To estimate the health deprivation of children in North Macedonia, two indicators were calculated: (1) Delayed child vaccination, at least once, by more than 12 months according to the immunization schedule for 2019; [9] (2) Child does not have health insurance.

Figure 3: Raw headcount ratio: immunization hesitancy and no health insurance



Source: Authors' calculations based on MICS 2018-2019

Figure 3 presents the child deprivation in health following the same divisions. Parents' immunization hesitancy is rather high at 7.89 percent for 0-35-month age group considering that immunization is required by law. Surprisingly, the delay in child vaccination is prevalent for urban (12.06 percent), richest households (34.67 percent) and households headed by better-educated adults (17.08 percent).

[9]Considered vaccines: Bacillus Calmette–Guérin vaccine (bcg), Hepatitis B vaccines (hepb 1, hepb 2, hepb 3), inactivated polio vaccines (ipv 1, ipv 2, ipv 3, ipv 4), vaccines against diphtheria, tetanus, and pertussi (dtp 1, dtp 2, dtp 3, dtp 4), vaccines against haemophilus influenzae type b (hib 1, hib 2, hib 3, hib 4), and vaccine against measles, mumps, and rubella (mrp).

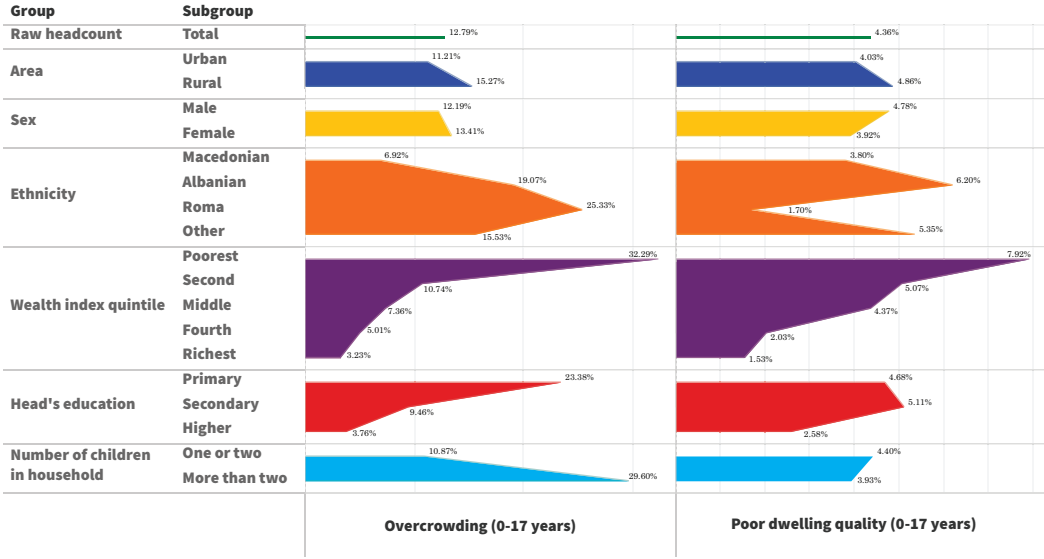
Interestingly, Roma and the group of other ethnicities experience no delay in child vaccination, while Macedonian and Albanian children received late immunization in 11.3 percent and 9.37 percent of the cases, respectively. Regarding the health insurance coverage, 5.41 percent of children have no health insurance. 9.66 percent of children in Albanian and the group of other ethnicities, 8.04 percent of children in rural and 12.49 percent of children in poorest households are not covered with health insurance.

Lower education of household heads and larger household size contribute to the health deprivation of children in North Macedonia. To summarize, contradicting patterns are observed regarding these two indicators. Immunization hesitancy is present more in highly educated, urban and richer households – which may be a product of insufficient information provided directly by healthcare providers or abundance of misinformation in media. UNICEF (2021) finds that parents' doubts on vaccine safety in Montenegro arise from deceptive information, mainly coming from media rather than from healthcare providers. On the other hand, poorest, Albanian and the group of other ethnicities, rural, less educated and larger households lack an appropriate health insurance coverage. While non-uniformly dispersed, the health-insurance-coverage-deprivation is low due to the universal health insurance coverage in North Macedonia.

3.2.4. Housing (Shelter)

Overcrowded and poorly constructed dwellings pose a threat to the health and safety of adults and children. Sharing a room by too many people increases the risk of disease transmissions, in addition to affecting the stress levels and mental health of those living in overcrowded places (Gordon et al. 2003). Additionally, the lack of privacy exacerbates the living environment in overcrowded households. Furthermore, poor dwelling quality augments the risk of accidents and injuries of household members. To assess the deprivation in housing, two indicators constructed from household level data are used: (1) Overcrowding – Child lives in a household who has on average more than three people per room; (2) Dwelling quality – Child lives in a dwelling with earth/sand flooring, or flooring made from dung or wood planks, or there is no roof or the roof is made from thatch, sod, or stone slabs/leaf stone, or there are no walls or the walls are made from cane/trunks, dirt or stone with mud.

Figure 4: Raw headcount ratio: overcrowding and poor dwelling quality



Source: Authors' calculations based on MICS 2018-2019

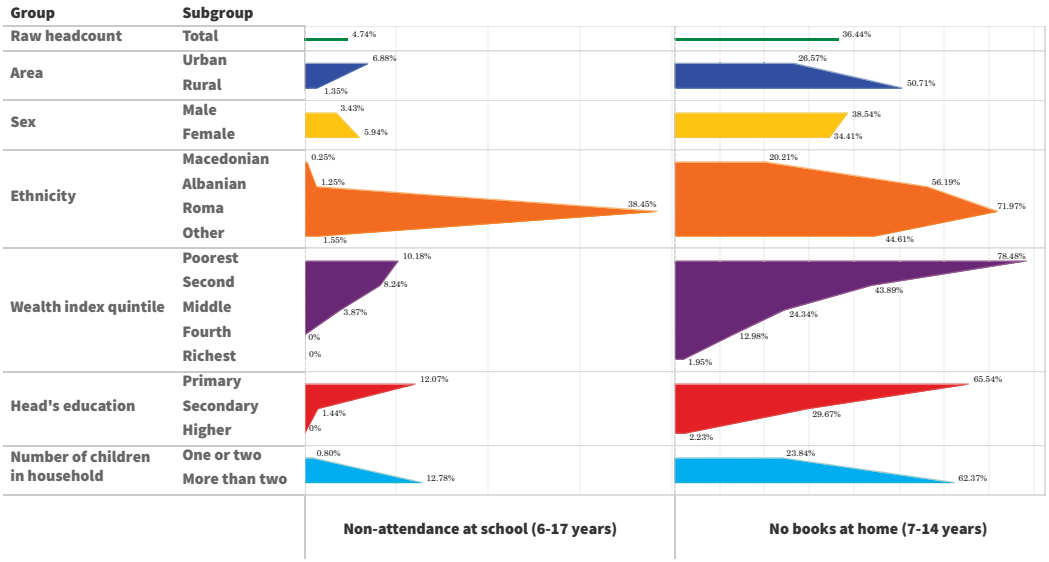
Children deprivation in housing is presented in Figure 4. The percentage of children living in overcrowded households is 12.79. While that percentage is higher for rural households, 15.27 percent, considerable percentage of children also reside in overcrowded dwellings in urban areas (11.21 percent). Every fourth Roma child and every fifth Albanian child lives in overcrowded household. Overcrowded households are highly represented in poorest (32.3 percent), and multi-child households (29.6 percent), as well as in households headed by less-educated adults (23.4 percent). With respect to the dwelling quality, the child deprivation is less severe affecting 4.36 percent of children. No significant differences exist between urban and rural children as well as between boys and girls, but the percentage of children living in poor quality dwellings is higher for Albanians (6.2 percent), Macedonians (3.8 percent) and the group of other ethnicities (5.35 percent). The wealth index quintile and the education of the household head are important determinants of child deprivation in housing.

3.2.5. Education

Educational attainment shapes a child's future development and paves the way to overcome poverty not only for the child but also for whole household. On the contrary, a child's poor access to education and poor educational performance increase the likelihood that the child would remain in the vicious education-poverty cycle. The deprivation in education may reflect on two aspects: firstly, the child may have no access or necessary conditions for schooling, and secondly, even if it has access to education, the child may perform poorly and gain limited skills for future development. To account for the former, two indicators are

introduced: (1) Child of compulsory school-age not attending school, and (2) Child has no books at home; while to account for the latter, two other indicators are designed: (3) Reading and numeracy skills – child missed/incorrectly read more than 10 percent of the presented words or made more than two mistakes in each group of tasks: recognizing symbols (six tasks), comparing numbers (five tasks), adding numbers (five tasks), ordering (five tasks), and (4) Child is two or more years behind age-appropriate grade.

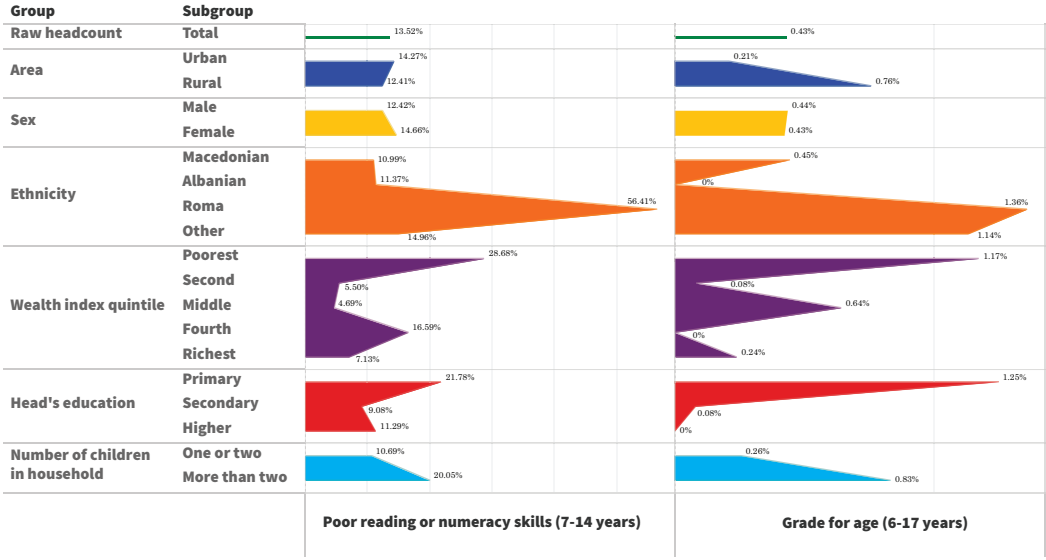
Figure 5: Raw headcount ratio: non-attendance at school and no books at home



Source: Authors' calculations based on MICS 2018-2019

Figure 5 shows the raw headcount ratios of children not attending school and not having books at home. 4.74 percent of children of compulsory school-age do not go to school in North Macedonia. Surprisingly, the percentage rises to 6.88 when the focus is put only on urban areas, while it equals 1.35 percent for rural areas. Moreover, the percentage of Roma children not attending school is at an alarming 38.45. Children not attending school mainly come from households with more than two children and which are headed by adults with only primary education. On the other hand, 36.44 percent of children do not have books at home. Half of the rural children and a quarter of urban children face this problem. Besides Roma children (71.97 percent), Albanian (56.19 percent) and children from the group of other ethnicities (44.61 percent) are also deprived according to this indicator. The household's economic status, the educational level of its head and household size are associated with the possession of books at home.

Figure 6: Raw headcount ratio: poor reading and numeracy skills and grade for age



Source: Authors' calculations based on MICS 2018-2019

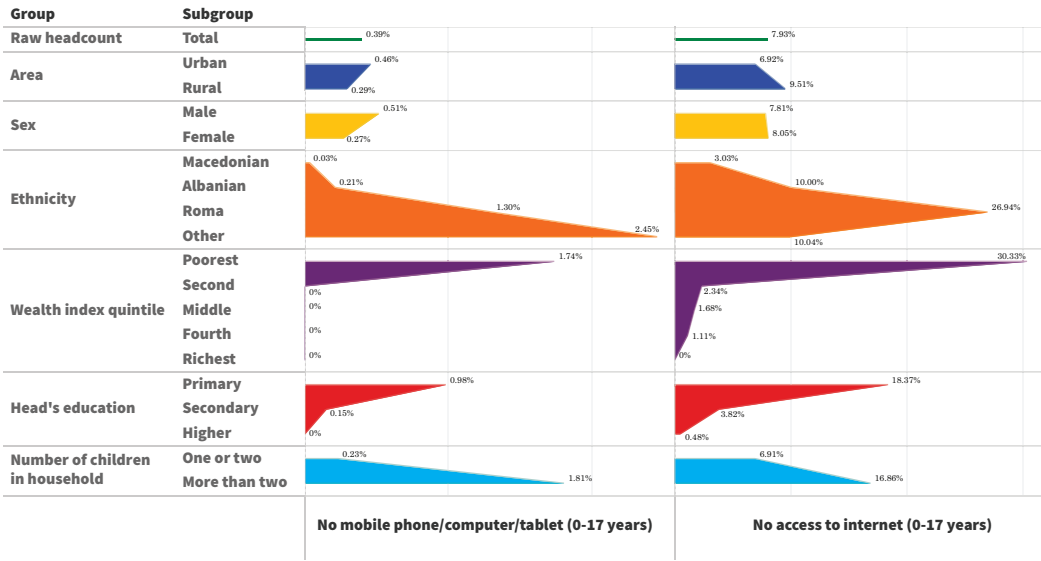
Figure 6 refers to the skills-related education indicators. The share of children having poor reading or numeracy skills is 13.52 percent without important urban/rural and gender differences. More than half of Roma children have problems in reading and numeracy. Also, poor-skilled children belong to households in the first and fourth wealth index quintile indicating that wealth does not always support better educational skills. Very low numbers are observed in the last indicator. Only 0.43 percent of children fall behind in achieving age-appropriate grade. [10] While the percentage is low, the deprivation of this kind is typical for rural (0.76 percent) and Roma children (1.36 percent). Similarly, the household's economic status, the educational level of its head and household size affect the child's educational performance. To summarize, the analysis highlights the high level of deprivation in education of the Roma population across all considered indicators. The educational deprivation is significantly affected by the wealth, the educational level of the household head and the household size.

[10] One explanation for this result could be the policy to avoid repetition of grades for students from first to fifth grade. Students that fall behind in achieving age-appropriate grade, are usually children with disabilities or children who get enrolled in school after the enrollment age.

3.2.6. Information

Children's limited access to information technology arises as a major constraint for implementation of the recent school reforms aimed towards digitalization. To reap the benefits of more efficient e-learning, children should have basic conditions such as, mobile telephone, computer or tablet and internet access.[11] Since there are no child-targeted questions in MICS 2018-2019 regarding the information dimension, two indicators are defined based on household data: (1) Child lives in a household which does not have a mobile telephone/computer/tablet, and (2) Child lives in a household which does not have access to the internet.

Figure 7: Raw headcount ratio: No mobile telephone/computer/tablet and no access to internet



Source: Authors' calculations based on MICS 2018-2019

Figure 7 shows a low level of deprivation regarding the first indicator. Namely, only 0.39 percent of children live in households without a mobile telephone, computer or tablet. Roma (1.3 percent) and the group of other minorities (2.45 percent) are more likely to suffer in this regard. Moreover, this characteristic is typical for poorest and more-than-two-children households, as well as those headed by less educated adults. The situation is gloomy regarding the children's internet access. 7.93 percent of children live in households without access to the internet with no significant differences related to residing in urban/rural area and sex. Albanians and the group of other ethnicities retain similar percentage (10 percent) except for Roma children where 27 percent are deprived in this regard.

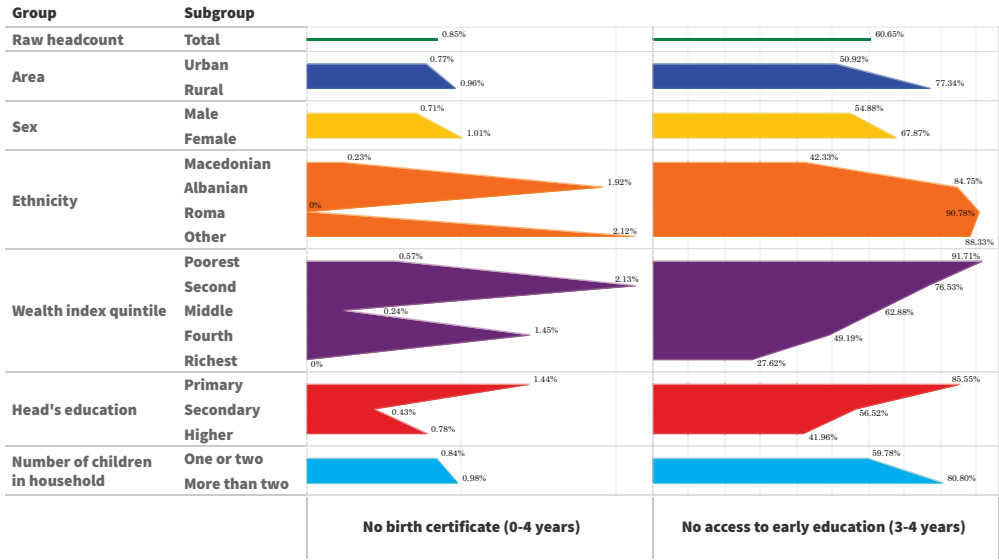
[11]While it is possible to access online educational resources or attend online classes using a smartphone, it is less than ideal informational technology for e-learning.

Moving up along the wealth index scale from poor to rich, the internet deprivation becomes less of an issue, however 30.3 percent of poorest households have no internet access. In conclusion, the access to information for children is fairly good on average, however not uniform, since certain number of households with specific socio-economic characteristics still remain detached.

3.2.7. Other social services[12]

The access to early childhood education is of utmost importance for early child development. The public investments in early childhood education are heavily neglected in the neighboring countries in the Western Balkan region (UNICEF, 2015b). The initial condition for having access to key social services is possessing a birth certificate. Even if the child has a birth certificate, the lack of education facilities nearby limits the access to basic social services. Two indicators are included in this dimension: (1) Child has no birth certificate; and (2) Child never attended early childhood education program;

Figure 8: Raw headcount ratio: no birth certificate and no access to early education



Source: Authors' calculations based on MICS 2018-2019

Figure 8 presents the deprivation prevalence in each indicator. Firstly, only 0.85 percent of children do not possess birth certificates. The prevalence is higher among Albanians (1.92 percent) and the group of other ethnicities (2.12 percent). It is notable that no-birth-certificate children live even in richer (fourth

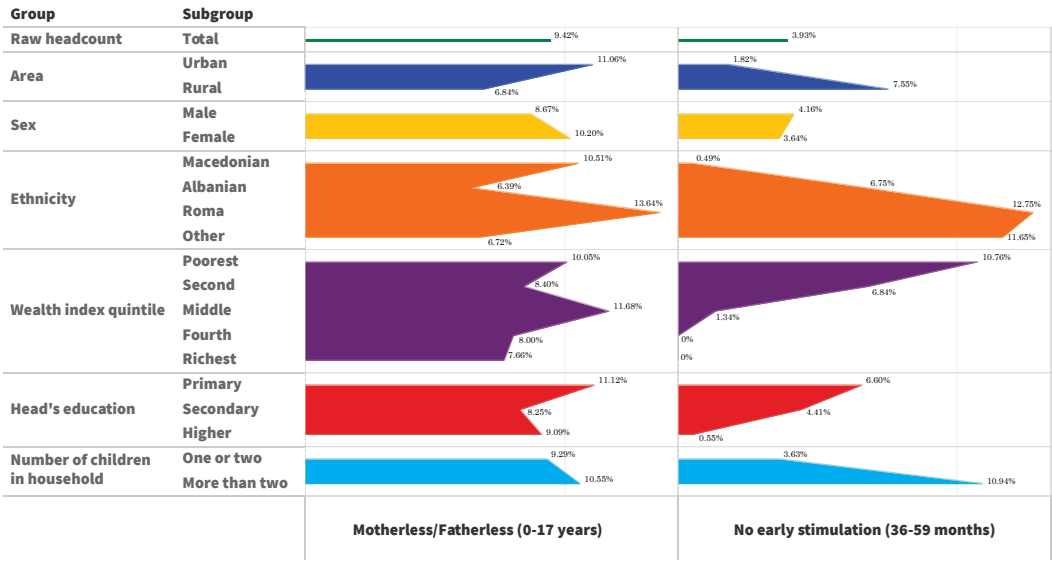
[12] The dimension, basic social services, generally captures the limited access to education and health facilities, as well as to other public services. Since education and health deprivations have been encapsulated in separate dimensions, this dimension should approximate the limited access to other public services.

wealth index quintile) and more educated households, although that number revolves around 1 percent. Secondly, the data shows that 60.65 percent of children never attended an early childhood education program. Raw headcount ratio is higher for rural children (77.34 percent) and girls (67.87 percent). Also, lack of early education exists among all ethnicities, but it is especially relevant for minorities (over 84 percent). Most of the children without early childhood education live in poorest, households with less educated head and with more than two children. To summarize, rural children are heavily deprived in this dimension and ethnicities other than Macedonian have limited access to early childhood education.

3.2.8. Love and care

The bottom-up participatory studies reveal that children highly value the relationship between them and adults (Biggeri et al. 2006). Love and care dimension describes the type of link between the child and parents (especially, mother) which plays major role in ensuring a child's emotional balance (Trani et al. 2013). Additionally, the lack of parents' attention may negatively affect the emotional state of the child, even if both parents live in the household. Two indicators are used to measure the deprivation in love and care: (1) Child is motherless/fatherless (mother/father is not alive or mother/father does not live in the household); and (2) Early stimulation – no adult has engaged with the child in four or more activities to promote learning and school readiness in the past three days (e.g., read books or looked at picture books; told stories; sang songs, including lullabies; took outside the house; played together; named, counted or drew things for or with the child).

Figure 9: Raw headcount ratio: motherless/fatherless and no early



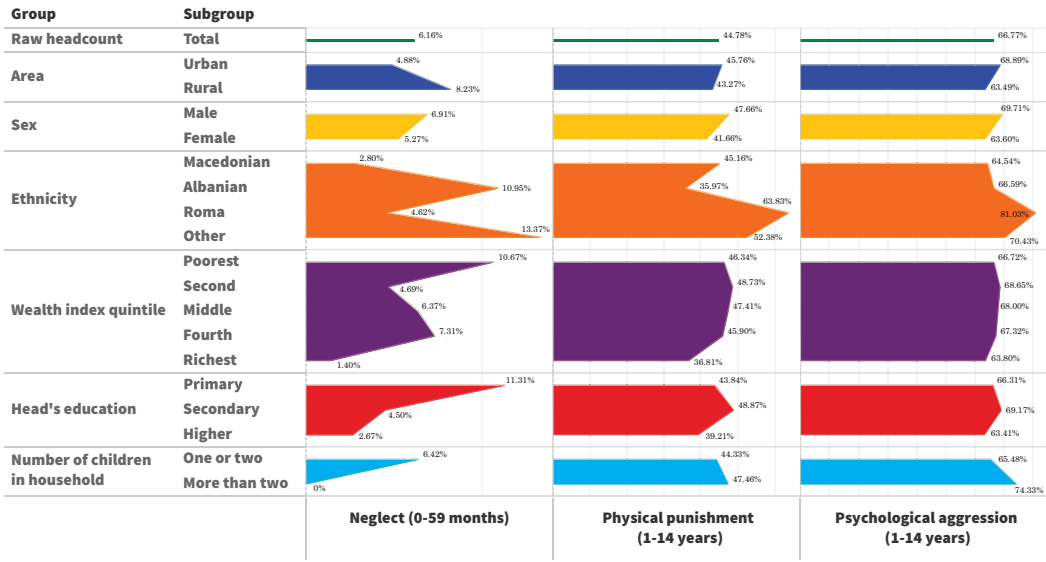
Source: Authors' calculations based on MICS 2018-2019

The prevalence and distribution of love and care deprivations are presented in Figure 9. Almost 9.5 percent of children live without at least one of their parents. The percentage rises to 11 when considering only children living in urban areas. Regarding the ethnical division, Roma (13.64 percent) and Macedonians (10.51 percent) face this deprivation more often. There are no significant differences according to the gender of the child, household wealth, the educational level of the household head and the number of children in the household. With respect to the second indicator, the percentage of children receiving no early stimulation is rather low and equals 3.93 and rises to 7.55 percent for rural children. Roma children (12.75 percent) and those in the group of other ethnicities (11.65 percent) lack important interactions with adults for early childhood development. Contrary to the distribution in the previous indicator, the household's wealth, the educational level of the household head and the household size play an important role in explaining the differences in the deprivation of children in terms of early stimulation. To sum up, children's deprivation in love and care is not widespread, but is also not uniform because important differences exist, especially among between urban/rural areas and ethnicities.

3.2.9. Safety

While the love and care dimension may show lack of positive behavior in the household, parents may implement other, negative methods to discipline the child or be prone to negative behavior due to other reasons. For instance, excessive alcohol consumption by one or both parents may lead to violence in the household (Pinilla-Roncancio and Silva, 2018). A child's safety may be endangered from violence both inside the household (child abuse and neglect) and outside the household (unsafe environment) (García and Ritterbusch, 2015). The future educational development and mental health of the child depend on the existence and extent of child abuse and neglect (García and Ritterbusch, 2015). To account for the deprivation of children in terms of safety, three indicators have been created: (1) Neglect – a child, 0-59 months old, has been left alone for more than one hour, or left in the care of another child younger than 10 years old, at least once in the past week; (2) Physical punishment – a child being shaken; being spanked, hit or slapped on the bottom with bare hand; being hit on the bottom or elsewhere with belt, brush, stick, etc.; being hit or slapped on the hand, arm; being hit or slapped on the face, head or ears; being beaten with force; and (3) Psychological aggression - a child is either shouted, yelled or screamed at, or is called dumb, lazy or with another derogatory term.

Figure 10: Raw headcount ratio: neglect, physical punishment and psychological aggression



Source: Authors' calculations based on MICS 2018-2019

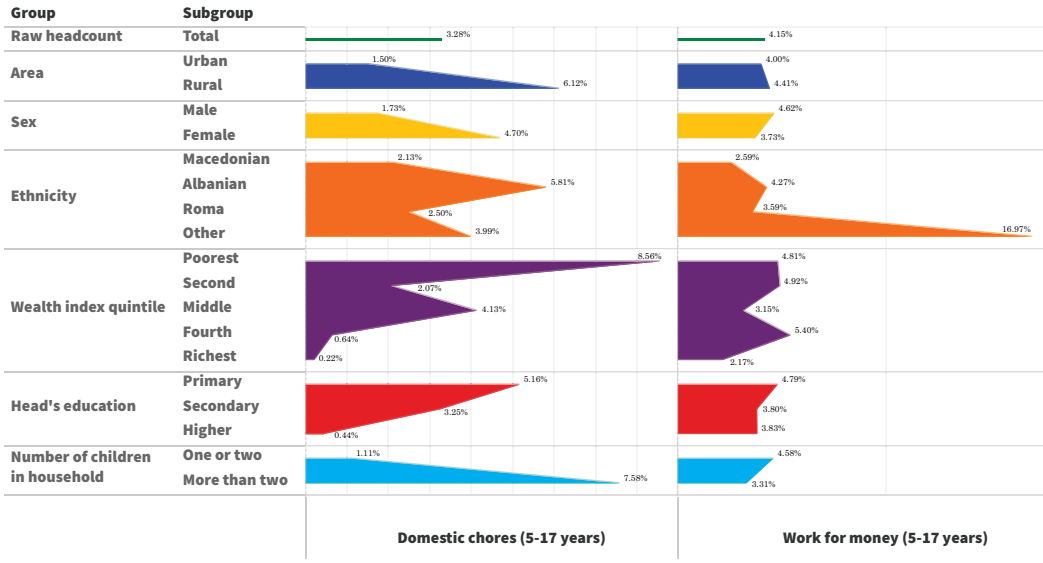
Figure 10 shows the prevalence of child neglect, physical punishment, and psychological aggression. Child neglect is the least frequent safety deprivation among the households in North Macedonia affecting only 6.16 percent of children. This percentage is slightly inflated for rural children (8.23 percent) and boys (6.91 percent). Albanians (10.95 percent) and the group of other ethnicities (13.37 percent) are more likely to experience child neglect. Child neglect occurs exclusively in small households having one or two children. Regarding physical punishment and psychological aggression, the situation is alarming. 44.78 percent of children have been physically punished, while 66.77 percent of them suffered from psychological aggression. Similar prevalence exists regardless of the group of children, although it is slightly higher for Roma children, 63.83 percent with respect to physical punishment and 81.03 percent for psychological aggression. To sum up, this form of negative behavior within households in North Macedonia is very frequent which might be attributed to the cultural antecedents of disciplining children.

3.2.10. Freedom from exploitation

Children's school attendance, leisure times and activities, and autonomy and future expectations could be significantly affected by child labor (Pinilla-Roncancio and Silva, 2018). Also, child labor may be perceived as a 'normal' activity by children to help their parents (UNICEF, 2021), however children's work for money is typical for poor households (Roelen and Camfield, 2013). Since both, child housework and work for money have important consequences on

educational and cognitive development of children, two indicators to measure the extent of child labor among children in North Macedonia are used: (1) Domestic chores – child is engaged in more than five of the following activities: fetching water, collecting firewood, shopping, cooking, washing dishes/ cleaning, washing clothes, caring for children, caring for elderly household member, other HH tasks; and (2) Work for money – helped in the family business, produced or sold articles or engaged in any other activity for income.

Figure 11: Raw headcount ratio: domestic chores and work for money



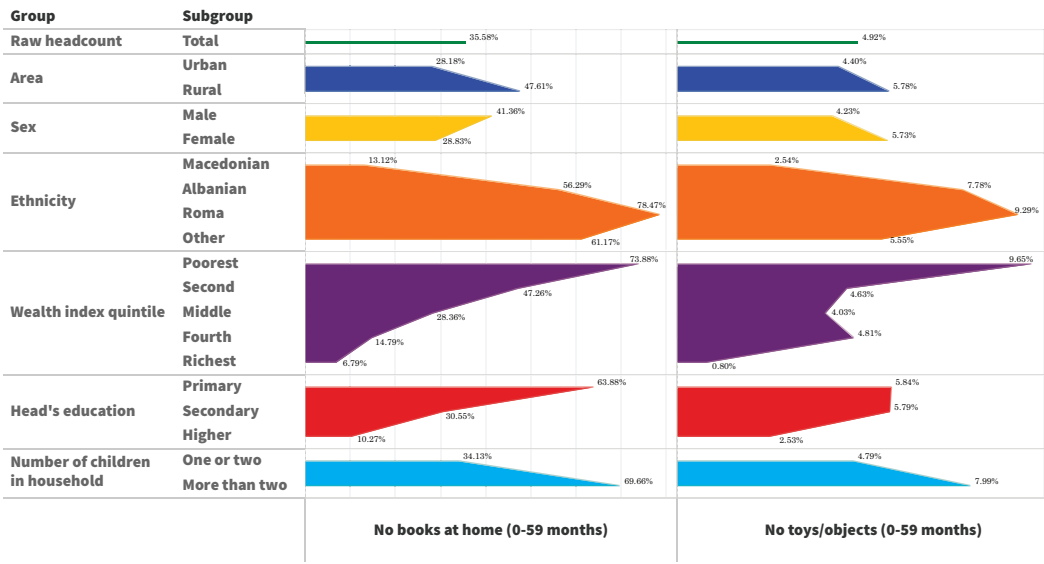
Source: Authors' calculations based on MICS 2018-2019

Figure 11 shows that child labor is rare in North Macedonia. Only 3.28 percent of children are engaged in housework activities, largely within rural households (6.12 percent) and among girls (4.7 percent). Albanian children more frequently perform unpaid work at home comparing to other ethnicities. Almost 9 percent of poorest households and 8 percent of households with more than two children activate their children to do domestic chores. With respect to work for money, 4.15 percent of children engaged in helping in a family business, producing or selling articles or doing any other activity for income. This deprivation is typical for children from the group of other ethnicities (16.97 percent), while there are no significant differences regarding urban/rural area, gender, the education of the household head and household size. Unsurprisingly, children in richest households engage the least in activities for income. To sum up, child labor is limited in North Macedonia – child work for money is largely uniform across different groups of children, while child housework shows irregular frequency when considering different groups of children.

3.2.11. Leisure

Leisure and recreational activities enhance children's socialization, creativity and cognitive development. Time use may have important effects on educational attainment and on child's health. Leisure time is relevant for both children and adolescents. However, for the former, early child development starts with extracurricular activities inside the household, while for the latter, both in-household and out-household (for example, in school) free time activities shape their physical and cognitive development. Having tools for entertainment (books or toys) in the household is one step forward towards providing early stimulation for children. While this dimension is important for children and adolescents, data is available only for the younger age group (0-59 months). Two indicators are devised: (1) Child has no books at home; and (2) Child has no toys/objects to play at home.

Figure 12: Raw headcount ratio: no books at home and no toys/objects



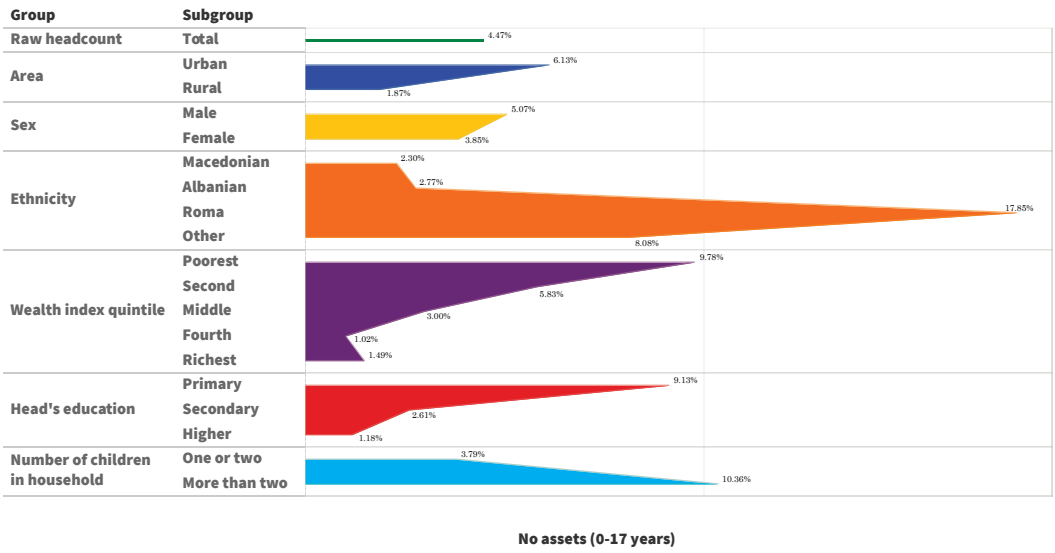
Source: Authors' calculations based on MICS 2018-2019

The distribution of children deprived in the leisure dimension is presented in Figure 12. More than a third of children have no books at home. Almost half of rural children are deprived in relation to this indicator, and boys suffer more often. No-books deprivation prevails among minorities, poorest, multi-child households. On the other hand, the percentage of children lacking toys/objects to play at home is almost 5. In contract to the previous indicator, girls are more deprived in this regard. Finally, minorities, poorest and multi-child households have larger percentage of children without toys/objects to play. To conclude, discrepancies exist regarding the extent of deprivation between the two indicators, however the leisure deprivation follows similar patterns across the chosen classifications.

3.2.12. Material situation

Economic hardships may cause adverse behavior by household members, thus increasing stress and anxiety in the family (García and Ritterbusch, 2015). Additionally, the lack of financial resources constrains adolescents' confidence and future expectations and negatively influences physical and mental health. To assess material deprivation of children, household level data were used and the following indicator was defined: (1) Child lives in a household that does not own a dwelling, land, animals, car, truck or van.

Figure 13: Raw headcount ratio: no assets



Source: Authors' calculations based on MICS 2018-2019

Figure 13 shows that the extent of materially deprived children equals 4.47 percent. The children in urban areas are more likely to suffer from material deprivation compared to rural children. The percentage jumps to 17.85 within the Roma population. Similar to most of the indicators, the wealth index quintile, the educational level of the household head and the number of children in a household influence whether children and households would face economic hardships. While material deprivation is less prevalent in North Macedonia, policymakers should pay attention to certain groups of households and children, such as Roma and larger households.

4. MULTIDIMENSIONAL CHILD POVERTY INDEX

4.1. VALIDITY TESTS TO CHOOSE THE BUILDING-BLOCK DIMENSIONS OF THE CHILD MPIs

The previous chapter lists all possible indicators and dimensions of child poverty adapted to the Macedonian context. However, the central aim of this study is to design a multidimensional child poverty index (MPI) which should be constructed of dimensions capturing different aspects of poverty. To account for the eligibility and validity of the chosen indicators/dimensions, two validity tests were conducted. Initially, each indicator/dimension was regressed on household wealth score to ascertain whether the indicators/dimensions relate to the construct of poverty. [13] Since wealth is tightly related to the construct of poverty, it is expected for the eligible indicators to be significantly related to the wealth scores of households (e.g., Qi and Wu, 2019). Additionally, the (Cramer V) correlations and redundancy values were calculated across dimensions to identify if any dimension is redundant (e.g., Alkire et al., 2014). The lower values of correlation coefficients and redundancy suggest that the dimension represents different aspect of child poverty.

[13] We use logistic regression models to perform this analysis. The wealth score is derived from the wealth index which represents a composite indicator of wealth capturing the ownership of consumer goods, dwelling characteristics, water and sanitation and other characteristics related to the household's wealth. For detailed description, see here.

Table 2: Logistic regressions for each indicator/dimension on wealth score

Dimension	Indicator	Odds ratio (I)	Odds ratio (D)
Nutrition	Breastfeeding	0.613**	0.834***
	Poor feeding	0.836**	
	Malnutrition	0.846**	
Water and sanitation	Sanitation	0.289***	0.291***
	Water	0.687***	
Health	Delayed vaccination	1.605	0.687***
	Health insurance	0.668***	
Housing	Overcrowding	0.462***	0.480***
	Poor dwelling	0.814***	
Education	Non-attendance at school	0.556***	0.573***
	No books at home (7-14)	0.225***	
	Poor reading/numeracy	0.523***	
	Grade for age	0.634***	
Information	No mobile/computer/tablet	0.427***	0.288***
	No internet	0.288***	
Other social services	No birth certificate	0.826	0.666***
	Access to early education	0.287***	
Love and care	Motherless/Fatherless	0.810***	0.773*
	No early stimulation	0.538***	
Safety	Neglect	0.679***	0.934*
	Physical punishment	0.934*	
	Psychological aggression	0.971	
Freedom from exploitation	Domestic chores	0.544***	0.655***
	Work for money	0.851*	
Leisure	No books at home (0-4)	0.270***	0.269***
	No toys/objects	0.804***	
Material situation	No assets	0.603***	0.603***

****p<0.01, **p<0.05, *p<0.1*
Authors' calculations

Table 2 presents the odds ratios for each indicator/dimension.[14] All dimensions satisfy the assumption that they describe the construct of poverty, although few indicators show no significant relationship with the wealth score. Namely, the delayed immunization, the lack of birth certificate and the psychological aggression do not arise mainly within poor households. Despite the insignificance of these indicators, retaining them within the chosen dimensions does not affect the explanatory power of dimensions with respect to the poverty measure (wealth score).

[14] In the validity analysis, the dimensions are constructed using the union approach.

A validity analysis was conducted to assess the redundancy of retaining all indicators/dimensions as initially defined.

Table 3: (Cramer's V) Correlations across raw headcount ratios

	Nutri-tion	Wat.& sanit.	Health	Hous.	Educ.	Info.	Soc. serv.	Love & care	Safe.	Ex-ploit.	Lei-sure	Mater. sit.
Nutrition	1	0.05	0.03	0.04		0.07	0.24	0.04	0.36		0.28	0.04
Water & sanitation		1	0.03	0.20	0.13	0.22	0.22	0.01	0.00	0.07	0.21	0.11
Health			1	0.04	0.11	0.12	0.06	0.08	0.03	0.08	0.16	0.04
Housing				1	0.09	0.18	0.10	0.00	0.03	0.03	0.17	0.14
Education					1	0.11	0.05	0.06	0.00	0.06		0.05
Informa-tion						1	0.10	0.11	0.04	0.15	0.24	0.26
Other social services							1	0.12	0.18	0.17	0.02	0.08
Love & care								1	0.00	0.06	0.07	0.09
Safety									1	0.01	0.19	0.01
Exploita-tion										1		0.01
Leisure											1	0.07
Material situation												1

Authors' calculations

Table 3 reports the Cramer's V correlation coefficients between the dimensions. The results show low association between the chosen dimensions which reflects the diversity of aspects each dimension is representing. Nutrition and Safety have the highest correlation coefficient (0.36), although the magnitude of the association is still moderately low. Alkire et al. (2014) suggest that correlation analysis needs to be supplemented with measures of redundancy. The redundancy values were calculated (as suggested in Alkire et al., 2014), which show the percentage of children who are deprived in both dimensions as proportion of those deprived in the one with the lower headcount. The results are presented in Table 4. The redundancy values are moderately high to high across the dimensions. The highest value arises between leisure and information (0.77), meaning that 77 percent of children deprived in Leisure, also experience deprivations in Information. Additionally, higher redundancy values exist when the Safety dimension is coupled with others. This is a result from the high frequency of safety deprivations among children. Despite the prevalence of Safety deprivations, the redundancy values show that some percentage of children that are not deprived in Safety, experience other deprivations. For example, 31 percent of materially deprived children have no deprivations

in Safety. To summarize, the validity analysis showed that the dimensions are properly defined and measure different aspects of child poverty. Some redundancies appear within the Safety dimension resulting from the prevalence of psychological aggression among the children, which indicator may not belong to the construct of poverty. Regardless of the possible problems of redundancies, based on UNICEF (2021) psychological aggression was retained as a deprivation indicator, and later its importance has been checked in the post-estimation sensitivity analysis.

Table 4: Redundancy values across raw headcount ratios

	Nutri-tion	Wat.& sanit.	Health	Hous.	Educ.	Info.	Soc. serv.	Love & care	Safe.	Ex-ploit.	Lei-sure	Mater. sit.
Nutri-tion	1	0.37	0.36	0.35		0.42	0.12	0.23	0.34		0.56	0.39
Water & sani-tation		1	0.15	0.40	0.30	0.39	0.56	0.14	0.67	0.20	0.62	0.30
Health			1	0.25	0.46	0.19	0.41	0.15	0.61	0.15	0.64	0.11
Hous-ing				1	0.25	0.44	0.40	0.19	0.70	0.11	0.50	0.46
Educa-tion					1	0.32	0.60	0.25	0.73	0.36		0.28
Infor-mation						1	0.46	0.18	0.74	0.21	0.77	0.41
Other social ser-vices							1	0.53	0.74	0.46	0.36	0.48
Love & care								1	0.67	0.17	0.48	0.19
Safety									1	0.71	0.49	0.69
Ex-ploita-tion										1		0.08
Leisure											1	0.51
Ma-terial situa-tion												1

Authors' calculations

4.2. Alkire-Foster method – some comparison with other approaches

The counting approaches (with axiomatic properties)[15] for measuring multidimensional poverty received particular attention, especially after the development of the Alkire-Foster method (Alkire and Foster, 2011). The AF method applies dual cut-off approach in counting the deprived households/individuals. First, it sorts the poor from the non-poor in each dimension, taking separate cut-offs for each dimension, then aggregates the households/individuals who are multidimensionally poor (deprived in a number of dimensions based on pre-specified cut-off point). The Multidimensional Poverty Index is the most common representative of the AF method. Conceptually, the MPI relies on Sen's capability framework, treating poverty as more than just a lack of resources and taking the household as a unit of the analysis. However, the MPI makes strong assumptions to measure child poverty: firstly, it assumes that children equally share the resources within the household; secondly, it does not take into account that certain services, such as health and education, are more relevant for children than for adults and for those services markets are imperfect; finally, it neglects certain key dimensions relevant for child well-being such as, absence of violence and participation in society (Chzhen and Ferrone, 2017).

To accommodate the MPI's assumptions in measuring child poverty, UNICEF developed a child-centered toolkit named Multiple Overlapping Deprivation Analysis (MODA) (de Neubourg et al. 2012a). MODA draws on child rights approach for constructing its indicators and dimensions. Additionally, MODA considers the life-cycle approach since different dimension are relevant for child well-being depending on the child's age. Hjelm et al. (2016) recognize these conceptual differences between MPI and MODA in measuring child poverty and find significant discrepancies when both are used for identifying poor children. The discrepancies arise not only due to the conceptual differences, but also due to operational reasons (see, Table 5). Firstly, MODA treats each indicator within each dimension as equally important and applies the union approach in sorting poor from non-poor children,[16] while MPI applies equal weights to each indicator and defines cut-off point to identify poor children for each dimension. Secondly, MPI aggregates its indicators into one index, while MODA presents the entire distribution of dimensional deprivations.

[15] The measures which satisfy certain principles and axioms given their mathematical structure have axiomatic properties. For instance, the headcount ratio satisfies symmetry, replication invariance, scale invariance, weak dimensional monotonicity, weak monotonicity, weak transfer, weak rearrangement and poverty focus (Alkire et al., 2015).

[16] According to the union approach, the child is considered poor in each dimension if it is deprived in at least one indicator within the dimension.

Table 5: Key features of MODA, MPI and Child MPI

	MODA	Household MPI	Child MPI
Conceptual framework	Children's rights (e.g. CRC)	Basic needs/ capabilities	Children's rights (e.g. CRC)
Unit of analysis	Child (could be extended to measure MD poverty of adults)	Household/adult (disaggregating children living in MD poor households possible)	Child
Age-specific indicators	Yes	No	Possible age-specific MPIs
Data requirements	Single survey data	Single survey data	Single survey data
Aggregation of indicators into dimensions	Aggregates indicators into dimensions using the union approach	Assigns indicators to three dimensions and aggregates indicators directly into one index	Assigns indicators to multiple dimensions and aggregates indicators directly into one index
Number of indicators per dimension	One or two (preferably two indicators in each dimension)	Typically, two to six indicators per dimension	Flexible (one to several indicators)
Weighting	Dimensions are weighted equally; reports the number of dimensions an individual is deprived in	Dimensions have the same weight and indicators are weighted equally within dimension	Dimensions have the same weight and indicators are weighted equally within dimension
Overlaps analysis	Overlaps analysis (where individual is deprived in multiple dimensions)	Supports overlaps analysis between dimensions at the household level	Supports overlaps analysis between dimensions
Sensitivity to changes	Sensitive to variation in a single indicator only when this indicator defines the entire dimension	Sensitive to variation in a single indicator because each indicator has a separate weight	Sensitive to variation in a single indicator because each indicator has a separate weight
Use of monetary indicators	Excludes	Excludes	Excludes
MD threshold	Deprivation count index between 0 and number of dimensions (no predefined cutoff)	Index between 0 and 1 for each household and has a predefined cutoff to define poor households (e.g. 0.33)	Index between 0 and 1 for each child and has a predefined cutoff to define poor children (e.g. 0.33)
Headline population-level MD measure	Headcount, intensity and intensity-adjusted headcount measures	Headcount, intensity and intensity-adjusted headcount measures	Headcount, intensity and intensity-adjusted headcount measures
Lead agency	UNICEF	UNDP and OPHI	UNDP and OPHI

Source: Hjelm et al. (2016)

Despite the important differences between MPI and MODA, the recent application of MPI on child-level data eliminates the conceptual differences. For instance, Alkire and Roche (2011) calculate a Multidimensional Child Poverty Index using the Bristol Deprivation approach taking children aged 0 to 5 as a unit of analysis. Similarly, Pinilla-Roncancio et al. (2020) develop a child MPI considering children aged 0 to 17 years. Evidently, MPI could be easily adapted to account for MODA's children rights approach into a child MPI with possibility to calculate age-specific MPIs (depending on data availability). Consequently, MODA's more restrictive aggregation/weighting approach would produce higher multidimensional child poverty comparing to the child MPI's.

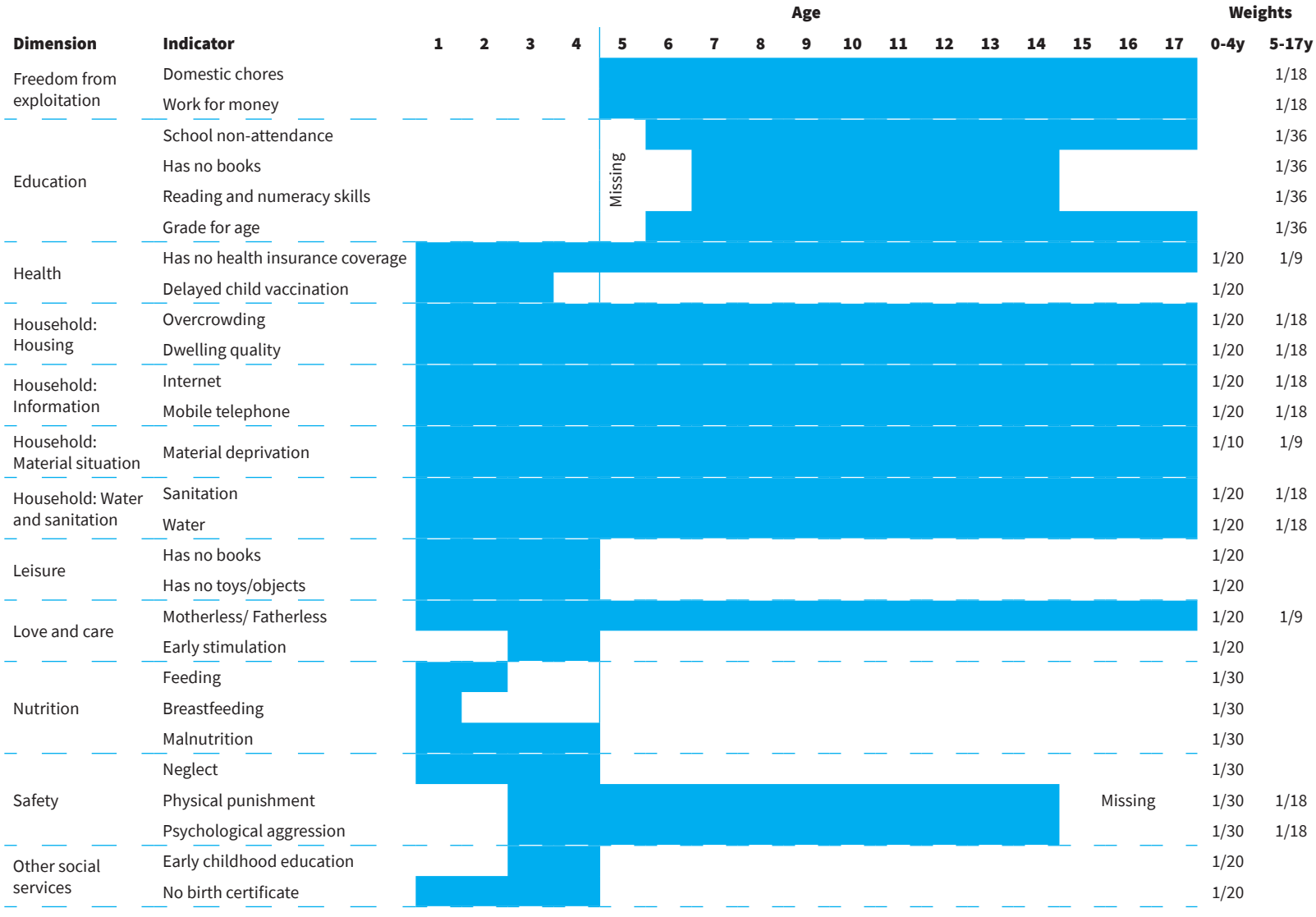
4.3. AF Methodology: Incidence, intensity of poverty and adjusted headcount ratio

This section describes the steps and calculation of main statistics of Alkire-Foster method, namely, the censored headcount ratio, deprivation intensity and adjusted headcount ratio. The procedure involves several steps. Firstly, the unit of analysis needs to be defined. Since children's needs vary depending on age, two age-groups of children were defined: children aged 0 to 4 years and children aged 5 to 17 years as units of analysis, implying calculation of two age-specific child MPIs. The next step is the selection of dimensions/ indicators for each group, deprivation cutoff for each indicator[17] and weights for each indicator/dimension. Table 6 summarizes the dimensions, indicators and corresponding weights. Considering data constraints, ten dimensions were defined for the 0-4 age-group and nine dimensions for the 5-17 age-group. The 0-4 age-group's dimensions include, *Nutrition, Water and sanitation, Health, Housing, Information, Other social services, Love and care, Safety, Leisure and Material situation*, while the 5-17 age-group's, *Freedom from exploitation, Water and sanitation, Health, Housing, Information, Love and care, Safety, Education and Material situation.* Dimensions and indicators within each dimension are equally weighted.[18]

[17] Deprivation cutoffs have been described in the section: Single deprivation analysis.

[18] If there is one or more missing indicators, other indicators in the dimension receive higher weights (Alkire and Santos, 2014). Moreover, the Education and Safety indicators are not applicable to the 5 years old and 15-17 years old children, respectively. We treat the children with non-applicable population as non-deprived in the relevant dimensions. In the post-estimation analysis, we check the sensitivity of results by dropping the missing values due to non-applicable population.

Table 6: Dimensions, indicators and weights



In the final step, the share of poor children, average deprivation intensity among the poor and adjusted headcount ratio have been identified and calculated. n_a children were selected in the sample and poverty was measured in d_a indicators, where $a = 1,2$ denotes each age-group. Deprivation matrices X_a were designed where a child's achievement in indicator j_a is denoted by $x_{i_a j_a}$ for all $i_a = 1, \dots, n_a$ and $j_a = 1, \dots, d_a$. Each indicator receives weight w_{j_a} such that $w_{j_a} > 0$ and $\sum_{j_a=1}^{d_a} w_{j_a} = 1$ and child i_a receives sample weight $W_{i_a} > 0$ to adjust the representativeness of each unit in the population.

The identification of poor children follows the dual cutoff approach. Firstly, a child receives deprivation status value $g_{i_a j_a} = 1$ if child i_a is deprived in indicator j_a such that $x_{i_a j_a} < f_{j_a}$ (where f_{j_a} is a deprivation cutoff), and $g_{i_a j_a} = 0$, otherwise. Secondly, overall deprivation score $c_{i_a} \in [0,1]$ was computed for each child i_a using $c_{i_a} = \sum_{j_a=1}^{d_a} w_{j_a} g_{i_a j_a}$. The child is poor if $c_{i_a} \geq k$ (where k is a poverty cutoff and $k \in [0,1]$), and non-poor, otherwise. Initially it was set that $k = 25\%$, however the sensitivity of results for k has been checked ranging from 20 to 50 percent.[19] To calculate the incidence of poverty (H) and the intensity of poverty (A), the following formulas were used:

$$H_a = \frac{\sum_{i_a=1}^{z_a} W_{i_a}}{\sum_{i_a=1}^{n_a} W_{i_a}} \quad (1)$$

and

$$A_a = \frac{\sum_{i_a=1}^{z_a} W_{i_a} c_{i_a}}{\sum_{i_a=1}^{z_a} W_{i_a}} \quad (2)$$

where z_a denotes the number of poor children in the sample for each age-group. Finally, the product of Equation 1 and 2 gives the adjusted headcount ratio (M_0). For instance, if $H = 5\%$ and $A = 35\%$, then $M_0 = 1.75\%$ meaning that 5 percent of children are multidimensionally deprived in higher percentage of indicators than the cutoff point k and those children are on average deprived in 35 percent of indicators.

[19] The defined cutoff point k=25% shows that a child aged up to 5 years is deprived in at least 4 indicators (or at least 3 dimensions: Material situation and other two dimensions comprised of two indicators), or a child aged 5-17 years is deprived in at least 3 indicators (or at least 3 dimensions: two of the following, Material situation, Health or Love and care, plus any other dimension).

$$M_{0_a} = H_a \; x \; A_a = \frac{\sum_{i_a=1}^{z_a} w_{i_a} c_{i_a}}{\sum_{i_a=1}^{n_a} w_{i_a}} \quad (3)$$

M_0 has two additional properties which allow for a more detailed analysis of multidimensional poverty: dimensional breakdown and subgroup decomposition. M_0 can be expressed as a weighted sum of censored headcount ratios of each dimension. Censored headcount ratio of a dimension represents the share of population that is multidimensionally poor and simultaneously deprived in the corresponding dimension. Additionally, the analysis may be extended by calculating the percentage contributions of each dimension to the overall multidimensional poverty.[20] Finally, M_0 can be decomposed and calculated for different mutually exclusive and collectively exhaustive subgroups. These analyses serve to inform policymakers to design well-targeted policies for reduction of dimensional and overall multidimensional poverty.

[20] Percentage contribution of a dimension is the weighted ratio between censored headcount ratio of that dimension and adjusted headcount ratio.

4.4. IDENTIFICATION OF MULTIDIMENSIONALLY POOR CHILDREN

The identification of multidimensionally poor children depends on the choice of the cutoff point. The children, whose weighted sum of deprivations is greater or equal than the poverty cutoff, are multidimensionally poor, while the rest are identified as non-poor regardless of their deprivations in some dimensions. The censoring allows to concentrate on poor children and to identify the most deprived by increasing the cutoff point.

Table 7 presents the incidence of poverty (H), intensity of poverty (A), adjusted headcount ratio (M) and censored headcount ratios for each age-group where the cutoff point ranges between 20 and 50 percent. Noticeable differences between the age-groups arise as we move from lower to higher k. Initially, for $k \geq 20\%$, the younger group experiences higher incidence of poverty ($H_{0-4}=17.34\%$), while the older group has slightly higher intensity ($A_{5-17}=28.1\%$) but lower incidence ($H_{5-17}=15.69\%$). The situation reverses once we increase the cutoff point, $k \geq 25\%$. In that case, 11.96 percent of children aged 5-17 years and 8.67 percent of children aged up to 5 years are multidimensionally poor. One more reversal was detected at $k \geq 30\%$ where the older group become more intensely but less frequently deprived and the picture does not change significantly for higher k. The previous patterns suggest that many of the younger children are deprived in fewer deprivations (less than 25 percent), while more intense poverty arises within the older group of children.

Additionally, Table 7 shows the censored headcount ratio patterns for each dimension for different cutoff points. Nutrition, Safety and Leisure drive the multidimensional poverty within the 0-4 age-group, while Love and care, Safety and Education in the 5-17 age-group. Regarding the common deprivations between the age-groups, the younger group has higher censored headcount rations within Water and sanitation, Housing, Information and Material situation compared to the censored headcount ratios of the older group within the same dimensions. On the other hand, the older group is more likely to experience deprivations in Health, Love and care and Safety compared to the younger group. Evidently, household-level deprivations are more frequent within the 0-4 age-group, while child-specific deprivations are more common within the 5-17 age-group.

Table 7: Incidence of poverty (H), intensity of poverty (A), adjusted headcount ratio (M_0) and censored headcount ratios by age-groups for *k≥20%-50%*

	k≥						
	20.00%	25.00%	30.00%	35.00%	40.00%	45.00%	50.00%
0-4 age-group							
H_{0-4}	*17.34%*	*8.67%*	*5.35%*	*3.16%*	*1.78%*	*0.87%*	*0.54%*
A_{0-4}	*27.60%*	*33.61%*	*37.57%*	*41.70%*	*45.81%*	*50.01%*	*51.84%*
$M_{0\,0-4}$	*4.79%*	*2.91%*	*2.01%*	*1.32%*	*0.82%*	*0.44%*	*0.28%*
	Censored headcount ratios						
Nutrition	6.10%	2.99%	2.12%	1.29%	0.83%	0.53%	0.26%
Water and sanitation	3.55%	2.45%	1.40%	0.95%	0.58%	0.30%	0.23%
Health	3.22%	2.17%	1.60%	0.67%	0.41%	0.21%	0.11%
Housing	4.70%	3.03%	2.01%	1.60%	0.96%	0.46%	0.27%
Information	3.46%	2.87%	2.30%	1.75%	1.12%	0.57%	0.32%
Other social services	4.23%	2.50%	1.53%	0.83%	0.53%	0.28%	0.22%
Love and care	2.41%	1.02%	0.79%	0.52%	0.37%	0.37%	0.37%
Safety	7.02%	3.79%	2.18%	1.68%	1.03%	0.47%	0.32%
Leisure	8.43%	4.52%	3.03%	1.71%	1.02%	0.50%	0.31%
Material situation	4.55%	3.64%	3.11%	2.16%	1.31%	0.69%	0.40%
5-17 age-group							
H_{5-17}	*15.69%*	*11.96%*	*3.87%*	*2.33%*	*1.20%*	*0.78%*	*0.77%*
A_{5-17}	*28.10%*	*30.17%*	*39.30%*	*44.26%*	*51.06%*	*55.67%*	*55.81%*
$M_{0\,5-17}$	*4.41%*	*3.61%*	*1.52%*	*1.03%*	*0.61%*	*0.43%*	*0.43%*
	Censored headcount ratios						
Freedom from exploitation	1.18%	1.13%	0.59%	0.38%	0.28%	0.24%	0.24%
Water and sanitation	2.29%	1.87%	0.81%	0.40%	0.17%	0.11%	0.10%
Health	4.09%	3.48%	1.80%	1.13%	0.81%	0.44%	0.42%
Housing	3.06%	2.48%	1.33%	0.81%	0.38%	0.24%	0.24%
Information	2.74%	2.53%	1.41%	0.99%	0.55%	0.37%	0.37%
Love and care	6.93%	5.42%	2.00%	1.62%	0.89%	0.72%	0.71%
Safety	8.75%	5.77%	2.02%	1.28%	0.50%	0.29%	0.28%
Education	5.99%	5.46%	1.20%	0.85%	0.62%	0.51%	0.50%
Material situation	3.52%	3.04%	1.99%	1.39%	0.96%	0.69%	0.69%

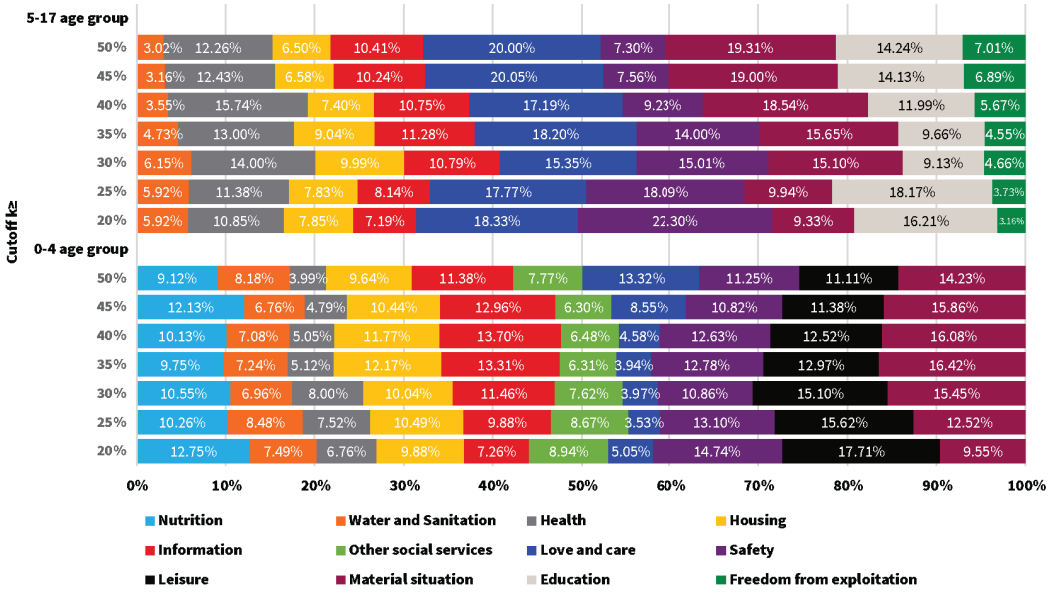
Authors' calculations

To illustrate the importance of each dimension to the multidimensional poverty for each age-group, the percentage contributions of each dimension for different cutoff points were calculated. Figure 14 shows the dimensional breakdown

within each age-group. As suggested in Table 7, Nutrition, Safety and Leisure contribute approximately 45 percent to the multidimensional poverty of the children aged up to 5 years. However, their relevance (contribution) decreases for the most deprived children (higher *k*) dropping to 31.5 percent at *k≥50%*, while Material deprivation, Love and care and Information become dominant contributors.

Different patterns evolve for the older group. At *k≥20%*, Safety, Love and care and Education contribute 56.84 percent to the multidimensional poverty in that age-group. Education and Love and care retain their high importance even at higher levels of deprivation (higher *k*), while Safety has been replaced by the Material situation in the top 3 contributors to the overall multidimensional poverty.

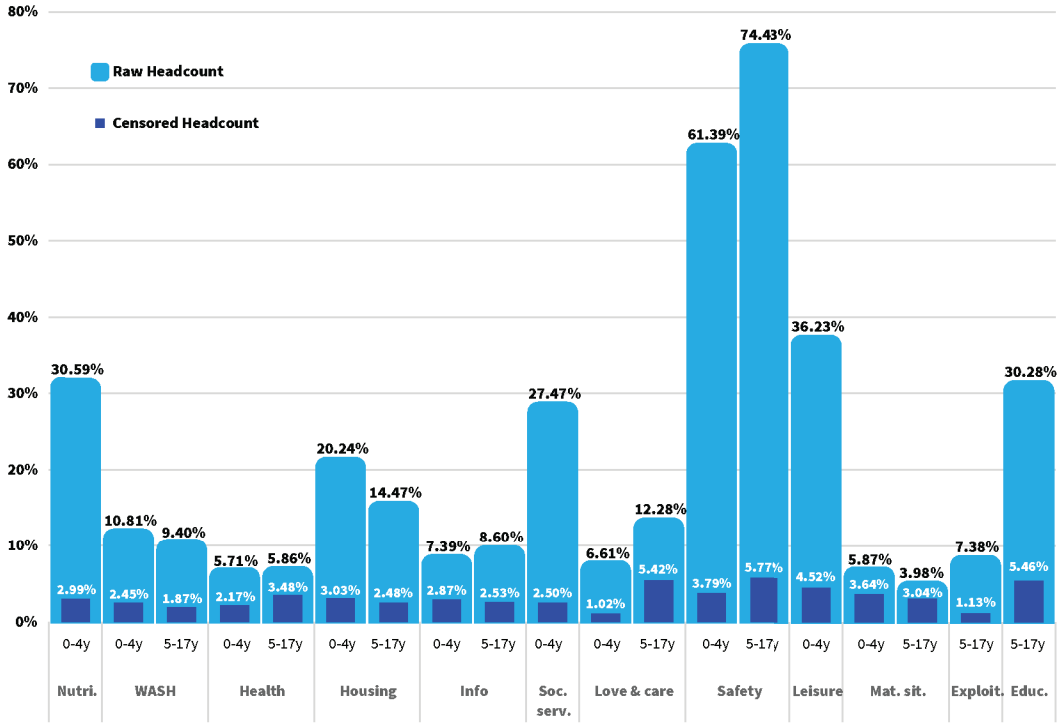
Figure 14: Dimensional breakdown by age-groups for k≥20%-50%



Authors' calculations

Multidimensional analysis generates significantly lower poverty (headcount) ratios compared to the results in the single deprivation analysis. This indicates that children deprived in one indicator are not simultaneously deprived in sufficient number of other indicators to be multidimensionally poor. We present the differences between raw and censored headcount ratios (for *k≥25%*) in Figure 15. The highest discrepancies ensue in Nutrition, Other social services, Safety and Education. For instance, 74.43 percent of children aged 5-17 years are deprived in Safety, however only 5.77 percent are simultaneously deprived in Safety and are multidimensionally poor. The lowest discrepancies arise in Material situation and Health dimensions suggesting that these dimensions provide a 'good' representation of poverty. Moreover, Figure 15 highlights the cross-age-group differences in the common dimensions re-confirming the conclusions from Table 7.

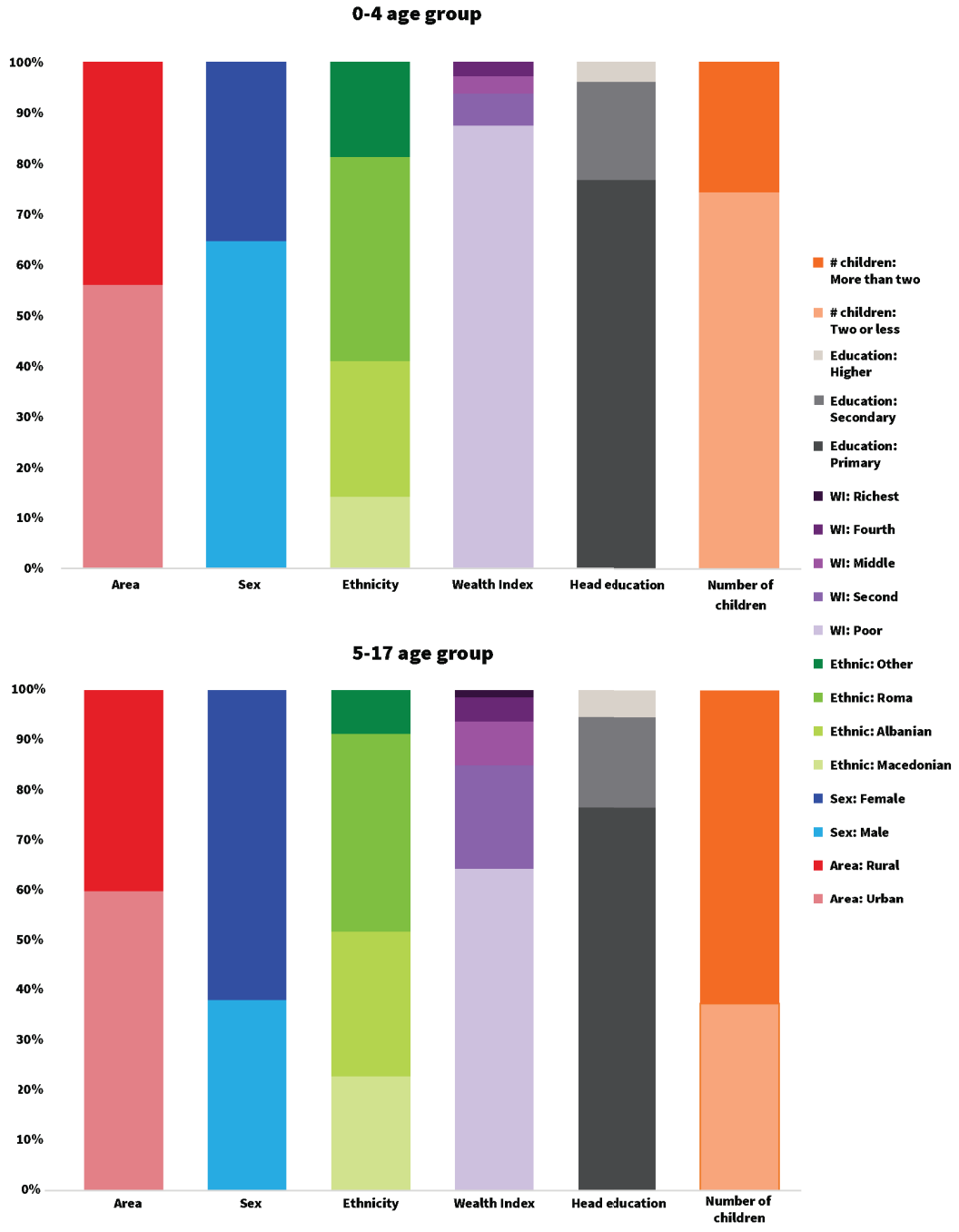
Figure 15: Raw and censored headcount ratios



Authors' calculations

Finally, the structure of multidimensional child poverty was examined by calculating the percentage contributions of different subgroups to the adjusted headcount ratio (for $k \geq 25\%$). Figure 16 presents the share of each subgroup within different classifications. Similar patterns are observed across age-groups with respect to the area, ethnicity and education and household's wealth index. Children living in urban areas contribute more to the multidimensional poverty (56 percent for 0-4 age-group and 60 percent for the 5-17 age-group). Roma children contribute the most to the adjusted headcount ratio, approximately 40 percent for both age-groups. Additionally, the first two wealth quintiles construct more than 80 percent of multidimensional child poverty, while the households where the head has primary or secondary education form more than 95 percent of child poverty. On the other side, boys constitute dominant 65 percent of multidimensional child poverty within the 0-4 age-group, while girls contribute 61.8 percent within the 5-17 age-group. Similarly, households having more than two children compose 62.6 percent of multidimensional child poverty within the 5-17 age-group, while only 25.8 percent within the 0-4 age-group.

Figure 16: Subgroups contributions to the multidimensional poverty



Authors' calculations

To summarize, the results justify the calculation of age-specific child MPIs. Signficant cross-age-group differences ensue for different cutoff points. While younger children experience higher incidence of poverty, older children are prone to more intense poverty. The dimensional breakdown shows that Nutrition, Safety and Leisure are dominant contributors to the multidimensional poverty for the younger group, while Safety, Love and care and Education for the older group. Regardless of child's age, Material situation becomes one of the leading contributors to the overall multidimensional poverty at higher levels of intensity of multidimensional poverty.

Moreover, the raw headcount ratios in Nutrition, Other social services, Safety and Education within the single deprivation analysis overstate the poverty prevalence since the censored headcount ratios in the same dimensions are significantly lower. Finally, urban households, Roma, materially poorest and households headed by less-educated adults contribute the most to the multidimensional child poverty. Girls and more-than-two children households form large share of multidimensional poverty for the older group, while boys and less-than-three children households contribute more to the poverty for the younger group.

4.5. SUBGROUP DECOMPOSITION

The previous analysis captures the contributions of each subgroup to the overall multidimensional poverty; however, it does not consider the state of child poverty within each subgroup. In this section, the incidence of poverty, intensity of poverty, adjusted headcount ratios, censored headcount ratios and percentage contributions for various subgroups are analyzed with respect to the urban/rural area, sex, ethnicity and region.

4.5.1. Area

Table 8 shows that every tenth child in rural areas and every thirteenth child in urban areas, aged up to 5 years, is multidimensionally poor. Younger children in rural areas experience higher incidence of poverty in almost all dimensions, except in Information and Material situation compared to the younger children in urban areas. Nutrition and Leisure deprivations are frequent among rural children, while Leisure and Material situation are more relevant for urban children aged up to 5 years.

Within the 5-17 age-group, the incidence of multidimensional poverty equals approximately 12 percent regardless of rural/urban division. While incidence of poverty is similar across rural and urban children, the dimensional breakdown shows that older children in rural and urban areas are not uniformly affected in each dimension. Rural children have significantly higher censored ratios in

Water and Sanitation, Health, Housing and Safety, while urban children in Love and care, Education and Material situation.

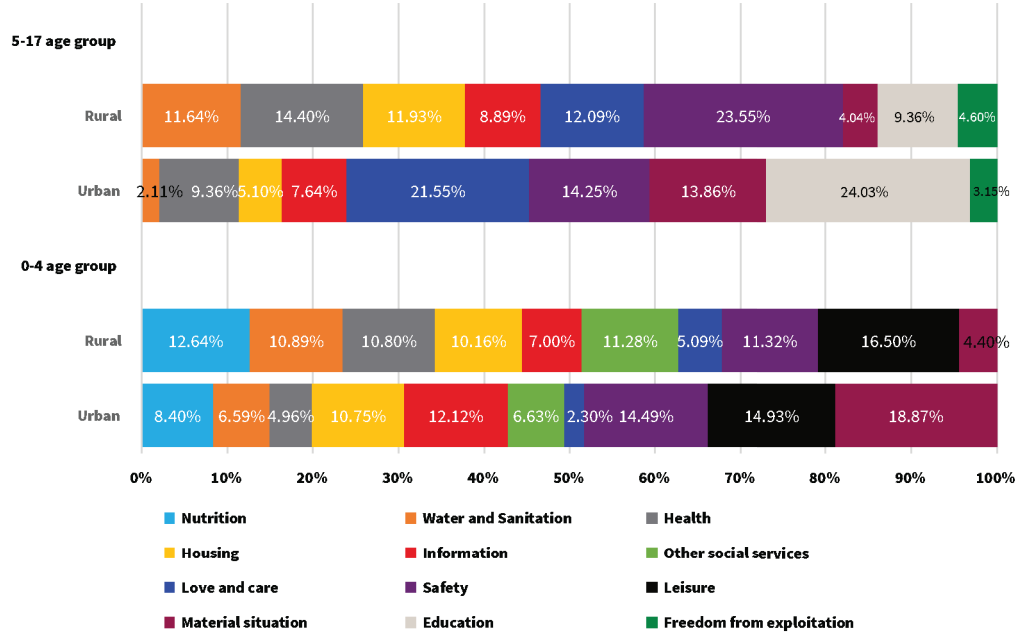
Table 8: Incidence of poverty (H), intensity of poverty (A), adjusted headcount ratio (M_0) and censored headcount ratios by age-groups and area for *k≥25%*

	Area	
	Urban	Rural
0-4 age-group		
H_{0-4}	7.64%	10.35%
A_{0-4}	34.55%	32.47%
$M_{0\,0-4}$	2.64%	3.36%
	Censored headcount ratios	
Nutrition	2.22%	4.24%
Water and sanitation	1.72%	3.63%
Health	1.31%	3.58%
Housing	2.82%	3.39%
Information	3.20%	2.34%
Other social services	1.72%	3.76%
Love and care	0.61%	1.70%
Safety	3.79%	3.78%
Leisure	3.92%	5.50%
Material situation	4.96%	1.48%
5-17 age-group		
H_{5-17}	11.80%	12.20%
A_{5-17}	29.88%	30.60%
$M_{0\,5-17}$	3.53%	3.73%
	Censored headcount ratios	
Freedom from exploitation	0.92%	1.47%
Water and sanitation	0.66%	3.78%
Health	2.72%	4.68%
Housing	1.58%	3.92%
Information	2.31%	2.86%
Love and care	6.37%	3.92%
Safety	4.43%	7.79%
Education	6.94%	3.10%
Material situation	4.13%	1.31%

Authors' calculations

Observing the percentage contributions of each dimension within each subgroup (Figure 17), we notice important differences between rural and urban child poverty. Rural children aged up to 5 years have more uniform distribution of dimensional contributions where seven dimensions contribute between 10 and 16.5 percent to the multidimensional poverty in this group. On the other hand, almost 50 percent of the total poverty of urban children aged 5 to 17 years comes from three dimensions, Safety, Leisure and Material situation. Regarding the older children group, apart from the dominant share of Safety, four dimensions (Water and sanitation, Health, Housing and Love and care) contribute 50 percent to the multidimensional poverty in the rural areas. In contrast, Education, Love and care, Safety and Material situation form most of the child poverty in urban areas.

Figure 17: Dimensional breakdown by age-groups and area for *k*≥25%



Authors' calculations

To summarize, there are no crucial differences in the incidence and intensity of poverty between rural and urban children, however the dimensional breakdown uncovers differential sources of poverty for each subgroup. Much of the urban child poverty is attributed to the lack of love and care, economic hardships and poor education, while rural child poverty has more contributors, of which poor housing, water, sanitation, lack of health coverage and malnutrition have higher importance. Consequently, the eradication of rural child poverty requires much wider approach targeting several dimensions, while urban child poverty could be significantly reduced by addressing education and material deprivations.

4.5.2. Sex

Gender differences in child poverty are presented in Table 9. Boys in the younger group experience not only higher incidence of poverty, but also higher intensity, being deprived in 35% of the indicators on average, compared to the girls of the same age. Boys are dominantly more deprived in all dimensions, except in Health where the girls have slightly higher censored headcount ratio of 2.34 percent. A reversed situation is observed in the older group of children. Girls have higher incidence (14.03 percent) and intensity of poverty (30.38 percent) being more deprived in almost all dimensions except in Material situation compared to the boys from the same age group. Notably, the censored headcount ratios reach over 6 percent for the older girls in three dimensions, Love and care, Safety and Education.

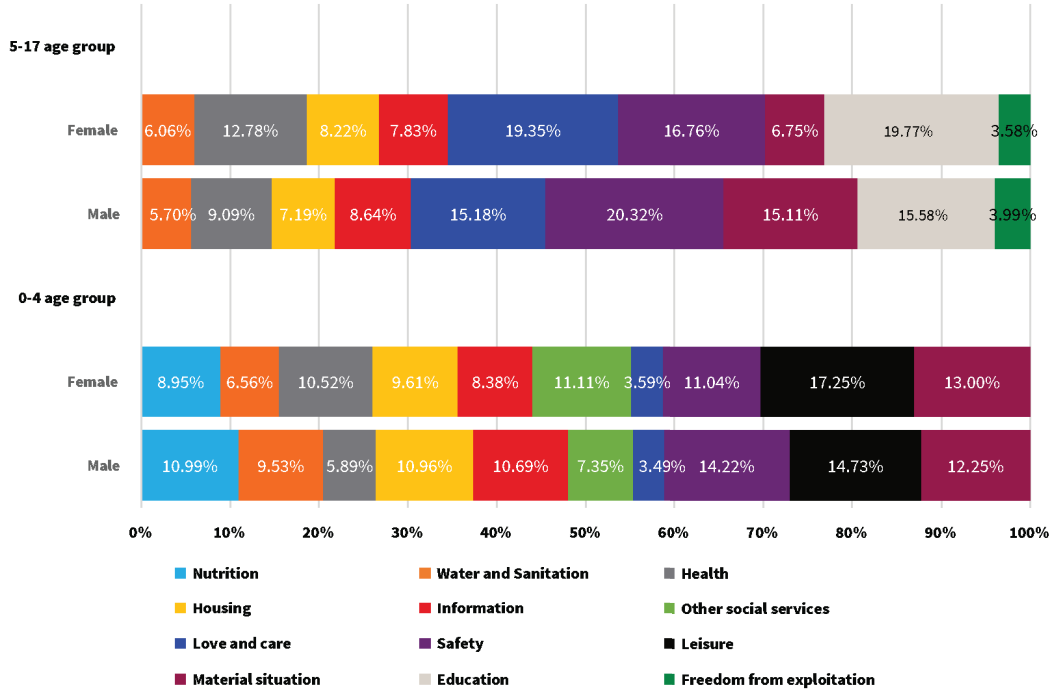
Table 9: Incidence of poverty (H), intensity of poverty (A), adjusted headcount ratio (M_0) and censored headcount ratios by age-groups and sex for $k \geq 25\%$

	Sex	
	Male	Female
0-4 age-group		
H_{0-4}	10.08%	7.03%
A_{0-4}	34.76%	31.68%
$M_{0\ 0-4}$	3.50%	2.23%
	Censored headcount ratios	
Nutrition	3.85%	1.99%
Water and sanitation	3.29%	1.46%
Health	2.03%	2.34%
Housing	3.80%	2.14%
Information	3.73%	1.87%
Other social services	2.52%	2.47%
Love and care	1.22%	0.80%
Safety	4.93%	2.45%
Leisure	5.11%	3.83%
Material situation	4.28%	2.89%
5-17 age-group		
H_{5-17}	9.67%	14.03%
A_{5-17}	29.82%	30.38%
$M_{0\ 5-17}$	2.88%	4.26%
	Censored headcount ratios	
Freedom from exploitation	0.97%	1.29%
Water and sanitation	1.42%	2.27%
Health	2.29%	4.55%
Housing	1.79%	3.11%
Information	2.13%	2.88%
Love and care	3.77%	6.92%
Safety	5.16%	6.34%
Education	3.77%	6.99%
Material situation	3.65%	2.49%

Authors' calculations

Figure 18 shows the percentage contributions of the chosen dimensions to the multidimensional poverty in each sex/age group. Regardless of the sex, boys and girls aged up to 5 years have the same three dominant contributors to their multidimensional poverty, Safety, Leisure and Material situation, contributing approximately 41 percent. Similar patterns arise in the 5-17 age-group. Safety, Love and care and Education contribute the most in each sex group.

Figure 18: Dimensional breakdown by age-groups and sex for k≥25%



Authors' calculations

In conclusion, younger boys and older girls face higher incidence and intensity of poverty compared to the older boys and younger girls, respectively. Namely, girls aged 5 to 17 years have the highest adjusted headcount ratio of 4.26 percent, to which Safety, Love and care and Education deprivations contribute the most. In addition to these three dimensions, Leisure and Material situation significantly add to the overall multidimensional child poverty regardless of sex, meaning that the same set of deprivations affects both boys and girls.

4.5.3. Ethnicity

The ethnical division of children generates stunning results. Table 10 shows that every third Roma child aged up to 5 years is multidimensionally poor, on average deprived in a third of indicators. The group of other ethnicities experiences lower but still high incidence of multidimensional poverty, having every fifth child as multidimensionally poor. The incidence of poverty for Albanian children is close to the population average incidence, while Macedonian children are the least deprived.

Younger Roma children are more likely to suffer in almost all of the dimensions, of which Safety, Leisure and Material situation have the highest censored headcount ratios. The differences in Nutrition are striking. Roma children have almost three times higher incidence than the second highest headcount ratio – the group of other ethnicities. The lack of health coverage is apparent issue for the group of other ethnicities, while less for Roma and Macedonian children. The situation worsens when we consider the 5-17 age-group. The incidence of poverty inflates to 40 percent for Roma children, 12.95 percent for Albanians and 5.16 percent for Macedonians, while decreases to 13.35 percent for other-ethnicity-children. The censored headcount ratios reveal higher discrepancies between the ethnic groups in some dimensions. For instance, Roma children have nine times higher incidence of poverty in Education and more than four times higher in Love and care and Material situation than the second highest incidence in each of those dimensions.

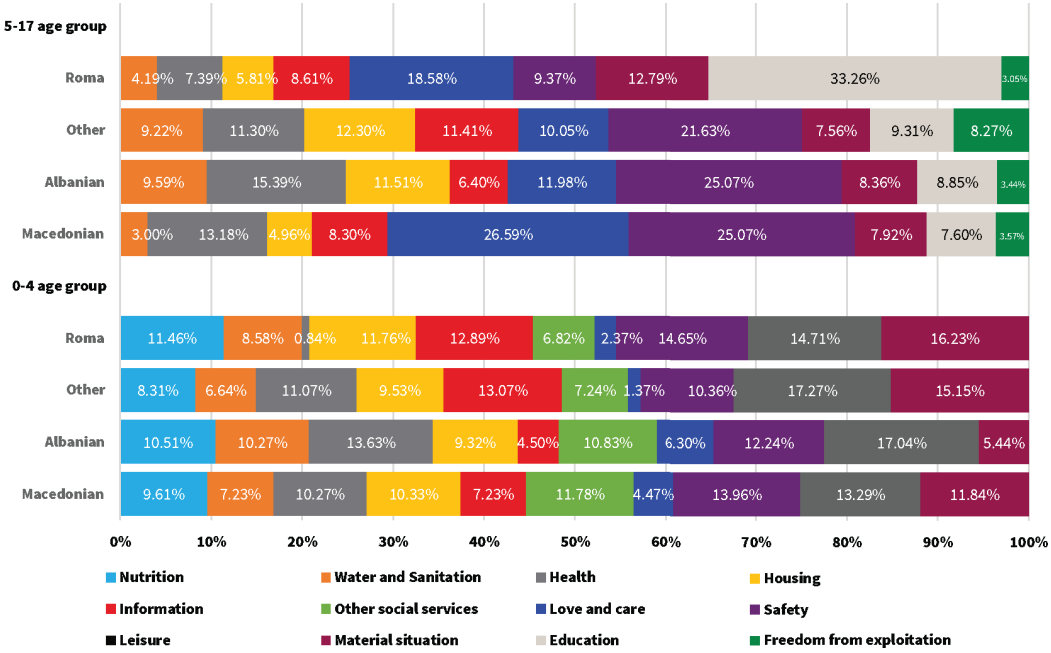
Table 10: Incidence of poverty (H), intensity of poverty (A), adjusted headcount ratio (M_0) and censored headcount ratios by age-groups and ethnicity for $k \geq 25\%$

	Ethnicity			
	Macedonian	Albanian	Other	Roma
0-4 age-group				
H_{0-4}	2.47%	8.41%	19.59%	35.54%
A_{0-4}	31.06%	32.11%	35.90%	34.65%
$M_{0\ 0-4}$	0.77%	2.70%	7.03%	12.31%
	Censored headcount ratios			
Nutrition	0.74%	2.83%	5.85%	14.11%
Water and sanitation	0.55%	2.74%	4.66%	10.40%
Health	0.79%	3.62%	7.79%	1.04%
Housing	0.79%	2.49%	6.68%	14.36%
Information	0.55%	1.22%	9.17%	15.84%
Other social services	0.90%	2.88%	5.09%	8.24%
Love and care	0.34%	1.69%	0.96%	2.92%
Safety	1.07%	3.27%	7.27%	17.86%
Leisure	1.01%	4.54%	12.13%	17.99%
Material situation	0.91%	1.45%	10.65%	19.93%
5-17 age-group				
H_{5-17}	5.16%	12.95%	13.35%	40.00%
A_{5-17}	29.49%	30.13%	33.68%	29.91%
$M_{0\ 5-17}$	1.52%	3.90%	4.50%	11.96%
	Censored headcount ratios			
Freedom from exploitation	0.48%	1.18%	3.02%	2.92%
Water and sanitation	0.41%	3.29%	3.37%	4.45%
Health	1.77%	5.20%	4.08%	7.07%
Housing	0.65%	4.00%	4.73%	6.13%
Information	1.12%	2.16%	4.18%	8.84%
Love and care	3.55%	4.06%	3.84%	18.00%
Safety	3.36%	8.71%	8.50%	9.89%
Education	1.04%	3.06%	3.59%	32.33%
Material situation	1.06%	2.84%	2.93%	12.64%

Authors' calculations

Looking at the percentage contributions by age and ethnicity (in Figure 19), similar patterns are noticed across ethnicities in the younger group, while different patterns emerge across ethnicities in the older group. In the younger group, Leisure and Material situation appear as major contributors to the multidimensional poverty for Roma and the group of other ethnicities, while Leisure, Safety and Health play dominant role within Macedonian and Albanian ethnic groups. In the older group, Safety coupled with Love and care form the most of child poverty among Macedonians, while with Health creates most of the child poverty among Albanians, and with Housing contribute the most to the child poverty within the group of other ethnicities. Finally, Education, Material situation and Love and care contribute 65 percent to the multidimensional poverty of older Roma children.

Figure 19: Dimensional breakdown by age-groups and ethnicity for *k≥25%*



Authors' calculations

In conclusion, significant poverty disparities exist across the ethnicities in North Macedonia. Roma children, regardless of their age, are heavily deprived, despite the disparate relevance of certain dimensions in each age-group. Challenges related to Safety, Leisure and Material situation affect the younger Roma more often, while Education, Love and care and Material situation more often affect the older Roma children. Albanians and the group of other ethnicities take the second and third place on the poverty scale, however, they are significantly less deprived than the Roma children. Targeted measures towards Safety, Health and Housing deprivations may significantly reduce child poverty among the Albanians and the group of other ethnicities.

4.5.4. Region

Table 11 shows the prevalence of child poverty across regions in North Macedonia. Two regions have the highest prevalence of child poverty within the younger group of children, namely, the Southeast region having every fourth child aged up to 5 years as multidimensionally poor and the East region having every fifth child aged up to 5 years deprived in several dimensions. The poor children in the same two regions are deprived on average in 36 percent of the indicators. Skopje and Polog are the next two regions with higher incidence of poverty, 8.21 percent and 7.75 percent, respectively. Comparing the top two regions across dimensions, both the Southeast and the East, have high censored headcount ratios in Water and sanitation, Housing, Safety, Leisure and Material situation. However the Southeast region has significantly higher incidence of poverty in Nutrition, Health, Information and Other social services. Noticeable regional discrepancies appear in Nutrition and Health. The Southeast, East and Skopje regions have dominant share of poorly fed children within the younger group, while Southeast and Polog have high share of multidimensionally poor children lacking health insurance coverage.

Similar patterns emerge in the older group of children. The Southeast and the East regions have the highest adjusted headcount ratios, 5.89 and 6.08 percent, respectively, followed by Polog and Skopje regions having adjusted headcount ratios of 4.32 and 3.89 percent, respectively. While the Southeast and the East region have similar adjusted headcount ratios, the Southeast region has a lower incidence of poverty with higher intensity of poverty compared to the East region. Looking at the dimensions, we notice that Health deprivations are especially relevant in the East, the Southeast and Polog; Information deprivations in the East and the Southeast; and Education deprivations in the East and Skopje regions. Additionally, there is an unusually high censored headcount ratio in Material situation in one of the least deprived regions, the Southwest.

Table 11: Incidence of poverty (H), intensity of poverty (A), adjusted headcount ratio (M_0) and censored headcount ratios by age-groups and region for $k \geq 25\%$

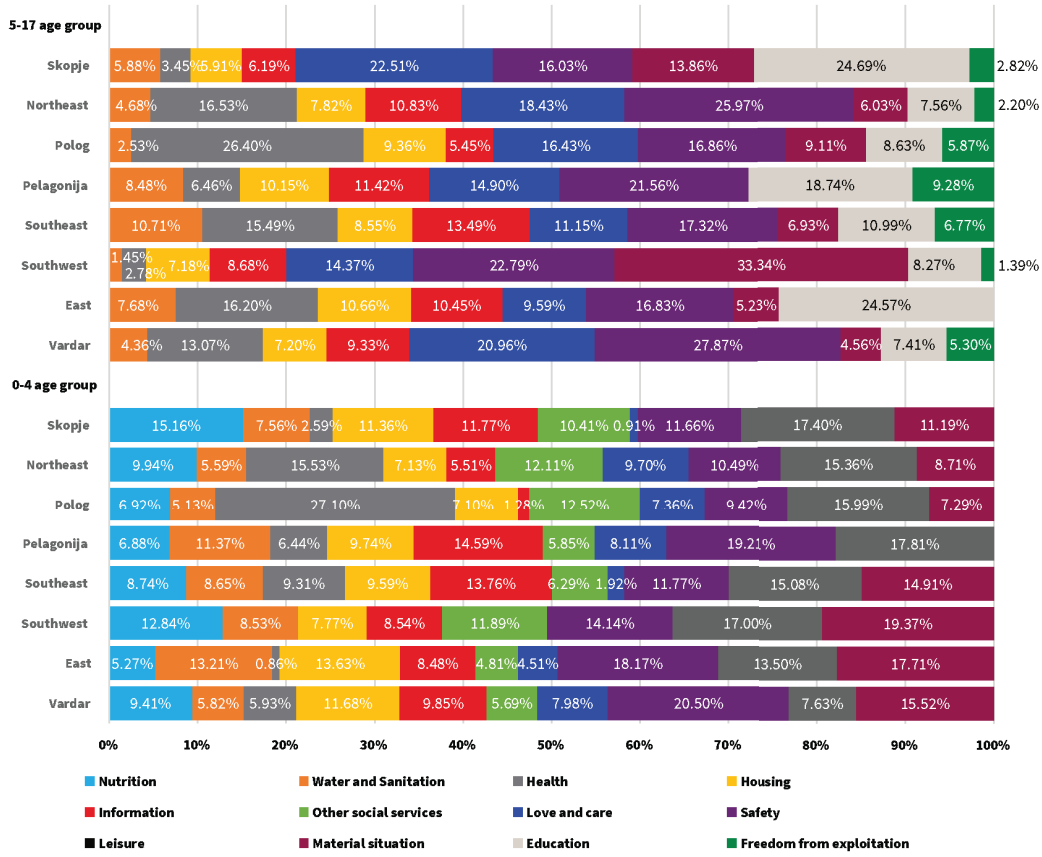
	Region							
	Vardar	East	South-west	South-east	Pelagonija	Polog	North-east	Skopje
0-4 age-group								
H_{0-4}	5.33%	22.22%	4.06%	26.83%	2.43%	7.75%	4.91%	8.21%
A_{0-4}	31.44%	36.14%	27.53%	36.15%	31.48%	30.61%	35.25%	32.82%
$M_{0\,0-4}$	1.68%	8.03%	1.12%	9.70%	0.76%	2.37%	1.73%	2.70%
	Censored headcount ratios							
Nutrition	1.58%	4.23%	1.44%	8.47%	0.53%	1.64%	1.71%	4.08%
Water and sanitation	0.98%	10.43%	0.92%	8.37%	0.87%	1.17%	0.97%	2.03%
Health	0.99%	0.69%	0.00%	9.03%	0.49%	6.29%	2.69%	0.70%
Housing	1.96%	10.76%	0.87%	9.28%	0.74%	1.65%	1.21%	3.06%
Information	1.65%	6.81%	0.92%	13.33%	1.12%	0.30%	0.93%	3.17%
Other social services	0.95%	3.68%	1.29%	6.10%	0.45%	2.89%	2.07%	2.81%
Love and care	1.34%	3.62%	0.00%	1.86%	0.62%	1.75%	1.65%	0.24%
Safety	3.44%	14.35%	1.58%	11.39%	1.47%	2.19%	1.77%	3.14%
Leisure	1.28%	10.65%	1.90%	14.61%	1.36%	3.71%	2.62%	4.68%
Material situation	2.60%	14.22%	2.09%	14.46%	0.00%	1.69%	1.51%	3.02%
5-17 age-group								
H_{5-17}	7.74%	20.49%	4.48%	17.27%	8.64%	14.40%	6.62%	13.11%
A_{5-17}	33.50%	29.66%	27.05%	34.09%	27.00%	30.00%	32.94%	29.70%
$M_{0\,5-17}$	2.59%	6.08%	1.21%	5.89%	2.33%	4.32%	2.18%	3.89%
	Censored headcount ratios							
Freedom from exploitation	1.24%	0.00%	0.15%	3.21%	1.73%	2.21%	0.43%	0.92%
Water and sanitation	1.01%	4.20%	0.16%	5.28%	1.72%	0.98%	0.92%	1.99%
Health	2.96%	8.00%	0.30%	7.60%	1.25%	9.90%	3.24%	1.08%
Housing	1.63%	5.83%	0.78%	4.24%	2.01%	3.58%	1.54%	2.02%
Information	2.16%	5.71%	0.95%	6.61%	2.17%	2.04%	2.10%	2.03%
Love and care	4.89%	5.23%	1.43%	5.29%	3.02%	6.12%	3.53%	7.25%
Safety	6.40%	9.18%	2.49%	8.72%	4.39%	6.55%	5.01%	5.49%
Education	1.73%	12.60%	0.90%	5.53%	3.59%	3.26%	1.48%	7.85%
Material situation	1.04%	2.84%	3.51%	3.50%	0.00%	3.34%	1.18%	4.50%

Authors' calculations

Figure 20 uncovers the major contributors to the child poverty in each region. While Safety and Leisure consistently contribute a great percentage of child

poverty in the younger group across all regions, there are important differences with regard to the other dimensions. For instance, Nutrition contributes more in Skopje and the Southwest; Health in the Northeast and Polog, and Material situation in the Southeast, the Southwest, the East and Vardar. For the older group, Love and care and Safety have consistently high contributions, however Education plays important role in Skopje, Pelagonija and the East, Health in the Northeast, Polog, the Southeast, the East and Vardar, and finally, Material situation in the Southwest region.

Figure 20: Dimensional breakdown by age-groups and region for *k*≥25%



Authors' calculations

To wrap up this section, four regions with significantly higher incidence of poverty were identified: the Southeast, the East, Skopje and Polog, of which the first two have the highest incidence regardless of the child age-group. Apart from Safety and Leisure deprivations, the children aged up to 5 years in the East and Southeast regions suffer mostly in the Housing, Water and sanitation, Information and Material situation. Younger children in Skopje necessitate improved nutrition, while older children in the same region require better access to education. Finally, the lack of health insurance coverage among the children in the Polog region is especially alarming for both younger and older children.

4.6. INTRAHOUSEHOLD INEQUALITY, PIONEER CHILDREN AND CHILD POVERTY RISK FACTORS

Household-level analyses of child poverty assume that children living in a same household share the same deprivations as any household member. However, Alkire et al. (2019) find that multidimensionally poor households may have a child suffering in one dimension, and another child that is not deprived in the same dimension. Such intrahousehold inequality arises, for instance, if a school-age child does not attend school, but lives in a household where another school-age child does. The intrahousehold inequality of multidimensionally poor children was analyzed with regard to two deprivations: non-attendance at school and nutrition.

Table 12 shows the prevalence of intrahousehold inequality across different groups. Among multidimensionally poor children aged up to 5 years, 10.52 percent are malnourished and live in a household where another child is not malnourished. The intrahousehold inequality in nutrition is more pronounced among urban children, boys, Roma children and children living in households with more than two children. On the other hand, the school attendance determinant is important for the older age-group. 22.47 percent of multidimensionally deprived school-age children do not attend school and live in a household where another school-age child attends school. The cross-group differences are striking. Every third multidimensionally poor child living in urban areas suffers from intrahousehold inequality in school attendance. The prevalence is similar among poor girls and among children living in households with more than two children. Finally, every second multidimensionally deprived Roma child does not attend school and lives in a household where another child does.

Table 12: Children experiencing intrahousehold inequality with regard to school attendance and nutrition and pioneer children

		Intrahousehold inequality		Pioneer children
		Percentage of multidimensionally poor children aged 0-4 who are malnourished and reside in a household where at least one child is not malnourished	Percentage of multidimensionally poor school-age children who do not attend school and reside in a household where at least one school-age child attends school	Percentage of children aged 10-17 who attend education that is higher compared to that of all other household members
	Total	10.52%	22.47%	6.32%
Area	Urban	13.18%	35.96%	5.69%
	Rural	7.32%	1.74%	7.28%
Sex	Boys	15.96%	6.08%	6.76%
	Girls	1.41%	32.74%	5.93%
Ethnicity	Macedonian	12.37%	0.86%	1.71%
	Albanian	8.55%	1.66%	11.43%
	Roma	15.95%	54.80%	11.08%
	Other	0%	0%	14.70%
Number of children	more than 2	23.92%	34.79%	10.26%
	2 or less	6.51%	1.31%	4.39%
MPI	Poor			5.32%
	Non-poor			6.49%

Authors' calculations

A child's greater educational attainment may open the gate out of poverty. The typical measure of educational deprivation in household-level analyses is the situation where at least one household member is not attending school. If the child is attending school, the household is classified as non-deprived. Alkire at al. (2019) find that the percentage of school-age children who have completed six years of schooling and live in a household where none of the adult members have completed six years of schooling (so-called pioneer children) is considerable. However, for the Macedonian context, such definition of pioneer children would generate very low percentage due to the very high percentage of people completing six years of schooling. Hence, we define 'pioneer children' as children aged 10-17 years who attend education that is higher compared to that of other household members. Table 12 presents the prevalence of pioneer children in North Macedonia. 6.32 percent of school-age children aged 10-17 years are pioneer children. That percentage remains similar in both the urban and rural areas and across sexes without significant differences between the groups.

Albanian, Roma children and children from the other ethnicity group have higher percentage of children attaining the highest education level within the household. Additionally, pioneer children are more prevalent within households with more than two children. Finally, 5.32 percent of multidimensionally poor children are pioneer children who may drive themselves and their households out of poverty.

In the final part of this section, cross-sectional regression analysis is presented to uncover the important risk factors of multidimensional child poverty in North Macedonia. The headcount (H) and adjusted headcount ratio (M_0) for each age-group are taken as dependent variables. The independent variables include both children's, parents' and households' characteristics such as children's age and sex, urban/rural area of living, the age, sex and ethnicity of the household head, the parent's education, household size, number of children in a household, caretaker's disability, wealth score, pioneer child dummy and region dummies. The nature of the dependent variable dictates the method used. For the headcount ratio which is a binary variable, Logit regressions are used, while for the adjusted headcount ratio which is a continuous variable bound between 0 and 1, two-limit Tobit models are used. [21]

[21]Logit and Tobit models are used in case of having limited dependent variable, when the optimizing behavior leads to a corner solution response. For estimating Logit and Tobit models, maximum likelihood methods are utilized. For more details, see Wooldridge (2019).

Table 13: Logistic and Tobit regressions on MPI measures (for $k \geq 25\%$)

Model	Logit	Tobit	Logit	Tobit	Logit	Tobit
Dep. var.	$H_{0\text{-}4}$	$M_{0\ 0\text{-}4}$	$H_{5\text{-}17}$	$M_{0\ 5\text{-}17}$	$H_{5\text{-}17}$	$M_{0\ 5\text{-}17}$
Child age	0.167	0.022	0.061	0.006	-0.251*	-0.027*
Male child (ref. female)	0.336	0.061	0.291	0.011	0.298	-0.022
Urban (ref. rural)	-0.337	-0.096	-0.544	-0.106	0.574	0.009
Ethnicity: Albanian	0.025	0.010	0.302	0.024	0.901	0.107
Ethnicity: Roma	0.866	0.226***	0.702	0.107	1.844	0.284**
Ethnicity: Other (ref. Macedonian)	0.670	0.088	0.896	0.157	2.411**	0.268**
Mother education: Primary	2.780***	0.436***	0.403	0.051	-1.366	-0.177
Mother education: Secondary (ref. Higher)	1.844***	0.280***	-0.478	-0.068	-1.434	-0.186
Father education: Primary	-0.262	-0.027	1.558	0.276*	2.225	0.334**
Father education: Secondary (ref. Higher)	-0.109	-0.057	0.640	0.099	1.733	0.211
# household members	-0.129	-0.015	-0.155	-0.034	-0.612*	-0.079***
More than 2 children (ref. two or less children)	1.944***	0.210**	0.904*	0.157**	2.039*	0.240***
Caretaker disabled (ref. not disabled)	-0.172	0.005	1.317**	0.208**	2.955***	0.253**
Wealth score	-0.992***	-0.127***	-0.918***	-0.152***	-1.997**	-0.181***
Male household head (ref. female)	-0.221	-0.060	-1.077	-0.110	-0.920	-0.020
Household head age	-0.002	0.001	-0.010	-0.002	0.013	0.001
Pioneer (ref. not pioneer)					-2.563*	-0.368***
Region: Vardar	0.144	0.055	0.711	0.088	-1.719	-0.152
Region: East	0.625	0.141	0.945	0.041	-0.617	-0.159
Region: Southwest	-0.262	-0.080	-0.938	-0.211*	-1.914	-0.186
Region: Southeast	0.815	0.091	-0.437	-0.126	-2.993	-0.266
Region: Pelagonija	-0.723	-0.098	0.411	0.058	0.263	-0.010
Region: Polog	0.799**	0.102	1.032*	0.159*	1.599*	0.188**
Region: Northeast (ref. Skopje)	-1.366***	-0.224***	-1.059	-0.200*	-4.574*	-0.413***
Constant	-4.712***	-0.838***	-3.874**	-0.571**	0.334	0.071
Observations	1,431	1,431	1,249	1,249	595	595
Pseudo R-sq	0.4731	0.4861	0.4461	0.4931	0.6259	0.7088
Wald chi-sq	128.24		151.28		81.74	
F-stats		17.19		6.142		4.953

*Note: Reference categories for the dummy variables in parentheses; Regressions run with robust weight-adjusted standard errors; *** p<0.01, ** p<0.05, * p<0.1*

Authors' calculations

Two by two (2 dependent variables x 2 age-groups) regressions were run for the same set of independent variables and additional two regressions for the older age-group including dummy for pioneer children. The results are presented in Table 13. Roma children, regardless of the age, are more likely to be multidimensionally deprived (note that coefficients for the Roma dummy are significant in the M_0 models but not in the H models indicating that Roma children are more likely to be more intensely deprived). The probability of being multidimensionally deprived within older children increases if the child belongs to the group of other ethnicities. The mother's education is relevant for children aged 0-4, while the father's education for the 5-17 age-group. Regardless of the child's age, if the child lives in a household with more than two children or in a poorer household (with lower wealth score) it is more likely to be multidimensionally deprived. Interestingly, the higher number of household members or being a pioneer child may alleviate child poverty, especially among older children. Conversely, caretaker's disability may be a major drag towards poverty for older children. The age of the child and the head of the household and sex differences have limited importance in explaining multidimensional child poverty. Finally, with regard to regional differences, children living in Polog are more likely, while those living in the Northeast are less likely to be poor, compared to the children in Skopje.

Summarizing this section, child poverty is complex phenomenon and requires a detailed analysis. Deprivation differences arise even among children within the same household. Urban, Roma and households with more than two children are prone to intrahousehold inequality in nutrition and education, while the prevalence of intrahousehold inequality in nutrition is higher among the boys and in education among the girls. The regression analysis shows that parents' and child's education is important determinant of child poverty and may pave the way out of poverty. Moreover, some household characteristics are important risk factors of child poverty. Households with lower wealth or more than two children are more likely to have multidimensionally deprived child. Finally, the analysis revealed important regional differences in child poverty in North Macedonia.

4.7. SENSITIVITY ANALYSIS

The analysis so far has been conducted using the maximum of the information available from the MICS survey without dropping the missing values and insignificant indicators (uncovered in the validity analysis). However, the presence of missing observations and of poverty-irrelevant indicators may significantly affect the results. Thus, a sensitivity analysis was performed using three scenarios and was compared with the results of the current version (with the missing observations included). In the first case, the missing observations were dropped, in the second the insignificant indicators were dropped in the validity analysis (delayed vaccination, no birth certificate and psychological aggression), and lastly, both the missing observations and the insignificant indicators were dropped.

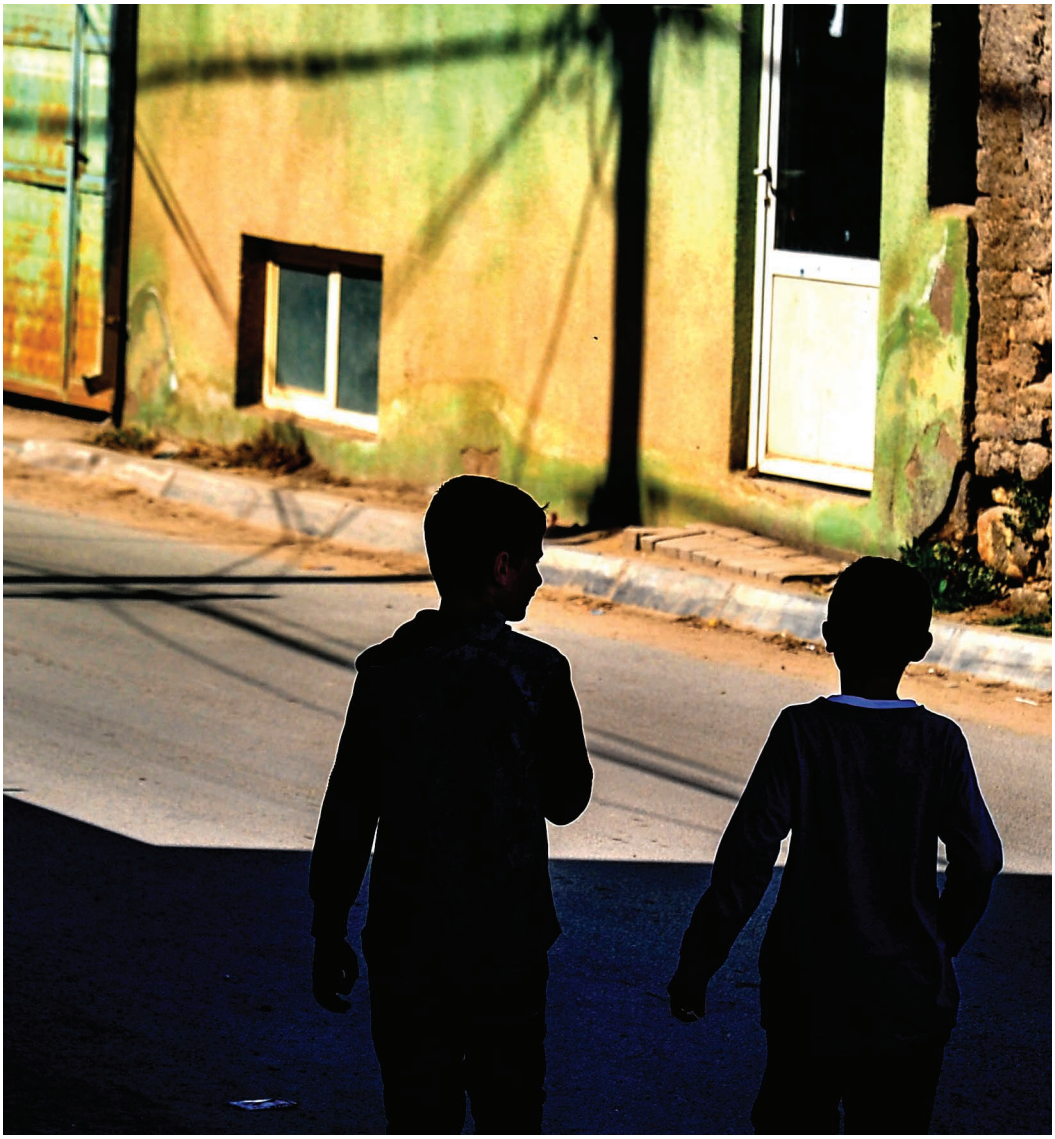
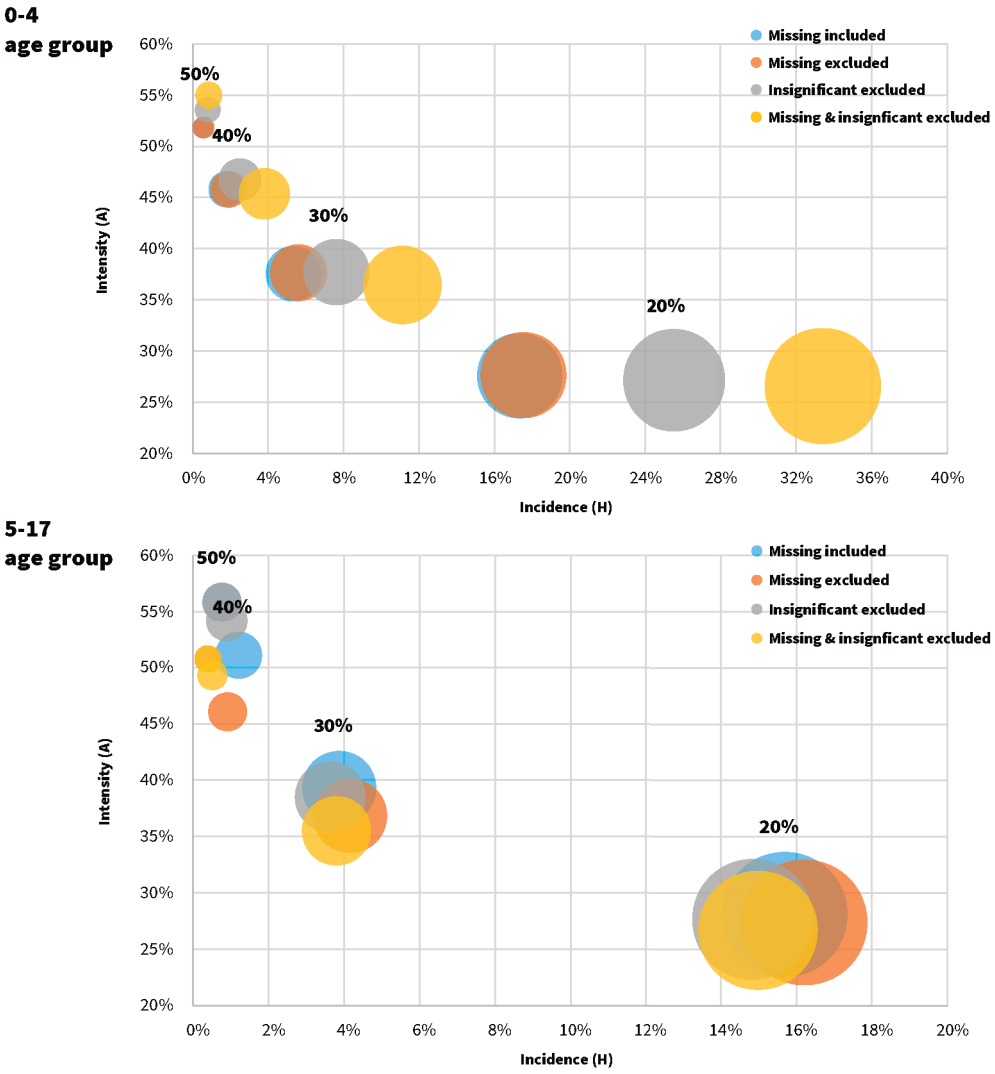


Figure 21: Sensitivity analysis - Incidence of poverty (H), intensity of poverty (A) and adjusted headcount ratio (M_0) for k ranging from 20% to 50%

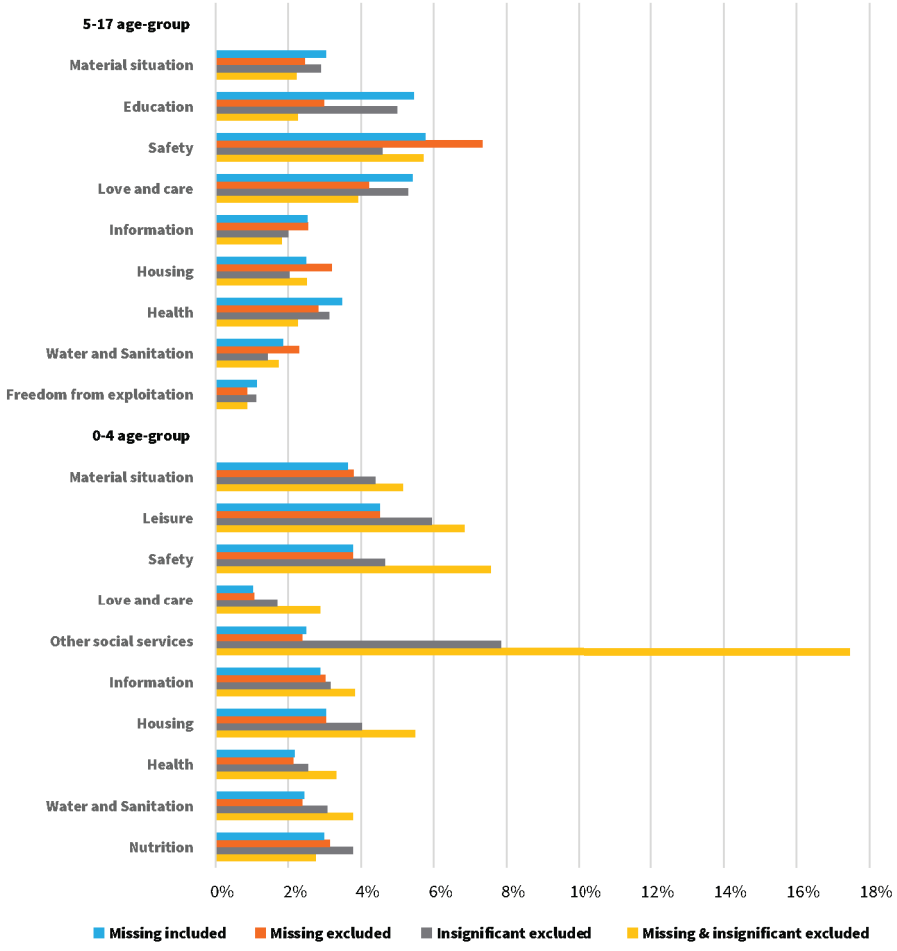


Note: Size of the bubbles indicates the adjusted headcount ratio.
Authors' calculations

Figure 21 shows the incidence, intensity of poverty and adjusted headcount ratio for each of the cases where k ranges from 20 to 50 percent. The missing observations do not result in much different values for the MPI measures for both age groups, except a modest drop in the intensity of poverty for the older age-group at higher values of k (40 and 50 percent). However, the exclusion of the insignificant indicators generates higher incidence rates (and with that, higher adjusted headcount ratio) for the younger group, especially at lower values of k. Such problem is absent for the older group of children. This result is

expected since two of the dropped indicators (delayed vaccination and no birth certificate) exclusively refer to the younger group of children. The incidence of poverty for the younger group reaches a maximum level in the third case (when we drop both the missing observations and the insignificant indicators), while the intensity remains relatively stable across any value of k. Obviously, the discrepancies arise due to the remaining indicators in the corrected dimensions (Health and Other social services) which have higher incidence and receive higher weights after the exclusion of delayed vaccination and no birth certificate indicators.

Figure 22: Sensitivity analysis – Censored headcount ratios (for *k*≥25%)



Authors' calculations

Moreover, Figure 22 presents the variation of censored headcount ratios across the scenarios. The censored headcount ratios for the younger group are mainly inflated once we exclude the insignificant indicators (and additionally drop the missing observations). The largest deviation exists within the Other social services due to the high incidence of the indicator, as well as access to early education, which now receives higher weight. Within the older group, the variation of the censored headcount ratios is lower. Almost all dimensions have lower censored headcount ratios, in which Education and Love and care have larger drops after the correction for the missing values. Thus, the inclusion of the psychological aggression slightly inflates the incidence of poverty in the older group. On the other hand, the inclusion of delayed vaccination and no birth certificate decreases the MPI measures for the younger group.

5. CONCLUSION AND POLICY RECOMMENDATIONS

There are at least two general reasons for a decisive policy action towards reduction of child poverty in North Macedonia. Firstly, every child has the right to thrive in the best possible circumstances. The United Nation's Convention on the Rights of the Child (CRC) sets the building blocks of child wellbeing which should enable to utilize its capabilities for future development. Secondly, North Macedonia is a landlocked country with limited natural resources, thus the population arises as an important driver of economic growth. Children form the base of the future human capital development of the country. Investments in children should increase the growth potential of the economy.

The first step towards policy action for improving child wellbeing and reducing child poverty is the measuring and understanding of child poverty. This study provides extensive analysis of multidimensional child poverty in North Macedonia examining two age groups: children aged up to 5 years and children aged 5-17 years. The study uses the Alkire-Foster method in developing two age-specific child multidimensional poverty indices (MPIs) by leveraging secondary data from MICS 2018/2019 for North Macedonia. The single and multiple deprivation analysis uncovers the most prevalent deprivations among the children in North Macedonia, as well as the most deprived child groups, while the regression analysis detects the most important risk factors of

multidimensional child poverty in North Macedonia. Table 14 summarizes the key findings and policy recommendations.

The study provides the following general key findings:

- There are significant cross-age-group differences. At higher levels of intensity, children below 5 years of age experience higher incidence of poverty, while older children are prone to more intense poverty;
- Urban, Roma, poorest and households headed by less-educated adults contribute the most to multidimensional poverty;
- Rural child poverty requires much wider approach targeting several dimensions, while urban child poverty could be significantly reduced by addressing education and material deprivations;
- There are no significant gender differences;
- Roma children regardless of their age are heavily deprived. At least every third Roma child is multidimensionally poor;
- Four regions have significantly higher incidence of poverty: the Southeast, the East, Skopje and Polog, of which the first two have the highest incidence regardless of the child age-group;
- Urban, Roma and households with more than two children are prone to intrahousehold inequality in nutrition and education;
- Parents' and child's education are important determinants of child poverty and may pave the way out of poverty.

Based on the study's purpose and general key findings, the following general policy recommendations have been formulated:

- **Institutionalize assessment of multidimensional child poverty** – Incorporating the calculation of child MPIs in the basket of relevant poverty measures in North Macedonia, on regular basis, should secure informed decision-making by the government, monitoring of the dynamics of multidimensional child poverty and evaluation of the government's relevant programmes (social protection, education, health, violence and discrimination, etc.);
- **Explicitly include the indicators of child poverty and deprivations into the National Strategy for Reduction of Poverty and Social Exclusion and other thematic relevant strategies** – the inclusion of the child poverty indicators, constituting the child MPI, into the national strategies should enable coordination of various institutions and raise the policymakers' accountability in reaching the desired targets towards child poverty reduction;

- **Prioritize policies and plans to address inequalities to reach the most vulnerable children (such as Roma children)** – address ethnical, urban/rural, regional and intrahousehold inequalities through appropriate budget allocations reflecting on the child MPIs by prioritizing the most disadvantaged groups;
- **Design integrated care for every child (registering and monitoring)** – construct an institutional recording and monitoring system in which each child is registered and a series of services are provided (for example, registration number, health insurance coverage, vaccination programme, nutritional monitoring, educational achievements, access to services, etc.);
- **Reform the education system to enable every child to develop appropriate skills during the education process, thus reducing the intergenerational reproduction of poverty** – Investing in safety and inclusive pre-school and school education should help in skills development and bring long-term outcomes.

The Alkire-Foster method's feature of subgroup and dimensional decomposability of multidimensional child poverty enabled to identify the most important contributors to the child poverty in North Macedonia. The following are the dimension-specific key findings:

- **Education:** Education deprivations are among the top 3 contributors to the multidimensional poverty of children aged 5-17 years, being prevalent in urban areas and among the Roma population, with significant regional differences.
- **Material situation:** Material deprivation is a number 1 contributor to the multidimensional child poverty at higher levels of intensity for both age-groups. It is typical for Roma children and children living in urban areas, as well as in the East and the Southeast regions.
- **Love and care:** The lack of love and care are among the top 2 contributors to the multidimensional poverty of children aged 5-17 years, being prevalent among the Roma population and in urban areas.
- **Safety:** The deterioration of child safety arises as a second most contributing factor to the overall multidimensional child poverty; however, it loses importance at higher levels of intensity.
- **Leisure:** Leisure deprivation is the number 1 contributor to the overall multidimensional child poverty at lower levels of intensity, without significant cross-group differences.

- **Nutrition:** Malnutrition is among the top 2 contributors to the multidimensional child poverty in the Skopje region. 14 percent of Roma children are deprived in this dimension and are multidimensionally poor.
- **Health:** It takes the second place as a contributor to the multidimensional poverty of children aged 5-17 years and of Albanian children. Polog is heavily deprived in this dimension for children 0-4 years of age.
- **Housing:** Poor housing and overcrowding problems are typical for rural households; however, these contribute moderately to the overall multidimensional child poverty, without significant cross-group differences.
- **Information:** It takes the second place as a contributor to the multidimensional poverty of children aged 0-4 years if intensity is higher than 35 percent. The single deprivation analysis shows that internet deprivations are dominant within this dimension.
- **Other social services:** The limited access to social services is less important for the child poverty in North Macedonia, however the sensitivity analysis and single deprivation analysis show that the prevalence of limited access to pre-school education facilities may drive up multidimensional child poverty.

The dimension-specific key findings instruct the authors to recommend the following dimension-specific policy actions:

- **Education:**
  - *School-attendance allowance for Roma children* – certain adjustments are needed within the existing education allowance which should allow relaxed eligibility criteria and greater amounts for Roma children;
  - *Voucher for education services for poor-skilled children* – supplementary education services provided by certified service providers are needed for poorly skilled children;
  - *Free supplementary classes in schools* – supplementary classes for developing math and reading skills to be provided within the schools;
  - *Integrated psychological and educational support for poor-skills children in schools* – through designing safe spaces within schools, including allocation and adaptation of space, provision of equipment, tutoring and psychological support to pupils. [22]

[22] Details for the proposed measure (p.26): here

- **Material situation:**
  - *Design government-supported microfinance arrangements* – child grants or cheap and flexible crediting options should be available to the most materially-deprived households;
  - *Stimulate philanthropy and private sector activities* (for example stimulating monetary vouchers for employees with children, on top of their salaries).
- **Love and care:**
  - *Design a parenting programme and promote good-parenting* – developing an early childhood parenting model should equip parents with skills to effectively support children's development, while digital advertising to encourage parents to talk, sing and play with their young children should elevate the children's wellbeing;
  - *Home visits to disadvantaged and one-parent households by trained supervisors* – support development of early childhood professionals who would assist parents in poor households in providing the needed care to their children.
- **Safety:**
  - *Strengthen child protection legislation in terms of childhood violence, and build capacities to identify and respond to cases of violence;*
  - *Educational campaigns for increasing good-parenting awareness* – UNICEF campaign for parenting;
  - *Strengthen research and data to monitor the extent of early childhood violence.*
- **Leisure:**
  - *Create child-friendly urban environments* – develop city spaces where the youngest children would have warm and responsive interactions with loving adults and safe environment.
- **Nutrition:**
  - *Free school meals for poor and Roma children;*
  - *Food vouchers for Roma children;*
  - *Design a healthy weight programme* (informing, detecting and intervening) – the programme should provide information to the parents about healthy nutrition at all ages of their child's life, enable detection of malnourished children and design interventions to improve the nutritional profile.

- **Health:**
  - *Targeted health insurance coverage* - Mapping and integrating children without health insurance in the system;
- **Housing:**
  - *Providing housing benefits for overcrowded poor households;*
  - *Subsidizing houses for poor households.*
- **Information:**
  - *Vouchers for free internet package for deprived households and children;*
  - *Stimulate philanthropy and private sector activities.*
- **Other social services:**
  - *Intensify investment efforts for kindergartens, especially in the rural areas;*
  - *Create space for pre-school education in schools, especially in rural areas;*
  - *Consistent and universal implementation of the Government's policy commitment to ensure free preschool education for Roma children.*

Table 14: Key findings and policy recommendations

Dimension	Indicator	Specific key findings	Specific policy recommendations	General key findings	General policy recommendations
Freedom from exploitation	Domestic chores Work for money	- Highly limited (on average 1.13 percent of children are deprived in this dimension and multidimensionally poor).		- Significant cross-age-group differences (at higher levels of intensity, children 0-4 years of age experience higher incidence of poverty, while older children are prone to more intense poverty); - Urban, Roma, materially poorest and households headed by less educated adults contribute the most to multidimensional poverty; - Rural child poverty requires much wider approach targeting several dimensions, while urban child poverty could be significantly reduced by addressing education and material deprivations; - No significant gender differences; - Roma children regardless of their age are heavily deprived (at least every third Roma child is multidimensionally poor); - Four regions with significantly higher incidence of poverty: the Southeast, the East, Skopje and Polog, of which the first two have the highest incidence regardless of the child age-group; - Urban, Roma and households with more than two children are prone to intrahousehold inequality in nutrition and education; - Parents' and child's education is important determinant of child poverty and may pave the way out of poverty	- Institutionalize assessment of multidimensional child poverty as a part of policy action; - Explicitly include the indicators of child poverty and deprivations into the National Strategy for Reduction of Poverty and Social Exclusion and other thematic relevant strategies; - Prioritize policies and plans to address inequalities to reach the most vulnerable children (such as, Roma children); - Design integrated care for every child (registering and monitoring); - Reform the education system to enable every child to complete the appropriate education level reducing the intergenerational reproduction of poverty
Education	School non-attendance Has no books Reading and numeracy skills Grade for age	- Among top 3 contributors to the overall multidimensional child poverty; Typical for urban areas; Every third Roma child is deprived in Education and multidimensionally poor; - Top 3 regions deprived in this dimension: the East, the Southeast and Skopje.	- School-attendance allowance for Roma children; - Voucher for education services for poor-skilled children; - Free supplementary classes in schools; - Integrated psychological and educational support for poor-skilled children in schools		
Health	Has no health insurance coverage Delayed child vaccination	- Moderate importance overall; - Takes the second place as a contributor to the multidimensional poverty of children aged 5-17 years and of Albanians; - Polog is heavily deprived in this dimension for children below 5 years of age.	- Targeted health insurance coverage		
Housing	Overcrowding Dwelling quality	- Moderate importance overall; - Typical for rural children, especially in the below 5 years age-group; on average 3 percent of the deprived in this dimension and multidimensionally poor; without significant cross-group differences.	- Providing housing benefits for overcrowded poorhouseholds; - Subsidizing houses for poor		
Information	Internet Mobile	- Moderate importance overall; - Contributes more at higher intensity of poverty; - Takes the second place as a contributor to the multidimensional poverty of children below the age of 5 if the intensity is higher than 35 percent.	- Vouchers for free internet package for deprived households and children; - Stimulating philanthropy and private sector activities		
Material situation	Material deprivation	- Number one contributor to the overall multidimensional child poverty at higher levels of intensity; - Typical for urban and Roma children; - The Southeast and the East regions are heavily deprived in this dimension with regard to children below the age of 5	- Design government-supported microfinance arrangements - Stimulating philanthropy and private sector activities		

Water and sanitation	Sanitation Water	- Limited importance (on average 2.45 percent and 1.87 percent of children aged 0-4 and 5-17 years are deprived in this dimension and multidimensionally poor, respectively); - Typical for rural children	
Leisure	Has no books Has no toys/objects	- Number one contributor to the overall multidimensional child poverty at lower levels of intensity; without significant cross-group differences	- Creating child-friendly urban environments
Love and care	Motherless/Fatherless Early stimulation	- Among top 2 contributors to the overall multidimensional child poverty of children aged 5-17 years; - Typical for urban and Roma children	- Designing a parenting programme and promoting good-parenting; - Home visits by trained supervisors
Nutrition	Feeding Breastfeeding Malnutrition	- Moderate importance overall; - Among the top 2 contributors to the multidimensional poverty in the Skopje region; - 14 percent of Roma children are deprived in this dimension and are multidimensionally poor	- Free school meals for poor and Roma children; - Food vouchers for Roma children; - Designing a healthy weight programme (informing, detecting and intervening)
Safety	Neglect Physical punishment Psychological aggression	- Among the top 2 contributors to the overall multidimensional child poverty, however it loses importance at higher levels of intensity;	- Strengthening child protection legislation; - Educational campaigns for increasing good-parenting awareness - Strengthening research and data to monitor the extent of early childhood violence
Other social services	Early childhood education No birth certificate	- Limited importance (on average 2.5 percent of children aged 0-4 are deprived in this dimension and are multidimensionally poor); - Typical in rural areas; - The East and the Southeast regions are heavily deprived in this dimension	- Intensifying investment efforts for kindergartens, especially in the rural areas; - Creating space for pre-school education in schools, especially in rural areas; - Free access to kindergartens for Roma children

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