Multidimensional Child Deprivation: Constructing Longitudinal Indicators for the Early Childhood Period

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Multidimensional Child Deprivation: Constructing Longitudinal Indicators for the Early Childhood Period

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Abstract

Longstanding research has shown that childhood poverty and deprivation have negative consequences for children, from birth. Much of this literature, especially in the early childhood period, uses one-dimensional, static concepts that relate to households rather than children per se, missing a nuanced and dynamic description of children's lived experience of poverty and deprivation during their first years of life. We propose an early childhood deprivation framework that is multidimensional, dynamic and child-centred, and describe its methodological application to a micro-level panel survey of early childhood. We use a nationally-representative birth cohort of 18,000 children born in France in 2011, observed from birth to age 5, to produce a longitudinal multidimensional deprivation index composed of five distinct dimensions of deprivation (material, housing, extreme living conditions, parenting, and health behaviours). During the early years, income poverty does not always overlap with deprivation: in France, only 40% of deprived children are also income poor. We show that different populations are deprived in different dimensions: for example, young children from a migrant background are twice more likely to be deprived in housing and material dimensions, while not at higher risk of health behaviours deprivation, compared to their non-migrant peers. This paper therefore highlights that early childhood deprivation has a dynamic and complex structure that must be considered when studying the early years period.

Keywords Early childhood · Multidimensional deprivation · Child poverty · Inequalities · Longitudinal methods · France

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1 Introduction

A vast literature confirms that children growing up in low-income households experience disadvantages that have negative consequences in multiple domains of their lives. For example, living in poverty has negative impacts on children's physical and mental health, socio-emotional and cognitive development, etc. (Case et al., 2002; Ferraro et al., 2016; Reiss, 2013; Yang et al., 2023). Yet, even in the world's richest countries, over 20% of children live below the poverty line (UNICEF, 2023). France presents a concerning scenario, with 22.8% of children living in financially poor households in 2021 (Eurochild, 2022), which is a 10 percentage points increase over the past decade (UNICEF, 2023).

The experience of poverty and deprivation during the early childhood period can be especially detrimental to subsequent health and development (Currie & Almond, 2011; Almond et al., 2018; Siddiqi et al., 2007; Cattan et al., 2024), as the early years are characterized by a particularly malleable developmental phase that is very sensitive to its environment. Thus, fully understanding the characteristics of child poverty during this crucial lifestage is key. Yet, much of this literature, especially in the early childhood period, characterize poverty and deprivation using one-dimensional, static concepts and indicators of poverty, that often relate to households' (financial) experiences rather than children's per se, missing a nuanced, dynamic description of children's lived experience of poverty and deprivation during their first years of life.

Household income is often used to describe childhood poverty, especially in the early childhood period, when many of the items used by other non-income based deprivation indicators are not relevant. However, the literature has questioned whether household income is a reliable guide to the resources available to children or their experience of poverty, decreasing its research validity and policy relevance (Chzhen et al., 2018a; Fusco et al., 2010). Furthermore, household income might better reflect the experience of child poverty at certain periods of the lifecourse than others; its relevance might also vary across national and historical contexts. Therefore, comparisons across time and space may be biased if using income-based measures only.

To address these concerns, the concept of deprivation, and particularly multidimensional deprivation, have been increasingly used. Pioneered by Peter Townsend (1979), deprivation is different from income-based poverty concepts: deprivation can be a consequence of a lack of income, and as such there is an overlap between these deprivation and income-based poverty concepts and measures. However, deprivation can also be the consequences of a lack of other resources beyond income, and can therefore capture distinct processes and groups than income-based measures. Deprivation is a measure of how people live, rather than just what they earn, and, different from income-based measures of poverty, it is a relative measure, as it takes into account what is normative for a given context. Deprivation is a multidimensional concept, and has therefore been measured as such, through frameworks such as the Multidimensional Overlapping Deprivation Analysis (MODA) or Multidimensional Poverty Index (MPI) (UNICEF, 2013). Most studies based on these frameworks focus on adults and, for children, on school-aged children. Significantly less is known about early childhood deprivation.

This lack of nuanced description of early childhood poverty may be due to the fact that many of the available multidimensional deprivation frameworks are not easily translatable to the early childhood period. First, because they rely on items that are not relevant for the early childhood period. Second, because they often propose cross-sectional approaches; the few that do propose longitudinal approaches are not relevant for the early childhood period, as they rely on measuring exactly the same indicators over time, which is often not possible during early childhood (for example, items around having three meals a day or shoes do not apply to babies; items around schooling are only relevant towards the end of the early childhood period; etc.). Being able to use relevant yet dynamic indicators for the early childhood period is crucial, both because children's needs change rapidly at this stage, and because families are usually at a crucial lifestage for poverty and deprivation around the birth and early years of a child, as many events related to careers and housing take place often around this stage. As such, conceptualizing "living in poverty" through a multidimensional deprivation framework is important for our theorization and academic understanding of early childhood inequalities.

Multidimensional measures of deprivation can also be important to guide policy formulation and interventions. By measuring deprivation in a variety of domains, these measures provide a more nuanced and comprehensive overview of children's lived experiences of poverty. As such, they can help target the recipients of interventions, and to define priority areas. Multidimensional measures of deprivation also highlight that poverty is a multifaceted experience in interconnected domains, emphasizing the need for more coordinated policy interventions. Furthermore, income poverty measures tend to overlook non-monetarized domains of child welfare (such as parental time, access to services, etc.). For instance, income-based measures would not identify as deprived a child living in a region where access to health services is difficult due to lack of appropriate infrastructures. Yet such domains have been shown to be crucial for children.

In this paper, we conceptualize and construct longitudinal measures of early childhood deprivation by using a dynamic, multi-domain, child-centered framework. We then apply this framework to investigate the patterns of multidimensional deprivation for children in France during their first five years of life, exploring which population groups are most at risk of different forms of deprivation. The study is based on the French Longitudinal Study from Childhood (*Étude Longitudinale française depuis l'enfance*, Elfe), a nationally-representative longitudinal study of children born in 2011. An aim of this paper is therefore to provide a first more nuanced description of early childhood deprivation in a national context that has been less explored in the literature but that has seen a large increase in child poverty in recent years, while also precisely describing all steps taken to construct these measures, based on the secondary analysis of existing survey data, to guide future researchers who want to recreate similar indicators.

2 Literature Review: Measuring Poverty and Deprivation in Childhood

Income-based measures of poverty are a classical approach to measuring childhood poverty. It is common to use child poverty lines that determine the income level below which a child is considered to be "poor". The specific methods for calculating child poverty vary across countries, but some common approaches include absolute and relative poverty lines. The absolute poverty line approach sets a fixed threshold below which children or families are considered to be in poverty. For example, a common absolute poverty line might be based on the cost of a basic basket of goods and services needed for a minimal standard of living. The relative poverty line approach defines poverty in relation to the overall distribution of income in a society. More specifically, the proportion of children living in relative poverty or in monetary poor households is defined as living in a household where disposable income, when adjusted for family size and composition, is less than a certain percentage (e.g. 60%) of the national median disposable equivalized income for the country in which they live.

While such approaches play a crucial role in both research and policy by providing standardized metrics for assessing and addressing child poverty, it is now widely recognized that income-based measures do not capture children's lived experiences of poverty (Main & Bradshaw, 2016). First, household income is not a reliable guide to the resources actually available to children (Chzhen et al., 2018a), notably because income-based measures ignore family composition and intra-household distribution of resources (Fusco et al., 2011). This is particularly significant for very young children, who lack control over resource allocation within a household (Dickerson & Popli, 2018). Additionally, relying solely on income fails consider elements of a household's financial security and resources such as savings, debt, housing tenure etc., and goods and services that are important for children but that income alone does not secure access such as health care, schooling, housing etc. (Chzhen & Ferrone, 2017). Furthermore, the overall understanding of poverty, as highlighted by fundamental works of sociologists (e.g., Townsend, 1979) and economists (e.g., Sen, 1999), emphasizes that poverty extends beyond the inability to meet basic needs. The poor themselves define their well-being as multifaceted, with both monetary and non-monetary dimensions, such as life expectancy, literacy and housing quality, regarded as important (Narayan, 2000). As a result, beyond not capturing well the lived experience of children, it is also likely that income-based measures of poverty fail to identify many children who may not live in income-poor families, but, because of a lack of other resources, do experience deprived living conditions.

A body of research has put forward multidimensional deprivation as a tool to better understand the lived experiences of "living in poverty", as well as identify all children who experience deprivation. The foundation of this approach is the Alkire-Foster counting method which integrates several different types of non-income deprivations that individuals experience at the same time, such as lack of education, insufficient employment opportunities, poor health, or inadequate living standards (Alkire & Foster, 2011; Alkire et al., 2015). Applications specific to children include MODA and MPI. MODA (de Neubourg et al., 2012, 2013) is a child-specific multidi-

mensional poverty measure rooted in the conceptual framework of children's rights, going beyond basic needs and considering elements necessary for full participation in society and achieving overall well-being. Studies of multidimensional child deprivation based on the MODA framework defines child deprivation as non-fulfilment of child life rights, including health, nutrition, education, water, sanitation, and housing. Several studies focus on multidimensional deprivation among children and adolescents in high- and middle-income countries in Europe, utilizing MODA (Chzhen & Ferrone, 2017; Chzhen et al., 2016, 2018b). For example, Chzhen et al. (2018b) identify six dimensions, such as nutrition, perceived health, school environment, protection from peer violence, family environment, and access to information in 37 European countries and Canada.

The second measure, the MPI, is rooted in the conceptual framework of basic capabilities, pioneered by Sen (1974, 1979, 1980). The capability approach changes the focus from means, i.e. the resources people have and the public goods they can access, to ends, i.e. what they are able to do and be with those resources and goods. In this context, poverty, according to Sen, is a complex and multidimensional concept that should consider diversity of characteristics and circumstances and that extends beyond a lack of income and resources. It also should consider a lack of education, health, and other productive opportunities. The MPI is a general framework, typically applied at the household level. MPIs can be applied exclusively to children, as detailed by Dirksen and Alkire (2021).

There are several similarities between the MPI and MODA approaches (Hjelm et al., 2016). The key points of overlap between the measures are that both aim to measure multidimensional deprivation, use the Alkire-Foster method for counting deprivation, and rely on a single source of micro data for all their dimensions. Both approaches can be used to identify children who are deprived, as well as define the severity or intensity of their experience of deprivation (this is often referred to as the "depth" of deprivation), although depth of deprivation measures are less used in the children's literature. At the same time, the MPI and MODA differ in several conceptual and methodological ways. MODA uses the child's right approach, while the MPI is rooted in Sen's capability approach. This conceptual difference drives different methodological choices. For example, the child MPI identifies deprivation at the child level, combining deprivations that directly affect the child (e.g. lack of immunization) with deprivations that affect all household members (e.g. housing quality), while MODA focuses exclusively on children. Another methodological difference is the decision on how to aggregate indicators of deprivation. MODA aggregates all indicators into dimensions and then count the number of dimensions each child is deprived in, while the MPI assigns indicators to dimensions notionally and aggregates indicators directly into an index. The choice of different indicators and a different weighting and aggregation scheme results in different estimates of the overall deprivation rates. Typically, MODA leads to notably higher rates, indicating that the MPI identifies children experiencing more severe levels of deprivation.

In this review, we focus on the child MPI approach, as it is most similar to the approach used in our analyses, as its conceptual and methodological flexibility regarding the use of both household and child-level items is more relevant for the early childhood period. The child MPI approach is used widely in the research literature

focusing on developing countries (Singh & Sarkar, 2015; Trani et al., 2013). There is significantly less work based on developed countries. A recent example includes Madden (2022), who examines the development of multidimensional deprivation and its dimensions (education, health, and family income/resources) over time for a cohort of Irish children from age 9 to 17. The results demonstrate that deprivation in health and education is relatively stable, while the family resources dimension shows more mobility, possibly related to the Great Recession. Two other studies relevant to our work because they also include a longitudinal element are Dickerson and Popli (2018) and Leturcq and Panico (2019), who examine multidimensional deprivation and its dynamics based on the UK Millenium Cohort Study (MCS). In the first paper, the authors construct an indicator of multidimensional deprivation based on five dimensions and using two waves, when the children were 3 and 7 years old. Both the Madden and the Dickerson and Popli papers do not include young children in their analyses, and their longitudinal approach rely on only including items that are consistent from wave to wave. Leturcq and Panico (2019) use first five MCS waves, when the children were about 9 months, 3, 5, 7, and 11 years old, and include items that vary over time with child age. In our paper, we employ a similar approach, with some modifications described below, and focusing on early childhood and its specificities.

These different approaches are reflected in the evolution of policy concerns in several Western countries (Huston, 2011). Absolute definitions of poverty, based on a minimum income needed by an individual or family to avoid serious hardship, is still used in countries such as the United States to identify poor households. In many other OECD countries, including France, absolute definitions have been abandoned in favor of relative definitions, based on a percentage (often 50 or 60%) of the median income in the country. As a result, relative poverty indicators are often used both for national policy formulation and to identify households for policy intervention. At international level, income-based definitions are beginning to be superseded altogether. For example, in 1984, the European Economic Community adopted a definition of poverty informed by deprivation concepts, which recognized the importance of a variety of resources beyond income (material, cultural, social) and the concept of a "minimum acceptable way of life in the Member States in which they live" (EEA, 1985). Similarly, UNICEF's policies now go beyond material deprivation to consider several domains, such as safety, education, relationships, behaviours, etc. (Unicef, 2013). Most national governments do not use such broad concepts in their policy making. An exception included the United Kingdom, which used "social exclusion" as a key policy principle during the New Labour years, targeting a broad range of resources beyond income, although this was deprioritized after the 2010 election of the Conservative party (Fahmy et al., 2018).

In this paper, we propose an approach to measure longitudinal deprivation in early childhood, and apply it to a recent cohort of children born in France, over their first five years of life. Compared to previous studies, we propose a number of conceptual and methodological advances in the construction of deprivation indicators: (1) our focus, both conceptually and methodologically, is on the specificities of the early childhood period, which has been less considered in this literature; (2) we consider dimensions of deprivation that are important for child wellbeing but are often ignored in the deprivation literature, such as health behaviours; (3) alongside different dimen-

sions of deprivation, and an overall indicator of multidimensional deprivation, we present an indicator of depth of deprivation, which has been used for adults but not as extensively for children; (4) we consider a relatively long time period and investigate dynamics of multidimensional deprivation longitudinally, over 5 years; (5) we apply two sets of weights, for dimensions and for items within each dimension. The weights for items help to overcome the fact that many measures are age-specific and the same questions therefore cannot asked in every wave, resulting in the inability to construct exactly the same dimensions. This is a problem faced by many researchers attempting to construct longitudinal indicators of multidimensional deprivations using the secondary analyses of existing datasets, particularly when focusing on early childhood, when children's needs change rapidly and therefore repeated items are less likely to be available. Therefore, a focus of this paper, alongside presenting substantive results on early childhood multi-domain deprivation in France, will be to clearly describe all the steps taken so that our approach can be replicated by other studies.

3 Data

3.1 Dataset and Sample Selection

This paper is based on the *Étude longitudinale française depuis l'enfance* (Elfe). Elfe is France's first nationally representative birth cohort; it aims to study the determinants of children's development, health and well-being, from birth to adulthood and is representative of all births in France in 2011. 18,329 children were recruited at birth in a random sample of maternity wards in France, during 25 selected days of 2011, distributed over the whole year to capture the four seasons. Inclusion criteria in the study were: single or twin live births; at least 33 weeks of gestation; mothers were at least 18 years old; and planned to remain France at least 3 years. The study does not include French overseas territories. Full details on the study can be found in Charles et al. (2020).

Interviews are conducted with the main carer, usually the mother, and their co-resident partner, which is usually the child's biological father but can also be the "social" parent, if they co-reside with the child. For simplicity, throughout the paper we will refer to them as "fathers". The first data collection took place face-to-face in the maternity ward with trained midwives, shortly after birth (we refer to this wave as "baseline"). The main follow-ups include telephone interviews by trained interviewers using CAPI protocols with both parents at 2 months (which we refer to as wave 1), 1 year (wave 2), 2 years (wave 3), and with one parent (the mother and, if not available, the father) at 3.5 (wave 4), 5.5 (wave 5) and 10.5 years (not used in this paper given the focus on early childhood). Participation rates, as compared to baseline, are 90% in wave 1, 80% in wave 2, 74% in wave 3, 66% in wave 4, and 66% in wave 5. Attrition was selective (Thierry et al., 2018), with more mobile and disadvantaged families more likely to drop out of the study. While survey weights allow taking this selection into account, it is therefore likely that our estimates of deprivation for this sample are a lower bound.

The focus of this paper is early childhood and therefore we take into consideration five survey waves from 2 months to 5.5 years of age. The total number of productive interviews in the first five waves is 68,381. Our analytical sample includes all children who do not have missing information on the items used in the construction of multidimensional childhood deprivation. This gives a final sample of 13,050 children for wave 1, 13,586 for wave 2, 11,699 for wave 3, 10,814 for wave 4, and 10,353 for wave 5, for a total of 59,502 child-wave observations (87% of the total number of productive interviews in first five waves). This corresponds to 15,237 children with a non-missing value of multidimensional deprivation in at least one wave. As shown in Section 5, the proportion of deprived children in this cohort study is rather low. Therefore, to increase statistical power for analyses, we pool data from the first five waves.

Appendix A shows summary statistics of the original and the final analytical samples. The analytical sample is similar to the original one, with small differences such as slightly more children with highly educated and working mothers in the analytical compared to the original sample: 2.0 and 2.7 percentage points differences between the two samples, respectively. These differences signal that more disadvantaged households are slightly less likely to be included in the analytical sample compared to the original sample.

3.2 Model Variables: Individual and Household Characteristics

Deprived versus not deprived children might differ on a number of socio-economic characteristics. To map which population groups are deprived, we use a set of time-variant and time-invariant variables that relate to individual and household characteristics. Time-invariant variables are the child's sex and the migration status of each parent; time-variant variables include the child's age in months, the number of siblings, the education level of each parent, the employment status of each parent, and maternal marital status. In case of shared custody arrangements, only the household of the main carer, usually the mother in our sample, is considered. In addition, dummy variables for the regions of residence are included, together with the year of interview and season of birth.

In our analyses, the migrant background is a dummy indicator which captures whether the mother/father was born abroad without French nationality. This variable is built on the migration history questions, available only in wave 1. The level of education indicates the highest diploma obtained by parents. It includes three categories, namely, "low" if the maximum educational attainment is upper secondary education, corresponding a high school diploma (*Baccalaureate*), "intermediate", which corresponds to a tertiary vocational qualification ("*Bac+2*" in the French education system), and "high" for any higher education, usually involving at least an undergraduate degree. This variable was constructed at every wave. The employment status dummy is based on the current work situation, collected at each wave. It is equal to 1 if the mother/father is unemployed, a student/housewife(-husband) or retired, and to 0 otherwise. To include single parent households in our analyses, father's variables (i.e. his migrant background, level of education, and employment status) include a missing category if the father does not live in the same household

as the child. Our analytical sample does not include any single father households. Finally, for mothers, we additionally include her marital status as a dummy variable which is equal to 1 if the mother is single and to 0 if she is married, in a civil union, or cohabiting with a partner.

3.3 Variables: Income Poverty

To contrast our multidimensional deprivation indicator with to classic income-based poverty measures, we construct an income poverty indicator, which measures the share of children falling below the poverty line, defined as 60% of the median equalized household monthly income in every wave. Equalized household income is calculated based on the parent-reported net monthly resources, i.e. all the types of income minus social security contributions and supplementary social security contributions, adjusted for needs of different household sizes by applying the OECD-modified equivalence scale. This scale assigns a value of 1 to the household head, of 0.5 to each additional adult member (14 years and older) and of 0.3 to each child. Because our analytical sample is slightly more advantaged than the original sample, we compute the poverty line for each wave based on the full Elfe sample, rather than our analytical sample. According to this definition, on average over five waves, 17.6% of the children in the original sample are identified as income poor. While we cannot directly compare this number to national statistics on child poverty (which include children of all ages as well as those living in overseas territories, where child poverty is particularly high), our figures closely align with the official child poverty rate in France over the last decade. This rate has shown an increasing trend, reaching an average of 19.9% in the years 2019–2021 (UNICEF, 2023).

4 Constructing Longitudinal, Multidimensional Childhood Deprivation Indicators

In this section, first, we provide a detailed description of the conceptualisation and construction of longitudinal indicators of early childhood deprivation and, second, we define all the measurement design elements. We describe these in detail in order to allow researchers to replicate our approach, which is particularly useful for the secondary data analyses of micro-level, pre-existing, longitudinal survey data. Appendix B provides a step-by-step guide that summaries this section.

4.1 Framework and Methodology

We base our analytical framework on definitions and methodologies of multidimensional deprivation (Alkire & Foster, 2011; Bourguignon & Chakravarty, 2003), adapted to change over time to account for children's changing needs, while still being comparable across ages (Leturcq & Panico, 2019; Castillo Rico et al., 2019). Our approach relies on the identification of various dimensions of deprivation that are important during early childhood. Dimensions of deprivation stay constant over time, which allows us to estimate how patterns of childhood deprivation vary over

time. Each dimension consists of indicators that signal a lack of specific age-relevant goods or activities. While dimensions are constant over time, the items making up each dimension are a mixture of stable and changing variables that reflect children's changing needs at different age and data availability. The items and dimensions are described in detail in Section 4.2.

Although the multidimensional approach to deprivation is widely used in the literature, one of the debated issues relates to assigning different weights to each dimension or individual items, i.e. whether different dimensions or items within should matter more for child deprivation. The majority of studies do not cover this issue and simply assign equal weights to each dimension/item, assuming that all dimensions or items have the same relative importance for children. Methods used in determining the weights for each dimension/item of deprivation include statistical, survey-based, normative-participatory, frequency-based methods, or a combination of these (Atkinson, 2003; Fernandes et al., 2013b). In our study, we apply equal weights across deprivation dimensions, as we consider that the dimensions we have identified correspond to crucial domains for child health, development and well-being, and therefore we define them as equally important. However, we apply a combination of two methods, i.e. equal weights and inverse proportion weights, for the items within each dimension. This is a novelty on much of the previous work on child deprivation, which does not consider item weights. The weights and the choices behind the use of different approaches are described in detail in Section 4.2.

The identification of deprived children is based on a double-counting approach which imposes a triple cut-off methodology (Alkire & Foster, 2011; Leturcq & Panico, 2019). We consider D dimensions of childhood deprivation, fixed at 5 dimensions for each wave. A child i at age a in every dimension d is described by a vector $X_{iad,}$ which is composed of k items x_{iak} specific to the dimension d. The methodology for defining multidimensionally deprived children is presented as follows:

Step 1. First, for each item x_{iak}, we define a deprivation cut-off z_{ak} and identify if the child is deprived in this item or not. The child is considered deprived in an item k if $x_{iak} \geq z_{ak}$. In this case, the child receives a score s_{iak} of 1. Otherwise, the score is equal to 0, which mean that the child is not deprived in this item.

Step 2. Second, for each dimension d, we specify a cut-off $\hat{z}_{ad}$, which represents the score below which the child is considered as deprived on that dimension. The scores s_{iak} from step 1 are multiplied by the weights w_{akd} previously assigned to each item, and then summed up to calculate the child's weighted deprivation score c_{iad} in every dimension:

$$c_{iad} = \sum_{k} w_{akd} * s_{iak} \tag{1}$$

Based on the cut-off $\hat{z}_{ad}$ for each dimension, we define a binary variable δ_{iad} indicating that the child is considered deprived in the dimension d if he/she does not reach the cut-off or $c_{iad} \geq \hat{z}_{ad}$. Thus, at this step we identify who is deprived in each dimension.

Step 3. We define the overall multidimensional deprivation index. The indicators δ_{iad} are multiplied by the weights of dimensions w_d, and then summed up to compute a score of deprivation over dimensions C_{ai}:

$$C_{ia} = \sum_d w_d * \delta_{iad} \tag{2}$$

As mentioned above, we apply equal weights to the dimensions, thus, the score of overall deprivation is an equally weighted aggregation of the five dimensions. We define an overall deprivation cut-off Z_a and a binary variable η_{ia}, which is equal to 1 if $C_{ai} \geq Z_a$ when the child is considered multidimensionally deprived.

Knowing individual multidimensional deprivation statuses (η_{ia}), we calculate the share of multidimensionally deprived children in the total sample, H. In accordance with the Alkire and Foster (2011) definitions, H refers to the multidimensional headcount ratio or the incidence of the multidimensional deprivation. This is a basic useful measure, but it does not reflect the intensity of deprivation and does not change if deprived people become more or less deprived. For these reasons, Alkire and Foster (2011) introduce two additional measures. First is a measure of the intensity of multidimensional deprivation among those identified as overall deprived, A. A is the percentage of deprivations a deprived person suffers from on average. Second is the adjusted headcount ratio, M_0, which reflects both the incidence of deprivation (H) and the intensity of deprivation (A) of deprivations and is calculated as H times A. Alkire and Foster (2011) call M_0 the multidimensional poverty index (MPI), but to be consistent with our research approach and to distinguish it from classic income-based poverty measures, we call it multidimensional deprivation index.

This methodology and our adaptations allow following children over time as we keep constant the dimensions of deprivation, while taking into account the changing needs of children according to their age as the item composition of each dimension can vary with child age. The methodology is sensitive to the underlying choices made by the researchers. This includes: (1) the number and choice of items and dimensions; (2) the weights used to aggregate the items into the dimensions, and the weights used to aggregate the dimensions into the overall index; (3) the cut-offs used within each dimension and the cut-off across dimensions to define a multidimensionally deprived child. These choices are described in detail in the next section.

4.2 Measurement Design: Items, Dimensions, Weights, and Cut-offs

The selection of the items, dimensions, weights, and deprivation cut-offs was based on the literature, the data available, and some normative choices.

4.2.1 Dimensions and Items

The choice of items reflects our child-centred, multidimensional framework to study early childhood deprivation, as well as, more pragmatically, the data available. First, we select potential child-centred items that may determine childhood deprivation. Child-centred items refer to specific measures that focus on the well-being, development, and rights of children. They assess various aspects of a child's life, taking into account their needs and experiences (we mainly use child-specific items, although some of them, such as housing quality, are measured at the household level). We consider the changing needs of children given their ages. This implies that some of the items change depending on the age of the child, while others remain constant, as we consider them to matter at all ages. Second, based on selected items, we run a Multiple Component Analysis to investigate which clusters of items emerge and which of items drive different axes. We run this analysis separately for each wave to take into account that different items can be more or less significant according to the child's age. Third, based on the results of previous steps, we identify dimensions of deprivation which are constant over waves, while the item composition of each dimension is allowed to vary at each age. In total, 35 items are used across five waves, which form five dimensions of deprivations. They are:

- *Material deprivation* aims at capturing household living conditions and the household's ability to afford basic items as well as items that are commonly available to most households in a given society. In practice, this dimension is defined as the inability to afford new clothes, two pairs of shoes per adult, meat or fish every second day, at least one proper meal per day, one week of holidays per year away from home, replacing furniture, presents for family/friends at least once a year, as well as whether the child has toys, attends sports clubs or classes, parents have organised a birthday celebration for the child, and whether there is Wi-Fi/internet at home. This dimension should distinguish between individuals who cannot afford a certain good or service, and those who do not have this good or service for another reason, e.g. because of a preference. Therefore, it should reflect inability rather than the choice not to acquire the item or good in question. However, due to the data available, not all items in this dimension indicate inability. For example, questions on birthday celebration and attending sport clubs could indicate household choice rather than inability to afford it. Nevertheless, we still include these items as they are relatively common activities for most children in France and due to the lack of other more appropriate ones. We use item weights to somewhat mitigate this issue; this is described in more detail in the next section.
- *Housing deprivation* is a measure of housing amenities. This dimension incudes housing quality variables such as difficulty to heat the home, whether the home has damp, mold on the walls and is too noisy, and whether the child has a bedroom (for themselves only or shared with siblings) as opposed to sleeping in the living room or their parents' own bedroom.[1]

[1] A classic definition of housing deprivation takes into account a dwelling's overcrowding, which we could not calculate with the available data. We therefore use a variable tapping into whether children had a bed-

- *Extreme living conditions deprivation* is a measure of extreme housing conditions. This dimension includes basic amenities in the home such as hot water, a bathroom and toilets, as well as whether the family lives in temporary or inadequate spaces (a hotel room, a shelter, another collective residence, a caravan or mobile home, a home in a place not intended for habitation). This dimension might conceptually overlap with the housing deprivation dimension, but these items were quite distinct in the MCA, suggesting a different dimension of deprivation.
- *Parenting deprivation* reflects parenting involvement in child rearing and education. Items in this dimension vary by wave, reflecting the child's changing needs, and include variables such as parents talking, reading and singing songs to the child, skin to skin contact with the child, playing, walking or drawing with the child, teaching the child to count, read, etc.
- *Health behaviours deprivation* considers four items that contribute to developing good health. These items are: good nutrition, adequate sleep, physical activity and sedentary behaviour. We follow the World Health Organization (WHO) guidelines on physical activity, sedentary behaviour and sleep for children under 5 years of age (WHO, 2019) to define these items.

Details of the dimensions and items used are presented in Table 1.

4.2.2 Weights

Constructing composite summary indexes involves selecting a method for aggregating items and dimensions, a topic of significant debate among social scientists (Fernandes et al., 2013a, 2013b). In our case, to construct the overall deprivation index, we use weights twice: (1) when we calculate the child's weighted deprivation score for each dimension and (2) when we calculate the overall multidimensional deprivation index.

The most common approach for aggregating items and dimensions is to consider that each item has equal importance and therefore to give equal weights to all items within dimensions, and to each dimension for the overall indicator (Hagerty & Land, 2007). The main advantage of this approach is its simplicity and alignment with the United Nations Convention on the Rights of the Child, which highlights that all the human rights are equally important. However, the equal weight approach faces two main criticisms: the first questions the universality of children's rights, suggesting that children's needs and interests vary across different contexts; the second argues for a child-centred perspective, where children's opinions are considered in defining what counts as a "good life" for child well-being (Dat & Pasquier-Doumer, 2016). To address the first critique, some researchers use data-driven approaches, which focus on the relative severity of deprivations, without making value judgements about trade-offs. For example, the frequency-based weight approach assumes that less common deprivations are more significant (Halleröd, 1994). In this case, if 95%

room. We use this variable both because of data availability, and because the bedroom variable makes this item more child-centered.

Table 1 Dimensions and items used to for the construction of multidimensional childhood deprivation

			Data availability (+available,—not available)				
Dimension	Item	Deprivation cut-off	2 months	1 year	2 years	3.5 years	5.5 years
Material deprivation	New clothes	Deprived if cannot afford it	+	–	–	–	–
	Two pairs of shoes per adult	Deprived if cannot afford it	+	–	–	–	–
	Meat/fish every two days	Deprived if cannot afford it	+	–	–	–	–
	At least 1 meal per day	Deprived if any member of the household had to spend a whole day without having at least one complete meal due to lack of money in the last 2 weeks	+	–	–	–	–
	Paying bills on time	Deprived if cannot afford it	+	–	–	–	+
	Replacing furniture	Deprived if cannot afford it	+	–	–	–	–
	One week of holidays per year	Deprived if cannot afford it (2 months); if the child did not go on summer holidays in the last 12 months (3.5 years); if there were no holidays with the child in the last 12 months (5.5 years)	+	–	–	+	+

Table 1 (continued)

			Data availability (+available,—not available)				
Dimension	Item	Deprivation cut-off	2 months	1 year	2 years	3.5 years	5.5 years
	Inviting friends/family	Deprived if cannot afford it at least once a month	+	–	–	–	–
	Presents for friends/family	Deprived if cannot afford it at least once a year	+	–	–	–	–
	Wi-Fi/Internet at home	Deprived if no Wi-Fi/internet at home	–	+	+	+	+
	Toys	Deprived if the child has less than half of the presented list of toys	–	+	+	–	+
	Child's birthday celebration	Deprived if the family did not organise a birthday celebration for the last child's birthday	–	+	+	–	+
	Sport clubs or lessons	Deprived if the child does not regularly practice a leisure activity in a club or association, such as judo, painting or music	–	–	–	+	+
Housing deprivation	Heating in the dwelling	Deprived if it is difficult or too costly to heat the dwelling	+	+	+	+	+

Table 1 (continued)

			Data availability (+available,—not available)				
Dimension	Item	Deprivation cut-off	2 months	1 year	2 years	3.5 years	5.5 years
	Damp in the dwelling	Deprived if the dwelling is too damp	+	+	+	+	+
	Mould in the dwelling	Deprived if there is mould on the walls of the dwelling	+	+	+	+	+
	Noisy dwelling	Deprived if it is noisy in the dwelling (external or internal noise)	+	+	+	+	+
	Child has own room or shares with sibling(s)	Deprived if the child does not have own (or shared with siblings) room	+	+	+	+	+
Extreme living conditions deprivation	Hot water in the dwelling	Deprived if no hot water in the dwelling	+	+	+	+	+
	Bathroom in the dwelling	Deprived if no bathroom or shower in the dwelling	+	+	+	+	+
	Toilet in the dwelling	Deprived if no toilet in the dwelling	+	+	+	+	+

Table 1 (continued)

			Data availability (+available,—not available)				
Dimension	Item	Deprivation cut-off	2 months	1 year	2 years	3.5 years	5.5 years
	Extreme type of dwelling	Deprived if the family lives in a hotel room, social residence, another collective residence, a caravan or mobile home, home in a place not intended for habitation	+	+	+	+	+
Parenting deprivation	Singing songs to the child	Deprived if parents rarely sing to the child (2 months, 1 year); if do not sing at all (3.5 and 5.5 years)	+	+	−	+	+
	Talking to the child	Deprived if parents sometimes/never talk to the child (2 months); if parents never/rarely spend calm time with the child talking to them (1 year); if parents never/less that once a week talk about school life (3.5 and 5.5 years)	+	+	−	+	+

Table 1 (continued)

			Data availability (+available,—not available)				
Dimension	Item	Deprivation cut-off	2 months	1 year	2 years	3.5 years	5.5 years
	Skin to skin contact	Deprived if parents do not have skin to skin contact with the child (2 months); if parent never/rarely have body contact to play with the child (1 year)	+	+	–	–	–
	Playing with the child	Deprived if parents rarely play with the child	–	+	+	–	–
	Reading books to the child	Deprived if parents rarely (1 year) or never (3.5 and 5.5 years) read books	–	+	–	+	+
	Drawing with the child	Deprived if parents do not draw with the child	–	+	–	+	+
	Physical activities with the child	Deprived if parents go on walks with the child rarely/sometimes (2 years); if parents do not play ball games or cycle together with the child (5.5 years)	–	–	+	–	+

Table 1 (continued)

			Data availability (+available,—not available)				
Dimension	Item	Deprivation cut-off	2 months	1 year	2 years	3.5 years	5.5 years
	Teaching the child counting, writing, reading etc	Deprived if 0 or 1 activity (3.5 years) and 0, 1 or 2 activities (5.5 years) in the past month	–	–	–	+	+
	DIY with the child	Deprived if no DIY with the child	–	–	–	–	+

Table 1 (continued)

			Data availability (+available,—not available)				
Dimension	Item	Deprivation cut-off	2 months	1 year	2 years	3.5 years	5.5 years
Health behaviours deprivation	Nutrition	Deprived if the child is never breastfed (2 months); if the child eats ready-to-eat food (meat, fish, vegetables, fruit) which is not specifically formulated for babies (1 year); if the child consumes daily unhealthy products such as pastries, sugar drinks, chips, sweets, crisps (2 years); if the child regularly consumes ready-to-eat meals, sugar-drinks, and skips at least one main meal per day (3.5 years); if the child skips at least one main meal per day and has a poor variety of eaten food (5.5 years)	+	+	+	+	+

Table 1 (continued)

			Data availability (+available,—not available)				
Dimension	Item	Deprivation cut-off	2 months	1 year	2 years	3.5 years	5.5 years
	Sleep time	Deprived if the child sleeps less than WHO recommended hours of sleep (including day naps): 11 h (1 and 2 years), 10 h (3.5 and 5.5 years)	–	+	+	+	+
	Sedentary behaviour—screen time	Deprived if parents watch TV with the child (1 year); if child's screen time exceeds WHO recommendations: 1 h per day (2 and 3.5 years) and 1.5 h per day (5.5 years)	–	+	+	+	+
	Physical activity	Deprived if parents sometimes or rare play physical games or go on a walk with the child (W3); if the child spends less than 30 min a day playing outside (W4, W5)	–	–	+	+	+

Across waves, there are questions that remain the same in terms of wording, but their answer categories may vary. This implies the use of different deprivation cut-offs

of a given society can afford at least one meal per day while 5% cannot, the assigned weight for this item would be high, indicating its significant importance in the assessment. Conversely, if 95% of a given society cannot afford holidays abroad while 5% can, the assigned weight for this item would be low. However, this method implicitly assumes that as an item becomes less prevalent, its weight changes, even if people's value judgement do not (Castilla, 2012). Some researchers have attempted to address both critiques by incorporating into the weighting approach children's own perspectives of their well-being and involving them in the measurement process (Fernandes et al., 2013a; Dat & Pasquier-Doumer, 2016). Nevertheless, this approach requires specific data on children's views regarding the importance of various items relevant to their well-being, which is often not available in large surveys, making it challenging to implement.

The choice of our weights is guided by the debates described above, and data features. To calculate the weighted deprivation scores for each dimension, we apply either equal or frequency-based weights, which are normalized to ensure their sum totals 1.

We apply equal weights to the housing, extreme living conditions and health behaviours dimensions of deprivation. We argue that in these dimensions, the items represent basic needs that are important for the child's healthy growth and development and should therefore be treated with equal importance. Because the number of questions on nutrition in the health behaviours deprivation vary over time, taking into account age-specific nutrition, we also apply equal weights to every item within nutrition sub-dimension.

For the material and parenting dimensions, the best option would be to apply the approach that takes into account children's views regarding the importance of various items. However, due to the lack of such data, we apply frequency-based weights to these dimensions. By doing so, we take into consideration variations in any item across a population, stemming from economic and social differences rather than other factors, such as lack of need in a particular item. Simultaneously, this approach helps in partially mitigating the inclusion of items that reflect preferences, rather than the inability to afford something, which may occur due to data availability, by assigning smaller weights to these items. We argue that applying this weighting approach to the material and parenting dimensions would adjust their deprivation indices so that the list of items they contain reflect a standard of living considered normal or necessary. For instance, in the material dimension at the age of two months, following this approach, we assign the highest weight to the "at least one meal per day" item and the smallest weight to the "one week of holidays per year" item. Similarly, in the parenting dimension at the age of one year, the highest weight is assigned to the "skin-to-skin contact" item, while the smallest weight to the "drawing with the child" item. This type of weighting emphasizes the prioritization of more critical items for child development and well-being, reflecting the normative standard of living within the context studied.

The weights attributed to each item of each dimension of deprivation are summarized in Table C1. To calculate the weighted deprivation scores for each dimension, we apply a simple additive formula where different weights are assigned to each item (see Eq. 1).

Finally, we apply weights to calculate the score of overall deprivation. Here, we use a simple additive formula (see Eq. 2), considering weights for each dimension. The weights used in this paper assign 1/5 of the overall multidimensional deprivation index's total weight to each of the five dimensions. Following the UNICEF position on measuring and monitoring child deprivation (UNICEF, 2020), we argue that each dimension corresponds to a key factor of a child's life and that all of them are equally important for the child's health and development.

4.2.3 Cut-offs

As described above, the identification of deprived children is based on a double-counting approach, which imposes a triple cut-off methodology. Three sets of cut-offs include:

(1) a deprivation cut-off for each item; a child is identified as deprived in each item if his/her score is equal to or above the cut-off. These cut-offs are described in detail in Table 1 and Table C2 shows the proportion of children classified as deprived in each items;
(2) a deprivation cut-off for each dimension, $\hat{z}_d$, which represents the cut off at which a child is considered deprived, in each dimension. In this study, we define this cut-off as a value of 25% for every dimension. Hence, we identify a child as deprived in a particular dimension if this child is deprived in 25% or more of weighted indicators in this dimension. Or, in other words, children whose weighted deprivation scores are equal to or greater than 25% in any particular deprivation dimension are identified as deprived in that dimension. Children whose score does not exceed 25% are identified as non-deprived. Clearly, the results on overall deprivation are sensitive to the choice of these dimension cut-offs. Our choice of 25% is driven by a sensitivity analysis presented in Appendix D, which demonstrates the incidence of deprivation as the deprivation cut-off gradually increases across dimension from 10 to 100%;
(3) an overall deprivation cut-off, which shows the level of overall deprivation score the child should reach to be considered overall (or multidimensionally) deprived. We define the overall cut-off to be equal to 40%. Since there are 5 dimensions and we apply equal weights to all dimensions to compute the overall deprivation score, 40% is equal to two dimensions, i.e. a child who is deprived in at least two dimensions is considered multidimensionally deprived. Appendix E reports the sensitivity analysis of the overall deprivation to different cut-offs and confirms that our choice of Z equal to 2 is optimal.

5 Results

5.1 Dimensions of Multidimensional Deprivation

Table 2 presents the share of children in our sample classified as deprived in each dimension of deprivation, both on average over five waves and at each wave of data, from 2 months to 5.5 years of age. The dimensions for which children are more likely to be classified as deprived are health behaviours and housing deprivation. Around 30% of children experience health behaviours deprivation at every age, with the maximum of 35.7% at age 3.5 years. Table C2 shows that these trends are driven by two factors: sedentary behaviour and poor nutrition. In terms of housing deprivation, around 20% of children are deprived when they are 2 months old, gradually decreasing to 8.1% by 5.5 years of age. The material and extreme living conditions dimensions also show a decrease over time: from 7.6% to 3.7% in the material dimension and from 2.4% to 1.0% in the extreme living conditions dimension. The proportion of children experiencing parenting deprivation remains constant over time at about 4%, except for the first wave (1.1%).

Table 3 presents the depth of deprivation on average over five waves, from birth to age 5 (Table F1 breaks down the results by wave). Panel A shows the proportion of children deprived in one, two, three, fourth or five dimensions, and how it relates to income poverty. In our sample, on average 58.1% of the children are not deprived in any dimension; 33.0% are deprived in one dimension; 7.6% in two dimensions; 1.2% in three dimensions; and less than 0.5% in four or five dimension. The share of income poor children increases with the depth of deprivation. However, even among extremely deprived (deprived in three or more dimensions), there is a large proportion of non-income poor children (around 43%).

Among those who are deprived in at least two dimensions, Panel B describes the most common combinations of deprivation: housing and health behaviours (41.1%), material and health behaviours (13.0%), parenting and health behaviours (10.3%), and material and housing dimensions (8.6%). The share of income poor children significantly varies among these combinations, for example, 52.9% of children who are deprived both in material and housing dimensions are also income poor, while among those who are deprived in parenting and health behaviours dimensions, only 26.5% are income poor.

Table 2 Percentage of children deprived, by dimension and wave, %

Dimension	Average, pooled data	2 months	1 year	2 years	3.5 years	5.5 years
Material deprivation	5.3	7.6	6.6	6.8	2.2	3.7
Housing deprivation	12.5	19.7	15.3	10.8	9.1	8.1
Extreme living conditions	1.8	2.4	2.2	1.9	1.4	1.0
Parenting deprivation	3.5	1.1	3.1	5.1	4.0	4.0
Health behaviours deprivation	29.4	29.4	27.5	19.5	35.7	34.2
N	59,502	13,050	13,586	11,699	10,814	10,353

The average results are based on pooled data from five waves, covering ages 2 months to 5.5 years; the age-specific results are based on data from the corresponding waves. At each wave, a child is classified as deprived in a particular dimension if he/she is deprived in 25% or more of the weighted indicators in this dimension

Table 3 Number of dimensions of deprivation and their combinations, %

	Average, pooled data		
		Income poor	
Panel A		No	Yes
No deprivation	58.2	90.9	9.1
Deprived in 1 dimension	32.9	79.0	21.0
Deprived in 2 dimensions	7.5	58.9	41.1
Deprived in 3 dimensions	1.2	42.4	57.6
Deprived in 4 or 5 dimensions	0.1	-	-
N	59,502		
Panel B			
Housing and Health behaviours deprivations	41.1	61.3	38.7
Material and Health behaviours deprivations	13.0	51.2	48.8
Parenting and Health behaviours deprivation	10.3	73.5	26.5
Material and Housing deprivations	8.6	47.1	52.9
Other combinations of deprivations	27.0	48.0	52.0
N	3,591		

The average results are based on pooled data from five waves, covering ages 2 months to 5.5 years. At each wave, a child is classified as deprived in a particular dimension if he/she is deprived in 25% or more of the weighted indicators in this dimension. A child is income poor if his/her family falling below the poverty line, defined as 60% of the median equalized household monthly income in every wave, calculated based on the parent-reported net monthly resources

Table 4 Multidimensional deprivation index (M_0), incidence of deprivation (H, %) and intensity of deprivation (A, %)

	Average, pooled data	2 months	1 year	2 years	3.5 years	5.5 years
M_0	0.038	0.047	0.050	0.032	0.032	0.031
H	8.9	11.0	11.2	7.6	7.7	7.3
A	42.7	42.8	43.6	43.0	41.4	42.1
N	59,502	13,050	13,586	11,699	10,814	10,353

The average results are based on pooled data from five waves, covering ages 2 months to 5.5 years; the age-specific results are based on data from the corresponding waves. H refers to the incidence of the multidimensional deprivation, i.e. the share of multidimensionally deprived children in the sample. A is a measure of the intensity of multidimensional deprivation among those identified as multidimensionally deprived, i.e. the percentage of deprivations a deprived person suffers from on average. M_0 is the adjusted headcount ratio which reflects both the incidence of deprivation (H) and the intensity of deprivation (A) of deprivations and is calculated as H times A

Table 4 presents the multidimensional deprivation index, M_0, the incidence of multidimensional deprivation, H, and the intensity of multidimensional deprivation, A (the percentage of deprivations a deprived child suffers from on average), for the overall deprivation cut-off Z equal to two dimensions. With this cut-off, we observe that the share of multidimensionally deprived children gradually decreases over waves: 11.0% of children are defined to be multidimensionally deprived at age of 2 months, 11.2% at age of 1 year, 7.6% at age of 2 years, 7.7% at age of 3.5 years and 7.3% at age of 5.5 years. However, this is likely due to more deprived children leaving the sample over time: when we calculate the share of deprived children among those who remained in the study for five waves, the proportion of deprived children is stable over time, at about 5–6%. The multidimensional deprivation index also decreases over time, due to the decrease in the incidence of deprivation. The intensity or depth of deprivation among deprived children remains relatively stable. The average intensity of deprivation is 42.7%, corresponding to 2.1 dimensions in our case.

Table 5 Share of multidimensionally deprived and income poor children, %

	Average, pooled data	2 months	1 year	2 years	3.5 years	5.5 years
Multidimensional deprivation	9.0	11.0	11.4	7.6	7.7	7.3
Income poor	15.9	16.5	18.0	16.1	14.9	14.3
% of income poor among deprived	43.3	46.8	49.9	43.3	40.9	32.8
% of deprived among income poor	23.0	30.4	26.5	19.3	21.2	16.8
Deprived and income poor	3.7	5.0	4.8	3.1	3.2	2.4

The average results are based on pooled data from five waves, covering ages 2 months to 5.5 years; the age-specific results are based on data from the corresponding waves. At each wave, a child is multidimensionally deprived if he/she is deprived in at least two dimensions. A child is income poor if his/her family falling below the poverty line, defined as 60% of the median equalized household monthly income in every wave, calculated based on the parent-reported net monthly resources

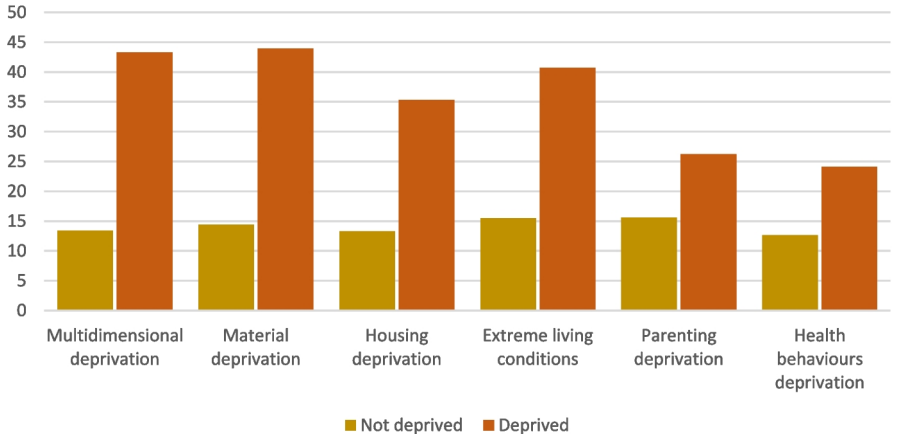

Fig. 1 Share of income poor children among deprived and not deprived children, by multidimensional deprivation status and by deprivation status in each dimension. Notes: The results are based on pooled data from five waves, covering ages 2 months to 5.5 years. At each wave, a child is classified as deprived in a particular dimension if he/she is deprived in 25% or more of the weighted indicators in this dimension and classified as multidimensionally deprived if he/she is deprived in at least two dimensions. A child is income poor if his/her family falling below the poverty line, defined as 60% of the median equalized household monthly income in every wave, calculated based on the parent-reported net monthly resources

Table 5 illustrates that multidimensional deprivation and income poverty capture different groups of children. On average over five waves, we observe that 16% of children in the analytical sample are identified as income poor. About 43% of multidimensionally deprived children are also income poor, while among income poor children, 23% are also classified as deprived. Approximately 4% of children experience both multidimensional deprivation and income poverty.

Figure 1 shows the proportion of income poor children according to deprivation status, both multidimensional deprivation and in each dimension separately. The share of income poor children among non-deprived children is significantly smaller than among multidimensionally deprived children, with a gap of 29.9 percentage

points between the two groups. This gap is largest for material deprivation (29.5 pp) and smallest for parenting deprivation (10.6 pp). The share of income poor children is similar across the dimensions of deprivation among non-deprived children, with an average of about 14%. Among deprived children, the share of income poor children varies by the dimension of deprivation: the highest share of income poor children is observed among materially deprived children (43.9%) and the lowest share is among children deprived in the health behaviours dimension (24.1%).

5.2 Who is Deprived?

Table 6 presents individual and family characteristics of the children who are classified as deprived, both multidimensionally and in each dimension separately. It also shows the differences between income poor and non-poor children. The table displays the average results based on data pooled from five waves. Table F2 presents results for each wave separately.

The results show that there are more boys than girls classified as deprived. This difference is particularly noticeable in the dimensions of extreme living conditions and parenting deprivation. Deprived children are also more likely to have two or more siblings than non-deprived children. However, this gap varies across dimensions: we observe the largest gap in the parenting dimension (a gap of 15.2 pp), and the smallest in the extreme living conditions dimension (3.5 pp).

In terms of mother's characteristics, multidimensionally deprived children are 1.7 times more likely to have a mother with a low level of education (76.4%) compared to the children who are not classified as deprived (44.1%), with differences across dimensions of deprivation, for example, there are significantly less children with a low educated mother among children deprived in the parenting dimension (59.0%). Multidimensionally deprived children are three times more likely to have a mother with a migrant background compared to non-deprived children (27.2% vs 11.9%), except for the health behaviours dimension, where the shares of children with a mother with a migrant background are relatively comparable among deprived and non-deprived children (16.9% vs 11.8%). Multidimensionally deprived children are twice as likely to have a non-working mother compared to non-deprived children (53.9% vs 25.7%). This gap decreases over time as mothers re-enter the labour market: by age 5.5 years, 36.4% of deprived and 20.5% of non-deprived children have a non-working mother (Table F2). In the parenting and health behaviours dimensions, there is a lower risk of having a non-working mother among deprived children (35.6% among deprived vs 28% among non-deprived children in this dimension). Deprived children are also three times more likely to live with a single mother compared to children who are not deprived (18.6% vs 6.1%), with the exception of the health behaviours dimension, where proportions are almost the same among deprived and non-deprived children (9.4% vs. 6.4%).

The structure of the data does not fully allow investigating the father's characteristics and Panel B shows father's characteristics only for households with two biological parents. We observe similar differences as for mothers: multidimensionally deprived children are 1.5–2.5 times more likely to have a father who is low edu-

cated, with a migrant background and a and not in work, compared to non-deprived children.

Notable differences emerge between income-poor and multidimensionally deprived children. Among income poor children, a higher percentage has a non-working mother (65.4%) or father (29.5%) compared to deprived children (53.9% and 19.2%, respectively). Additionally, income-poor children are more likely to have two or more siblings compared to multidimensionally deprived children (42.5% versus 34.5%).

To identify the impact of belonging to a particular subgroup on the incidence of multidimensional deprivation and its dimensions, we estimate a set of logit regressions, controlling for child and household characteristics. The odds ratio for each characteristic, i.e. the correlation between each characteristic and the probability to be classified as deprived, are presented in Table 7, columns 1–6, based on pooled data. We compare these results with the results between each characteristic and the prevalence of income poverty, presented in column 7. Additionally, column 8 presents the results of regression analysis for the depth of deprivation, i.e. the number of dimensions in which a child is classified as deprived at a given time. Table F3 presents marginal effects of the results presented in Table 7.

For multidimensional deprivation, the mother's level of education, the mother's migrant background, and the father's employment status show the strongest associations: children with these characteristics are, on average, about 5% more likely to be deprived compared to children of highly educated mothers, mothers without a migrant background, and with a working father. Comparing these results to income poverty, maternal and paternal employment as well as having two or more siblings are the key factors for being classified as poor. The magnitude of these associations is considerably larger for income poverty than for multidimensional deprivation. For example, a mother's non-working status is associated with a 17.0% increase in the probability of income poverty, compared to a 3.6% increase in the probability of multidimensional deprivation, relative to children of employed mothers.

There are notable differences between the dimensions of deprivation. For example, mother's education is associated with all dimensions of deprivation but least so for the parenting dimension and most with the health behaviours deprivation: children of low educated mothers are about 1% more likely to be deprived in the parenting dimension and 16% more likely to be deprived in the health behaviours dimension than children of highly educated mothers. The positive association between the mother's non-working status and the child's deprivation status is most pronounced in the housing dimension and close to zero in the parenting dimension. Number of siblings is particularly important for being classified as deprived in housing and parenting dimensions: the chance of being deprived in these dimensions grow with the number of siblings. However, the growing number of siblings decreases the risk of extreme living conditions and health behaviours deprivations.

Finally, in terms of the depth of deprivation, we observe similar patterns to those described above. We notice particularly marked associations with maternal education (less education is linked to deeper deprivation), migrant background (households with a migrant background are more likely to experience deeper deprivation), and

Table 6 Characteristics of children by deprivation status (pooled data), %

	Multidimensional deprivation		Material deprivation		Housing deprivation		Extreme living conditions		Parenting deprivation		Health behaviours deprivation		Income poor	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Panel A														
Child's characteristics														
Male	50.6	53.2	50.8	52.3	50.7	51.6	50.7	58.7	50.7	54.3	50.2	52.4	50.7	50.9
Female	49.4	46.8	49.2	47.7	49.3	48.4	49.3	41.3	49.3	45.7	49.8	47.6	49.3	49.1
Mother's characteristics														
Education														
Low	44.1	76.4	45.4	74.2	44.4	65.0	46.6	68.0	46.5	59.0	38.9	63.4	39.2	82.0
Intermediate	20.6	10.7	20.1	12.9	20.6	13.2	19.8	13.8	19.8	16.5	21.0	16.6	22.2	9.0
High	35.3	12.9	34.5	12.9	35.0	21.8	33.6	18.2	33.7	24.5	40.1	20.0	38.6	9.0
Migrant background														
Yes	11.9	27.2	12.6	25.3	11.5	25.6	13.0	26.9	13.0	22.8	11.8	16.9	10.3	25.7
No	85.3	64.8	84.3	67.9	85.7	67.8	83.7	65.8	83.8	72.2	85.4	78.7	88.5	70.5
Missing	2.8	8.0	3.1	6.8	2.8	6.6	3.2	7.3	3.2	5.0	2.8	4.4	1.2	3.8
Employment status														
Not working	25.7	53.9	26.9	52.0	25.4	48.1	27.9	49.3	28.0	35.6	24.5	37.3	19.6	65.4
Working	74.0	45.5	72.8	47.6	74.3	51.4	71.8	50.7	71.7	63.8	75.2	62.3	80.2	34.1
Missing	0.3	0.5	0.3	0.4	0.3	0.5	0.3	0.0	0.3	0.6	0.3	0.4	0.2	0.5
Marital status														
Single	6.1	18.6	6.4	22.9	6.1	15.3	7.0	20.6	7.1	12.8	6.4	9.4	3.8	24.6
Married/cohabiting	91.4	78.3	91.0	75.2	91.3	82.4	90.4	78.1	90.5	81.8	91.5	87.1	93.6	72.7
Missing	2.5	3.1	2.6	1.9	2.6	2.3	2.6	1.3	2.4	5.4	2.1	3.5	2.6	2.6
Father's characteristics														
Education														
Low	47.0	58.2	47.6	53.1	47.2	52.8	47.9	50.9	47.7	53.0	43.9	57.6	46.1	56.0
Intermediate	16.2	7.8	15.9	8.3	16.1	10.9	15.6	9.3	15.7	10.7	16.6	12.8	17.6	6.5
High	28.3	12.5	27.8	11.1	28.1	18.4	27.1	18.2	27.1	21.6	30.8	17.5	30.4	8.4

Table 6 (continued)

	Multidimensional deprivation		Material deprivation		Housing deprivation		Extreme living conditions		Parenting deprivation		Health behaviours deprivation		Income poor	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Missing	0.2	0.0	0.2	0.1	0.3	0.0	0.2	0.0	0.2	0.0	0.2	0.2	0.2	0.0
Father not resident	8.3	21.5	8.5	27.4	8.3	17.9	9.0	21.6	9.3	14.8	8.5	11.9	5.7	29.1
Migrant background														
Yes	3.7	8.8	3.9	7.5	3.6	7.7	4.1	7.4	4.0	7.1	3.3	6.1	3.0	10.0
No	81.0	63.8	80.3	65.2	81.3	66.3	79.7	67.8	79.7	72.6	81.6	74.3	84.9	60.7
Missing	11.8	15.1	12.1	12.3	11.6	15.8	12.1	12.2	12.1	13.5	11.3	14.0	10.0	14.7
Father not resident	3.5	12.3	3.7	15.0	3.5	10.2	4.1	12.7	4.2	6.9	3.8	5.6	2.1	14.7
Employment status														
Not working	6.9	15.4	7.3	15.1	6.7	14.1	7.6	9.6	7.5	11.2	6.8	9.8	5.0	20.1
Working	83.2	60.7	82.6	55.3	83.3	66.4	81.5	65.2	81.6	70.7	83.3	76.1	88.1	46.4
Missing	2.3	4.7	2.5	3.3	2.4	3.8	2.5	4.6	2.4	5.4	2.0	3.9	1.6	7.9
Father not resident	7.6	19.2	7.6	26.3	7.6	15.7	8.4	20.7	8.5	12.8	7.9	10.2	5.3	25.6
N of siblings														
0	31.5	30.1	31.1	37.1	31.5	30.9	31.2	42.6	31.9	19.6	31.7	30.9	32.4	25.5
1	43.9	35.4	43.8	32.4	43.9	37.5	43.3	35.4	43.2	40.2	44.2	40.5	45.6	31.9
2	18.0	21.2	18.2	19.3	18.1	19.4	18.3	13.9	17.9	27.1	17.8	19.3	17.1	24.4
3 or more	6.6	13.3	7.0	11.2	6.5	12.2	7.2	8.1	7.0	13.0	6.3	9.4	4.9	18.1
N	55,911	3,591	57,218	2,284	53,693	5,809	58,683	819	57,757	1,745	44,914	14,588	51,447	5,400
Panel B														
Father's characteristics (only for two-parent households)														
Education														
Low	50.8	73.8	51.7	73.1	51.1	64.0	52.4	64.2	52.3	61.2	47.7	64.9	48.6	78.4
Intermediate	17.7	9.9	17.4	11.5	17.6	13.3	17.2	12.1	17.3	12.6	18.2	14.4	18.6	9.2
High	31.1	16.1	30.6	15.3	30.8	22.7	30.0	23.7	30.1	25.7	33.9	20.1	32.4	11.8
Missing	0.4	0.2	0.3	0.1	0.5	0.0	0.4	0.0	0.3	0.5	0.2	0.6	0.4	0.6
Migrant background														

Table 6 (continued)

	Multidimensional deprivation		Material deprivation		Housing deprivation		Extreme living conditions		Parenting deprivation		Health behaviours deprivation		Income poor	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Yes	3.7	10.5	3.9	9.5	3.6	8.6	4.1	7.5	4.0	8.0	3.3	6.3	3.0	12.7
No	84.2	73.0	83.7	75.0	84.5	74.5	83.4	79.4	83.5	78.6	84.9	79.5	86.9	71.1
Missing	12.1	16.5	12.3	15.5	11.9	16.9	12.5	13.1	12.4	13.4	11.8	14.3	10.1	16.3
Employment status														
Not working	7.6	19.9	8.0	21.1	7.5	17.3	8.5	12.7	8.4	13.2	7.5	11.3	5.4	29.5
Working	91.7	78.9	91.3	77.5	91.8	82.2	90.8	86.4	90.9	84.9	92.0	87.7	94.1	68.3
Missing	0.7	1.2	0.7	1.4	0.7	0.5	0.7	0.9	0.7	1.9	0.6	1.0	0.5	2.2
N	52,569	2,294	53,758	1,775	50,503	5,030	54,833	700	53,995	1,538	42,172	13,361	49,113	3,974

The results are based on pooled data from five waves, covering ages 2 months to 5.5 years. At each wave, a child is classified as deprived in a particular dimension if he/she is deprived in 25% or more of the weighted indicators in this dimension and classified as multidimensionally deprived if he/she is deprived in at least two dimensions. A child is income poor if his/her family falling below the poverty line, defined as 60% of the median equalized household monthly income in every wave, calculated based on the parent-reported net monthly resources

Table 7 Odds ratios of multidimensional deprivation (pooled data)

	Multidimensional deprivation	Material deprivation	Housing deprivation	Extreme living conditions	Parenting deprivation	Health behaviours deprivation	Income poor	Depth of deprivation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Child's characteristics								
Male	1.111***	1.069**	1.024	1.398***	1.156***	1.099***	1.039	0.035***
	(0.037)	(0.036)	(0.033)	(0.101)	(0.050)	(0.019)	(0.032)	(0.006)
Child's age in months	0.979***	0.983***	0.960***	0.994	1.032***	0.998	0.999	-0.005***
	(0.005)	(0.006)	(0.004)	(0.007)	(0.006)	(0.003)	(0.005)	(0.001)
Mother's characteristics								
Mother's education: ref=high								
Intermediate	1.355***	1.522***	1.027	1.312***	1.163***	1.462***	1.513***	0.081***
	(0.072)	(0.085)	(0.052)	(0.134)	(0.059)	(0.031)	(0.103)	(0.006)
Low	2.639***	2.358***	1.509***	1.966***	1.328***	2.321***	3.614***	0.251***
	(0.121)	(0.108)	(0.060)	(0.266)	(0.064)	(0.050)	(0.203)	(0.007)
Missing	-	-	-	-	-	-	-	-
Mother has migrant background: ref=no								
Yes	2.000***	1.951***	1.875***	1.940***	1.587***	1.300***	2.251***	0.210***
	(0.075)	(0.081)	(0.073)	(0.169)	(0.087)	(0.035)	(0.098)	(0.010)
Missing	2.213***	1.897***	1.779***	2.063***	1.291**	1.313***	2.568***	0.210**
	(0.165)	(0.167)	(0.127)	(0.439)	(0.137)	(0.075)	(0.251)	(0.025)
Mother works: ref=yes								
No	1.897***	1.607***	1.726***	1.705***	1.070*	1.381***	4.710***	0.170***
	(0.060)	(0.056)	(0.052)	(0.114)	(0.040)	(0.027)	(0.134)	(0.007)
Missing	1.778***	1.059	2.481***	1	1.045	1.208	2.690***	0.111**
	(0.373)	(0.320)	(0.567)	(.)	(0.338)	(0.187)	(0.547)	(0.053)
Mother's marital status: ref=married, in a civil union, or cohabiting								
Single	1.468***	1.337***	1.433***	1.551***	1.259**	1.108**	1.785***	0.159***
	(0.101)	(0.109)	(0.112)	(0.251)	(0.118)	(0.056)	(0.101)	(0.018)

Table 7 (continued)

	Multidimensional deprivation	Material deprivation	Housing deprivation	Extreme living conditions	Parenting deprivation	Health behaviours deprivation	Income poor	Depth of deprivation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Missing	1.173**	0.943	0.959	0.617***	2.133***	1.299***	0.792**	0.077
	(0.083)	(0.096)	(0.105)	(0.105)	(0.190)	(0.070)	(0.083)	(0.015)
Father's characteristics								
Father's education: ref=high								
Intermediate	1.052	1.180***	1.135*	0.878	0.884*	1.178***	1.251***	0.035***
	(0.080)	(0.072)	(0.075)	(0.158)	(0.065)	(0.027)	(0.089)	(0.008)
Low	1.659***	1.662***	1.320***	1.108	1.188***	1.535***	2.089***	0.122***
	(0.083)	(0.084)	(0.057)	(0.148)	(0.058)	(0.035)	(0.110)	(0.007)
Father non-resident	1.970***	1.192	2.156***	0.321***	1.021	2.063***	2.491***	0.239***
	(0.315)	(0.209)	(0.322)	(0.097)	(0.190)	(0.205)	(0.313)	(0.038)
Missing	0.180***	0.742	1	1	1	1.284	0.315***	-0.150***
	(0.085)	(0.238)	(.)	(.)	(.)	(0.261)	(0.120)	(0.046)
Father has migrant background: ref=no								
Yes	1.295***	1.078	1.257***	1.071	1.103	1.381***	1.758***	0.120***
	(0.077)	(0.074)	(0.084)	(0.107)	(0.098)	(0.050)	(0.128)	(0.015)
Father non-resident	1.256***	0.779***	1.260***	0.802*	1.171	1.312***	1.169**	0.131***
	(0.106)	(0.061)	(0.101)	(0.103)	(0.128)	(0.074)	(0.085)	(0.023)
Missing	0.951	0.877**	1.198***	0.869	0.893*	1.050	1.164***	0.008
	(0.045)	(0.052)	(0.062)	(0.110)	(0.055)	(0.032)	(0.063)	(0.009)
Father works: ref=yes								
No	1.867***	1.962***	1.799***	0.997	1.489***	1.185***	5.863***	0.177***
	(0.083)	(0.108)	(0.070)	(0.090)	(0.105)	(0.040)	(0.262)	(0.013)
Father non-resident	1.086	3.898***	0.779	5.875***	1.269	0.520***	3.585***	-0.098**
	(0.197)	(0.761)	(0.148)	(1.747)	(0.253)	(0.063)	(0.485)	(0.044)
Missing	1.473***	2.058***	1.276*	2.403***	2.021***	1.003	5.278***	0.089***

Table 7 (continued)

	Multidimensional deprivation	Material deprivation	Housing deprivation	Extreme living conditions	Parenting deprivation	Health behaviours deprivation	Income poor	Depth of deprivation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(0.181)	(0.285)	(0.164)	(0.468)	(0.259)	(0.074)	(0.429)	(0.025)
Household characteristics								
N of siblings: ref=no siblings								
One	1.075*	0.858***	1.177***	0.778***	1.584***	0.873***	1.342***	-0.002
	(0.041)	(0.036)	(0.040)	(0.062)	(0.072)	(0.017)	(0.048)	(0.006)
Two	1.170***	0.962	1.230***	0.564***	2.292***	0.856***	2.124***	0.015*
	(0.051)	(0.045)	(0.054)	(0.060)	(0.141)	(0.023)	(0.104)	(0.009)
Three or more	1.399***	1.037	1.667***	0.628**	2.467***	0.945*	3.972***	0.090***
	(0.076)	(0.059)	(0.092)	(0.117)	(0.178)	(0.032)	(0.242)	(0.014)
Controls:								
Region	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interview year and season of birth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	59,258	59,292	59,163	59,046	59,185	59,299	56,648	59,302

The results are based on pooled data from five waves, covering ages 2 months to 5.5 years. Columns (1)-(7) present the odds ratios from separate logit regressions and column (8) presents the coefficients from a linear regression. At each wave, a child is classified as deprived in a particular dimension if he/she is deprived in 25% or more of the weighted indicators in this dimension and classified as multidimensionally deprived if he/she is deprived in at least two dimensions. A child is income poor if his/her family falling below the poverty line, defined as 60% of the median equalized household monthly income in every wave. Equalized household income is calculated based on the parent-reported net monthly resources. Depth of deprivation is the number of dimensions in which a child is classified as deprived at a given time. Robust standard errors in parenthesis. *$p<0.10$, **$p<0.05$, ***$p<0.01$

parents' employment status (when either parents do not work, children experience deeper deprivation).

6 Discussion

Income has long been used both in the academic literature and in policy to identify children vulnerable to poverty and deprivation; however, it is increasingly questioned whether it is a reliable guide to the resources available to children (Fusco et al., 2010). While multidimensional deprivation measures have been put forward to palliate some of these issues, conceptualizing and constructing nuanced, dynamic, child-centered indicators based on micro-level panel data from early childhood is still a notable gap in this literature. In this paper, we propose and carefully detail a conceptual and methodological framework to construct longitudinal indicators of early childhood multidimensional deprivation, based on secondary data analyses of the panel micro-level data from the French birth cohort, *Elfe*. We argue that such a framework can help move forward the literature on early childhood poverty and deprivation, by allowing a better understanding of its underlying mechanisms, its consequences, and the population touched by different forms of deprivation. This is crucial for a better understanding of this field, at a key stage of child development.

Our indicators distinguish between five dimensions of deprivation (material, housing, extreme living conditions, parenting and health behaviours) that are crucial for child development and well-being, as well as provide an overall multidimensional deprivation index, and characterise the intensity of the deprivation experienced. Our lifecourse approach suggests that, especially in the early childhood period, the individual items that make up each dimension of deprivation need to adapt over time to stay relevant to children's needs and reflect their lived experience of deprivation; we therefore allow items to vary over time. However, we also recognise the need for dynamic analyses that compare deprivation across time and allow studying its persistence, accumulation and change. Our framework therefore also allows for dimensions to stay constant; this permits the use of panel analyses and observe the accumulation and change in deprivation over time. The key elements of our childhood deprivation framework therefore are multidimensionality (several distinct dimensions of deprivation make up the overall index); a child-centered approach (items need to be relevant to the child's lived experience, given their age and context); a dynamic framework (dimensions need to be comparable over time); and applicable to micro-level secondary data analyses.

Our substantive results for a nationally-representative birth cohort of children born in France in 2011 show that around 8% of this cohort is multidimensionally deprived over their first 5 years of life. We show that income poverty does not always overlap with deprivation: in our sample, among deprived children, only around 40% are also income poor, and less than 5% of the sample are both multidimensionally deprived and income poor. This confirms that early childhood deprivation has a complex structure that must be considered when researching early childhood poverty and deprivation.

The partial overlap between income-based poverty and multidimensional deprivation may occur for several reasons. First, households may not necessarily target income to acquire goods and services for their children. For example, some services might be provided for free through national or local programs. Second, multidimensional deprivation measures encompass non-monetized domains, such as parental time. Third, even if income translates into lower deprivation through the purchase of specific goods and services, access to these resources can be hindered by contextual constraints. For instance, income cannot buy access to services if those services are simply not available locally (children in rural areas may have less access to certain amenities, such as after school activities, because of a lack of accessible amenities rather than inability to purchase them).

Our results highlight several population groups that experience higher risks of deprivation, and that the types of deprivation experienced vary across groups, suggesting different needs and therefore different policy interventions. Multidimensional deprivation is most strongly linked to maternal education, maternal migrant status, and parental employment. For comparison, the risk of being income-poor is highly correlated with the employment status of parents and with the number of children living in the household. The characteristics of children at risk of being deprived vary across dimensions of deprivation considered. For example, parenting deprivation is a concern for larger families. As our parenting deprivation dimension relates to amount of time parents are able to spend with their children, this result is expected. Both evolutionary theories of parental investment and economic models of resource dilution suggest larger families may be less able to assign resources, including parental time, to each child; these theories have been empirically confirmed for school-aged children (Lawson & Mace, 2009; Sheppard & Monden, 2020).

Another interesting case is health behaviours deprivation. Its strongest predictor is low levels of parental education (over and above other characteristics such as migrant status, family size, unemployment etc.), which calls into question the role of information and access to knowledge on guidelines for screen time, sleep, and balanced nutrition. At the same time, as low education is also a strong predictor of income poverty, it may indicate a lack of financial resources for good quality nutrition of children, although income also correlates with other socio-economic characteristics included in our model. The literature on the correlation between education and health behaviours is vast, identifying many potential mechanisms underscoring this relationship, such as income and other resources such as insurance, knowledge and cognitive ability, and social networks (Cutler & Lleras-Muney, 2010). However, there is still no strong support for the importance of one mechanism over another (Pampel et al., 2010). This is likely because these relationships might vary across national contexts (Cutler & Lleras-Muney, 2012), but also potentially across child age. Our results, focused on the early childhood stage, do suggest a strong channel through knowledge and cognitive ability, and perhaps social networks, for health behaviour deprivation in early childhood.

These substantive results therefore call for several practical, policy considerations. First, income-based measures (whether absolute or relative) of poverty often used to identify households for policy interventions clearly miss a large proportion of children experiencing deprivation. A reflection on how to identify these children,

depending on the policy goals, seems crucial to reach all groups requiring support. Second, our results show that different groups might be deprived in different domains, and therefore their needs are not homogenous. Our results therefore do not support one-size-fits-all policy approaches but call for nuanced interventions that consider groups' varying needs to better support deprived children and their families. Third, multidimensional deprivation is a concept that matters from the early years, and should not be limited to school-aged children.

The paper takes care to detail the methodological choices involved in the construction of the indicators to allow other researchers to apply this framework. The multidimensional deprivation methodology is based on a set of choices such as the selection of items, dimensions, item and dimension weights, and deprivation cut-offs. Our choices are guided by the relevant literature, data availability and structure, and an element of researcher choice. Such choices are context dependent: for example, different dimensions of deprivation might emerge in different contexts; different items might matter in different settings. Furthermore, for our sample, the ideal cut-off for classifying a child as overall deprived is being deprived in at least two dimensions; again, this might differ in different contexts. The children's ages will also guide these choices, as different items will be relevant at different ages, and we show our framework allows this child-centered approach while staying comparable over time.

While our study has many strong points, results should be considered in the light of several limitations. First, all the items used in these analyses rely on parental report. Second, while we believe this approach is ripe for academic research and policy, we recognise it might be more difficult to apply for policy targeting, i.e. to identify vulnerable children who should receive a given intervention, as it requires to collect and process a significant amount of information on children's living conditions and their environment, rather than just household income. Third, like many studies, selection into the *Elfe* sample is not random, and more disadvantaged children are less likely to be included. While survey weights applied in our analyses partly address this concern, it is likely that we underestimate the true prevalence of deprivation in this population, particularly among groups that surveys struggle to reach, such as newly arrived immigrants. Finally, our aim was to propose a flexible method that allows applying longitudinal, multidimensional concepts to the secondary analyses of existing survey data. Therefore, our indicators and many of the methodological choices made are to some extent driven by data availability, as well as by country-specific norms of what is considered as an important need for children. Thus, our measures are not easily comparable to those based on other datasets or other countries.

Concluding, the study of childhood poverty and deprivation requires a nuanced measurement of children's lived experience of poverty and should consider multiple domains of deprivation. We propose a childhood deprivation framework that is multidimensional, dynamic, and child-centered, and carefully describe its methodological application to a nationally representative panel of early childhood in France in order to show its relevance and value-added compared to classic income poverty measures, and to encourage further work and policy reflection in this direction.

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Author's Contribution Yuliya Kazakova: Conceptualization, Methodology, Data curation, Formal analysis and investigation Writing– original draft, Writing– review and editing.
Lidia Panico: Funding acquisition, Project administration, Conceptualization, Methodology, Data curation, Formal analysis and investigation Writing– original draft, Writing– review and editing.
Marion Leturcq: Funding acquisition, Conceptualization, Methodology, Writing– review and editing.

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Data Availability The data necessary to reproduce the analyses presented here are not publicly accessible for reasons of privacy for the participants. Established researchers who would like access to the data from the Elfe cohort study can request them to the Committee of Access to the Data from the Elfe cohort on the website of the survey: www.elfe-france.fr.

Declarations

Ethical Approval Not applicable.

Informed Consent Not applicable.

Competing Interests The authors declare no competing interests directly or indirectly related to this work.

Research Involving Human Participants and/or Animals Not applicable.

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