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Prevalence and factors associated with multidimensional child deprivation: Findings from the Future of Families and Child Well-Being Study

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Abstract

Despite the growing importance of the multidimensional methods of assessing child poverty, few studies in the U.S. have applied a rights-based approach to examining child deprivation. This study examines multidimensional child deprivation using eight dimensions and twelve indicators based on the Convention on the Rights of the Child (CRC). Using a sample of children at age nine from the fifth wave of the Future of Families and Child Well-being Study, this study applied the multiple overlapping deprivation analysis (MODA), a comprehensive analytic method to assess the multidimensionality of child deprivation and to provide a detailed picture of material and social forms of deprivation among the U.S. children. This study found that the overall child deprivation rate was 8.89%; environmental safety (20.36%), information (15.94%), and housing security (14.23%) dimensions contributed the highest to the overall child deprivation; the overlap between deprivation and income poverty was 12.83%. Results suggest that understanding multifaceted and interrelated contexts of child deprivation is crucial to promote child rights.

Keywords

Multidimensional child deprivation; Income poverty; MODA; Child rights

1. Introduction

Despite extensive research on child poverty in the U.S. (Huston, 2011; Sachs, 2016; Smeeding & Thévenot, 2016), most of this research uses the traditional income-based household-level measures of child poverty, thus not capturing complexity of the problem of child deprivation (Ciula & Skinner, 2015; Mitra & Brucker, 2017; Roelen & Gassmann, 2008; White, 2020). Income does not fully capture the experience of multidimensional deprivations by the same individuals (Mitra & Brucker, 2017). Although there are some measures of social and economic deprivation for the research purpose (Glassman, 2019),

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

the U.S. official measure of child poverty called the Official Poverty Measure (OPM) of income poverty (National Academies of Sciences, Engineering, and Medicine, 2019, pp. 33–35) typically considers income, meaning that a child's poverty status is decided by comparing a child's family income with pre-defined poverty threshold adjusted for the age of household head and family size. Thus, the OPM as a current estimate of child poverty masks multidimensional forms of deprivation that disproportionately affect low-income children. Meanwhile, using income-based child poverty measures to assess individual needs of children is based on the contested assumption that the household income sufficiently reflects the needs of all family members and that there is a fair distribution of resources within that family (Chzhen et al., 2016; White et al., 2003), overlooking children's needs that are different from adults' needs (de Neubourg et al., 2012).

To overcome the limitations of the household income-based measure of child poverty, an emerging body of scholarship on child poverty advocates adopting a multidimensional perspective on child deprivation (Ciula & Skinner, 2015; de Neubourg et al., 2012; de Neubourg et al., 2014; White, 2020). Multidimensional child deprivation is defined as a lack of access to various goods and services that are essential for children's basic material security and developmental progress (de Neubourg et al., 2012). Unlike current unidimensional concept of child poverty (Blank, 2008; Glassman, 2019; Huston, 2011; Mitra & Brucker, 2017), the multidimensional concept enables researchers to assess the needs and experiences of children who are deprived in various dimensions of quality of life. However, there is no consistent standard for the multidimensional child deprivation research in the U.S., although there are several previous studies on this topic (Ciula & Skinner, 2015; Dhongde & Haveman, 2019; Mitra & Brucker, 2019; White & Yamasaki, 2017).

In addition, few studies in the U.S. have applied a child's rights-based approach into the analysis of child deprivation. Studies of multidimensional child deprivation have typically used indicators based on the concept of child well-being (Ciula & Skinner, 2015; Moore et al., 2008), material hardship (Gershoff et al., 2007; Zilanawala & Pilkauskas, 2012), extreme poverty (Edin & Shaefer, 2016), or chronic poverty (Asiamah, 2021). A child's rights-based approach, as discussed later, is arguably the best way to capture a holistic picture of child well-being, as it provides a theoretical framework from which to understand the multiple domains of children's well-being and the interconnection across domains. The Convention on the Rights of the Child (CRC) has not been ratified or not officially approved by the state authority (i.e., the President's and the Senate's formal consent) in the U.S. (Blanchfield, 2015), meaning the child's rights-based approach has not been adopted within the U.S. context. Nevertheless, the child's rights-based approach may help develop effective social policy and social welfare interventions by providing detailed information about child deprivation.

The present study uses the Multiple Overlapping Deprivation Analysis (MODA) as an overarching framework to offer an important motivation and structure for the analysis in that it incorporates the multidimensional and rights-based contexts of child well-being by its reconceptualization of child deprivation as a violation of child rights (de Neubourg et al., 2012). The MODA, developed by the United Nations Children's Fund (UNICEF), is a tool to examine multi-faceted and interrelated experiences of child deprivation and provide

profiles of deprived children to policymakers, thereby promoting child rights (de Neubourg et al., 2012). The motivation of this study for using the MODA is that although studies of child deprivation in the U.S. have typically used the multidimensional approach as a standard, but those have not explicitly linked it with child rights. Although the analytic steps suggested by the MODA toolkit consist of 22 main and 3 optional steps (de Neubourg et al., 2012), the present study uses a modified version of the MODA methodology without loss of generality, which can impact the selection of measures, give a basic structure to the analysis, and guide analytic decisions. In this context, the findings from this study may provide insights on developing a U.S.-version of the MODA methodology for cross-country comparison. Thus, the goal of this study is to examine multidimensional child deprivation using the modified MODA methodology based on a right-based approach.

2. Background

2.1. Multidimensional child deprivation literature in the U.S.

Scholarship on child deprivation suggests that a multidimensional approach is imperative to identify and assess a variety of children's needs in most developed countries including the U.S. (Ben-Arieh, 2008; Ben-Arieh et al., 2014; Bradshaw et al., 2007). The multidimensional approach based on multiple forms of child deprivation is more advantageous compared with other existing approaches based on the concept of child well-being or material hardship in the following three aspects: conceptual comprehensiveness, nuanced interpretation of the evidence, relevance for policy intervention (OECD, 2021; White, 2020). First, the multidimensional approach argues that the concept of child well-being cannot be reducible to one or two dimensions, thereby emphasizing the conceptual complexity of child deprivation and its interconnectedness with surrounding environment at multiple levels (e.g., family, school, neighborhood, community, etc.). Second, the multidimensional approach yields a detailed picture of child deprivation (e.g., prevalence and overlap of different aspects of deprivation), offering a more nuanced and accurate depiction of the deprived children. Third, multiple forms of deprivation are more closely tied with risk and protective factors, which is of particular interest to child welfare policy; thus, deprivation measured by the multidimensional approach can be more useful for policymakers to evaluate and monitor the deprivation-reducing effect of policies on children instead of that measured by other existing approaches that tend to consider immediate data availability.

Although empirical research on the multidimensionality of child deprivation in the U.S. is still in its early stages, four studies on multidimensional child deprivation, two national child well-being projects (i.e., Child and Adolescent Health Measurement Initiative [CAHMI] [2021]; Federal Interagency Forum on Child and Family Statistics [FIFCFS] [2021]) and two academic studies (i.e., Ciula & Skinner, [2015]; Moore et al., [2008]) are noteworthy. Although there are several other multidimensional studies of deprivation in the U.S. (See Tab. 2.1 in White, 2020, pp. 35–37), the above two academic studies are selected because those studies used individual-level data from a nationally representative sample of children to measure multidimensional child deprivation in the U.S.

First, the FIFCFS has yielded a comprehensive report titled America's Children, which presents key findings on multiple dimensions of child well-being in the U.S. since 1997 (FIFCFS, 2021). Based on seven domains, the FIFCFS provides policymakers with a point of improvement for healthy child development through annual descriptive report (FIFCFS, 2021). Using estimated results from 21 surveys including the Decennial Census data, the FIFCFS provides nationally representative estimates of child deprivation (FIFCFS, 2021).

Second, the U.S. Census Bureau has conducted the National Survey of Children's Health (NSCH) sponsored by the DHHS's Maternal and Child Health Bureau (MCHB) since 2003. The NSCH is a nationally representative sample that includes information on child deprivation (CAHMI, 2021). The NSCH, collected quadrennially from 2003 to 2012 and annually since 2016, provides national and state-level estimates of various child and family health indicators (CAHMI, 2021).

Third, Moore et al.'s seminal 2008 study on measuring multidimensional child well-being in the U.S. (Ciula & Skinner, 2015). Based on the NSCH, Moore et al. used sixty-nine indicators across four individual (i.e., physical, psychosocial, social health, and educational/intellectual attainment) and three contextual domains (i.e., family, community, and sociodemographic). Moore et al. contributed to the literature of child well-being index by considering both individual and contextual domains of child well-being. Lastly, Ciula and Skinner's 2015 study, extending Moore et al. (2008), examined multidimensional child deprivation. Based on the Panel Study of Income Dynamics Child Development Supplement (PSID-CDS), Ciula and Skinner (2015) used seventeen indicators across seven domains. Ciula and Skinner (2015) confirmed evidence from Moore et al. (2008) that there exists child deprivation not captured by traditional measures.

Despite various benefits from the use of dimensions of child deprivation in the U.S., there is no consistent standard for research because the abovementioned four previous studies provide no explicit rationale for the chosen dimensions/indicators. Comparing dimensions/indicators across those four studies in Table 1, those studies have commonly examined the healthcare dimension but overlooked the information dimension. In addition, these four major studies include four or five out of eight dimensions used in this study (more details discussed later). Meanwhile, there is wide variation in the selection of dimensions/indicators across previous sixteen studies on multidimensional deprivation for the total U.S. population, although dimensions/indicators used in those studies can be categorized into five: Economic security, education, health, housing, and social inclusion/miscellaneous (White, 2020). In particular, dimensions such as leisure, protection from violence, and information have been relatively less examined in the previous sixteen studies. In this context, relying on the MODA toolkit can provide an explicit rationale for deciding a core set of dimensions regarding multidimensional child deprivation.

In addition to the lack of consistent standards in child deprivation research, extreme poverty in the U.S. has not been adequately addressed in policy or interventions (Edin & Shaefer, 2016). For example, as of 2011, nearly 3 million children lived with parents whose income was below two dollars per day threshold (Edin & Shaefer, 2016). The existence of extreme poverty in the U.S. can be considered as an area of hidden inequity or a blind spot in the

U.S. child welfare policy (Ciula & Skinner, 2015; Edin & Shaefer, 2016; Mitra & Brucker, 2017). Accordingly, the overlap between deprivation and income poverty yielded by the MODA toolkit can offer a realistic estimation of the size of extreme poverty in the U.S.

Compared with this rarity in the U.S. literature, research on multidimensional child deprivation outside the U.S. has been relatively rich and well-documented. The research focus used in several key non-U.S. studies on child deprivation is loosely grouped into two: cross-country (Chzhen et al., 2016; Milliano & Plavgo, 2018) and country-specific (García & Ritterbusch, 2015; Kim & Nandy, 2018; Musiwa, 2019). Those studies are typically based on a rights-based multidimensional poverty framework that highlights the link between child poverty/deprivation and child rights (Musiwa, 2019; White, 2020). In this vein, a review of those non-U.S. studies provides insights to what aspects of child well-being matter and how those aspects have been identified and measured for the U.S. children.

2.2. Theoretical basis for selecting dimensions: Rights-based approach

A child's right-based approach aims to realize children's rights by eliminating or reducing child deprivation (Bradshaw et al., 2007; Ciula & Skinner, 2015). The United Nations Convention on the Rights of the Child (CRC) advocates that children's rights should be guaranteed based on four fundamental principles: non-discrimination (article 2), best interests of the child (article 3), survival and development of the child (article 6), and respect for the views of the child (article 12) (Santos-Pais, 1999). These four principles are fundamental because they are a guiding reference for realizing all other rights described across the 54 articles of the CRC (Santos-Pais, 1999). The CRC, as a unique treaty on the protection of the child's rights, includes general principles, states' appropriate measures and responsibility for international cooperation for each article (Santos-Pais, 1999). The abovementioned four principles are the decisive basis for assessing the progress made in specific areas of child's rights called dimensions.

Eight dimensions of child deprivation drawn from the CRC align with key factors related to child well-being and deprivation suggested by previous literature (CAHMI, 2021; Ciula & Skinner, 2015; FIFCFS, 2021; Moore et al., 2008; White, 2020). As shown in Table 2, this study selected eight dimensions of child deprivation based on the CRC. Three dimensions such as food security, healthcare, and environmental safety are based on article 24. Five dimensions such as housing security, education, leisure, protection from violence, and information are based on articles 27, 29, 31, 19, and 17, respectively. Because the MODA toolkit suggests various dimensions and related indicators that may reflect the context of child deprivation for low- and middle-income countries (de Neubourg et al., 2012, p. 15), this study uses a modified version of the MODA toolkit to adjust those dimensions and indicators to the U.S. context.

2.3. Empirical evidence for selecting indicators

2.3.1. Food Security—Research suggests that food insecurity negatively affect healthy child development (Belsky et al., 2010; Gundersen & Ziliak, 2015; Thomas et al., 2019). Although there are various conceptualizations such as food insufficiency (Alaimo et al., 2002), poor nutrition (Hurley et al., 2016), food instability (Gassman-Pines & Bellows,

2018) and related indicators, for example, anthropometric indicators including the Body Mass Index (BMI) (Leavitt et al., 2003) and consuming fresh fruit and vegetables regularly (Currie et al., 2012; Fernandes et al., 2013), food insecurity and its relevant indicators are the most typically used to represent whether a child's healthy development is hampered by the family's food insecure situation (Gundersen & Ziliak, 2015; Thomas et al., 2019). In addition, the Centers for Disease Control and Prevention (CDC) and the U.S. Department of Agriculture (USDA) consider the measure of food security as health-promoting conditions for child development (Coleman-Jensen et al., 2022; Ullmann et al., 2022). This study uses one item (unable to eat due to financial problems) out of eighteen items provided by the USDA household food security measure.

2.3.2. Healthcare—Previous research suggests that access to quality healthcare increases the chance of a child to attain better developmental outcomes (Martorano et al., 2014; Moore & Oberklaid, 2014). This study selected regular check-ups and health insurance status as indicators for access to healthcare. Although several measures of children's unmet healthcare needs (e.g., dental care, prescription medications, vision care, and mental health services) have been suggested (Newacheck et al., 2000; Silver & Stein, 2001; Toomey et al., 2013), regular check-ups for medical/dental conditions are the most commonly used as an indicator to measure whether a child receives preventive care (e.g., wellness or well-child visits) for the early detection of medical problems (Aber et al., 2002; Tonniges & Leavitt, 2003). Meanwhile, health insurance status is still typically used as an indicator to measure whether a child has the right to access to essential health services (Land et al., 2001; Wolfe & Sears, 1997), although uninsurance rates among children considerably decreased from 7.1% in 2013 to 4.8% in 2015 due to the expansion of health coverage through the Affordable Care Act (Gates et al., 2016; White & Yamasaki, 2017). In addition, the CDC considers regular checkups (e.g., doctor visit or dental exam in the past 12 months) and health insurance (e.g., percentages of persons with public or private insurance, or uninsured) as key indices to monitor the status of child health (Clarke et al., 2021; Cohen et al., 2021).

2.3.3. Housing Security—Prior research suggests that poor housing conditions are linked to a higher risk of children's physical and mental health problems (Baker et al., 2019; Morris et al., 2017). Although there are various conceptualizations such as housing quality (Krieger & Higgins, 2002), housing affordability (Harkness & Newman, 2005), and housing stability (Bomsta & Sullivan, 2018), the concept of housing security representing housing hardships is the most typically used to examine the association between a child's healthy development and living conditions (Cutts et al., 2011). In addition, the CDC and the U.S. Department of Housing and Urban Development (HUD) consider housing security including the inability to pay a rent or mortgage due to limited financial capacity (Njai et al., 2017; U.S. Department of Housing and Urban Development, 2020).

2.3.4. Environmental Safety—Previous literature suggests that poor physical/built and social environmental conditions interrupt a child's trajectory toward healthy development (Fernandes et al., 2013; Furstenberg & Hughes, 1997). Two concepts such as environmental exposures and neighborhood collective efficacy are the most typically used to measure whether a child lives in a safe environment (Rauh et al., 2008; Sampson et al., 1997),

although there are many indicators related to environmental safety (e.g., lead exposure, poor air quality) (Aber et al., 2002; Coulton & Spilsbury, 2014). Neighborhood collective efficacy is included to measure environmental safety because this study intends to measure the child's broader environment beyond the intuitive notion that environmental safety means protection against environmental toxins (National Research Council and Institute of Medicine, 2000, pp. 329–331). Environmental exposures include such indicators as exposure to poor condition of the buildings, graffiti, vacant buildings, abandoned vehicles and neighborhood collective efficacy includes the indicators related to social cohesion & trust and informal social control (Rauh et al., 2008; Sampson et al., 1997). In addition, the CDC considers the quality of the physical/built and social environment as critical to reduce the risk of unhealthy development among children (Anderson et al., 2002; Centers for Disease Control and Prevention, 2019).

2.3.5. Education—Previous research suggests that conditions related to school education strongly influence the life chances of children through learning practices (Aber et al., 2002; Fernandes et al., 2013). Although there are a variety of indicators related to school education including school attendance and educational achievement (García Bacete et al., 2014; Phillips & Love, 1997), school connectedness (i.e., students' perception of being connected to school) is the most commonly used as an indicator for capturing how well a child engages in school academically and psychosocially based on previous studies (Fredricks et al., 2005; Institute for Social Research, 2012; McNeely, 2005). School connectedness as one of the key school context factors is considered as a protective factor to buffer against the detrimental effects of childhood adversity or social deprivation including physical and mental maltreatment and a lack of family-/neighborhood-level support (Centers for Disease Control and Prevention, 2009; Goetschius et al., 2021; Hein et al., 2020). The school connectedness scale developed by Eccles & Roeser (2004) is a 5-point Likert scale to measure the extent of inclusiveness, closeness, happiness, and safety at school (Institute for Social Research, 2012). The CDC considers school connectedness as a key concept to improve protective factors affecting child education (Centers for Disease Control and Prevention, 2009).

2.3.6. Leisure—Previous research suggests that participating in leisure activities affects child development through physiological (e.g., an increase in endorphins) and psychological (e.g., an increase in self-esteem and personal control) pathways (Kennedy & Prothrow-Stith, 1997; Ommundsen et al., 2014). Physical or outdoor activity (e.g., playing sports) and sedentary activity (e.g., reading books, playing games, etc.) are used as indicators for assessing whether a child enjoys the right to rest and leisure based on previous studies (Hofferth & Curtin, 2005; Hofferth & Sandberg, 2001). In addition, the DHHS considers regular leisure activity as a key concept to promote child health (U.S. Department of Health and Human Services, 2018).

2.3.7. Protection from Violence—Previous research suggests that children's exposure to different types of violence, for example, parental violence at home (Arruabarrena, 2014), peer violence at school (Gal, 2014), and neighborhood violence (Sleet & Mercy, 2003) adversely impact child development by discouraging the formation of stable relationships

with parents, peers, and others (Kennedy & Prothrow-Stith, 1997). Parental aggression, peer bullying, and witnessing severe events (e.g., being attacked with a weapon) are the most commonly used to assess whether a child is exposed to the risk of violence (Fernandes et al., 2013; Selner-O'Hagan et al., 1998). In addition, the CDC and the Department of Education consider bullying prevention as key to promote school-aged children's healthy development (Hamburger et al., 2011; National Academies of Sciences, Engineering, and Medicine, 2016).

2.3.8. Information—Previous research suggests that children's access to information through different types of media influences child development (Kalmus et al., 2014). Having access to information, i.e., books, computers is the most commonly used as an indicator to measure whether a child can use various opportunities (e.g., learning, socialization) (Bradley, 2015; Chiu & McBride-Chang, 2006). Having a television in a child's room is not included because the television's diminished role in providing useful information, in particular, age-appropriate knowledge (Hill et al., 2016; the American Academy of Child and Adolescent Psychiatry, 2022). In addition, the Department of Education considers students' access to digital learning sources as critical to promote healthy development (KewalRamani et al., 2018).

2.4. Current study

The present study examines the needs and experiences of deprived children in various dimensions of quality of life in the U.S. Building on previous literature applying the MODA method to estimate an overall percentage of deprivation, this study is among the first to incorporate a human rights-based approach into the analysis of deprivation among children in the U.S. Given the lack of consistent findings on dimensions and indicators of child deprivation, the present study provides a significant contribution to our knowledge of multidimensional child deprivation by showing a detailed picture of material and social forms of deprivation among the U.S. children. This study uses the MODA that is a comprehensive analytic method to assess the multidimensionality of child deprivation. The MODA allows for conducting a dimension-by-dimension analysis with an overlapping deprivation analysis, suggesting how children experience various forms of deprivation (de Neubourg et al., 2012). This study addresses a research question, "To what extent are children deprived in the U.S.?" Applying the MODA method addresses this question through steps that examine: a) an overall deprivation rate, b) unique contributions of each dimension to the overall deprivation, and c) an overlap between deprivation and income poverty.

3. Method

3.1. Data source and study sample

This study used the fifth wave (age 9) of Future of Families and Child Well-being Study (FFCWS). The FFCWS is a longitudinal panel study of 4,898 children born in 1998–2000 within 75 hospitals across 20 cities that were randomly selected in the U.S. (FFCWS, 2018). The FFCWS is nationally representative of urban areas, in particular, either the 20 cities (when unweighted) or 77 cities (i.e., all the cities with populations of 200,000 or more when weighted). The design of the FFCWS is based on multistage probability sampling

(i.e., sampling cities, and within cities, sampling hospitals, and within hospitals, sampling births) with oversampling of unmarried parents (by a 3:1 ratio) and low-income families (by a 2:1 ratio) (Reichman et al., 2001). In the baseline survey (response rate: 86% for mothers), mothers were interviewed in person within 48 hours after the focal children were born. Then, the focal children have been followed-up when they were at ages one, three, five, nine, and fifteen. This study focuses on children at age 9 because middle childhood including age 9, as a transitional stage from dependent preschoolers to more independent young individuals, is critical to enhance cognition, language, and social skills that are fundamental for successful adulthood (Mah & Ford-Jones, 2012). Middle childhood, as the life phase between the ages of 6 to 11, is a crucial transitional period between preschool years and young teen years as individuals seek growing independence and a sense of responsibility (National Research Council, 1984). The uncertainty of this “in-between” period includes eight kinds of developmental transition, such as body growth, brain growth, motor and perceptual skills, cognitive skills, motivation and social behavior, psychopathology, social context, and behavior genetics (DelGiudice, 2018). The middle childhood is both critical and sensitive (DelGiudice, 2018; National Research Council, 1984). However, relatively less attention has been given to studying this period because of the complexity of this period that includes nonlinear and multilevel nature of developmental processes in terms of healthy development in a life course perspective (LCHD) (DelGiudice, 2018).

To take the complex sampling design into consideration, this study applied individual-level sampling weights to all analyses, thereby yielding unbiased estimates of proportions in deprivation. Missing values were less than 1% for all the indicators so that this study used complete cases with non-missing values. The analytic sample includes responses by a mother or primary caregiver or child or interviewer.

3.2. Measures

Fig. 1 presents selected eight dimensions and twelve indicators. Dimensions include food security, healthcare, housing security, environmental safety, education, leisure, protection from violence, and information. Indicators include felt hungry but did not eat due to not enough money, regular check-ups for medical/dental conditions, health insurance, housing hardships, environmental exposures, neighborhood collective efficacy, school connectedness, activity, parental/peer/neighborhood violence, and information divide. Decisions for the presence or absence of deprivation in each dimension are made by the union approach suggested by the MODA toolkit (de Neubourg et al., 2012, pp. 22–23). The union approach is to identify a child as deprived in specific dimension if he or she experiences at least one deprivation in specific indicators within the dimension (de Neubourg et al., 2012, p. 23).

3.2.1. Food Security

Felt hungry but did not eat due to not enough money. Food security dimension was measured using one indicator, felt hungry but did not eat due to not enough money. It was assessed with the question “In the past 12 months, were you ever hungry but didn’t eat because you couldn’t afford enough food?”. Responses were dichotomized (food secure = 0; food insecure = 1).

3.2.2. Healthcare

Regular check-ups & health insurance.: Healthcare dimension was measured using two indicators: regular check-ups for medical/dental conditions and health insurance (public/private). Healthcare dimension was assessed as deprived if a child had no regular check-ups for medical/dental conditions or had no health insurance.

Regular check-ups for medical/dental conditions were measured by asking “In the last 12 months, approximately how many times has [a child] been seen by a doctor, nurse, or other health care professional for a regular check-up or well-child visit?” and “When was the last time [a child] saw a dentist for a regular check-up?” Responses to the regular check-up for medical conditions were dichotomized (1–3 times, 4 or more times (or yes) = 0; never (or no) = 1). In addition, responses to the regular check-up for dental conditions were dichotomized (less than 1 year (or yes) = 0; more than 1 year (or no) = 1). Regular check-up for medical/dental conditions was assessed as deprived if a primary caregiver answered “no” in either of the two questions.

Health insurance was measured by asking “Is [a child] currently covered by Medicaid or by another public, federal or state assistance program which pays for medical care, or do you belong to a Medicaid HMO?” and “Is [a child] currently covered by a private health insurance plan?”. From these two questions, responses were dichotomized (insured (or yes) = 0; uninsured (or no) = 1). Health insurance was assessed as deprived if a child had neither public nor private health insurance.

3.2.3. Housing Security

Housing hardships.: Housing security dimension was measured using one combined indicator consisting of four kinds of financial difficulty of maintaining housing: 1) skipping a rent or mortgage payment, 2) eviction, 3) doubling up with other people, and 4) homelessness. Responses to each question were dichotomized (no = 0; yes = 1). Housing security dimension was assessed as deprived if a respondent answered “yes” in at least one of four kinds of financial difficulty of maintaining housing.

3.2.4. Environmental Safety

Environmental exposures and neighborhood collective efficacy.: Environmental safety dimension was measured using two indicators: 1) environmental exposures and 2) neighborhood collective efficacy. First, environmental exposures were measured by asking four conditions of the immediate environment (i.e., within 100 yards of the respondent’s home): 1) poor condition of most of the buildings on the block, 2) graffiti on the buildings or walls of the buildings on the block, 3) vacant, abandoned, or boarded-up buildings on the block, and 4) abandoned vehicles on the block. Second, neighborhood collective efficacy was measured using two subscales: 1) social cohesion and trust and 2) informal social control. Social cohesion and trust consist of four items: willingness to help neighbors; a close-knit neighborhood; getting along with neighbors; sharing the same values. Informal social control includes five items: willingness to get involved in the situation where children were skipping school and hanging out on the street; spray-painting buildings with graffiti; showing disrespect to an adult; a fight broke out in front of the house or building; the

fire station closest to the neighborhood was threatened. Responses to each question were dichotomized (environmentally safe = 0; not environmentally safe = 1). Environmental safety dimension was assessed as deprived if an interviewer answered “not environmentally safe” in at least one of the two subdimensions such as environmental exposures and neighborhood collective efficacy. Neighborhood collective efficacy was assessed as deprived if an interviewer answered “little or low level of experience” in at least one of the two subdimensions such as social cohesion and trust and informal social control.

3.2.5. Education

School Connectedness.: Education dimension was measured using one indicator, school connectedness. School connectedness was measured using four questions: “[In the past month, do a child] feel like you were part of your school?”, “feel close to people at your school?”, “feel happy to people at your school?”, and “feel safe to people at your school?”. Each item was scored on a five-point scale ranging from 0 (not once) to 4 (every day). Raw items were averaged to create a composite score (range: 0 to 4). Higher composite score suggests greater sense of belonging to school. The composite score was dichotomized based on a median split at 2 (connected = 0; not connected = 1). Education dimension was assessed as deprived if a child did not feel connected to school¹.

3.2.6. Leisure

Activity.: Leisure dimension was measured using one combined indicator by asking whether a child had ever experienced the following activities (physical or sedentary) with family including: 1) playing sports, 2) watching TV/video, and 3) reading (or talking about) books. Each item was scored on a five-point scale ranging from 0 (not once in past month) to 4 (every day). The items were averaged to create a composite score (range: 0 to 4). Higher composite score suggests greater degree of playing activities. The composite score was dichotomized based on a median split at 2 (sufficient = 0; not sufficient = 1). Leisure dimension was assessed as deprived if a child did not experience sufficient activities with family.

3.2.7. Protection from Violence

Parental, peer, and neighborhood violence.: Protection from violence dimension was measured using three indicators: 1) parental violence at home, 2) peer violence at school, and 3) neighborhood violence. First, Parental violence at home was measured by asking how often a child had experienced two adverse conditions by parents: 1) being shouted/yelled/screamed/swore/cursed and 2) being spanked/hit. Second, peer violence at school was measured by asking how often a child had experienced four adverse conditions at school: 1) being picked on or heard mean things, 2) being hit, 3) being stolen (money or lunch), and 4) being purposely left out of activities. Third, neighborhood violence was measured by asking how often a child had experienced three conditions at neighborhood: 1) observing a person get hit/slapped/punched, 2) observing a person get attacked with weapon, and 3) a

¹Because many public schools in the U.S. are under-resourced (e.g., lack of adequate funding and teaching staff, and little classroom space, etc.), it may be more relevant to consider school connectedness as a situation where schools are not connected to children instead of vice versa (Biag, 2016).

person get shot. For three types of violence, each item was scored on a five-point scale (0 = never, 1 = once, 2 = 2–3 times, 3 = 4–10 times, 4 = more than 10 times). Those items were averaged to create a composite score. Higher composite score suggests greater degree of experiencing violence. The composite score was dichotomized based on a median split at 2 (no parental/peer/neighborhood violence = 0; parental/peer/neighborhood violence = 1). Protection from violence dimension was assessed as deprived if a child experienced at least one of the three types of violence.

3.2.8. Information

Information divide.: Information dimension was measured by asking whether a child had ever accessed two types of media at home: 1) having access to ten books, and 2) having a computer. Responses to these questions were dichotomized (no access = 0; access = 1). Information dimension was assessed as deprived if a child answered “no” in at least one of two types of media.

3.3. Analytic strategy

The MODA method is conducted in three steps²: 1) finding adjusted headcount ratio (i.e., overall deprivation level) by creating two indices such as deprivation headcount ratio and average intensity of deprivation and multiplying them (de Neubourg et al., 2012, pp. 25–31), 2) assessing the individual contribution of each dimension to the overall deprivation level by decomposing the adjusted headcount ratio (de Neubourg et al., 2012, pp. 33–34), and 3) finding a proportion of children who are at higher risk of poverty by identifying an overlap between deprivation and income poverty (Alkire, 2007; Alkire & Foster, 2011; de Neubourg et al., 2012, p. 34). In step one, the adjusted headcount ratio (M_0) is given as:

$$M_0 = H_k \times A \quad (1)$$

where H_k refers to headcount ratio, and A refers to the average intensity of deprivation. The ‘headcount’ means to count the number of children who are identified as deprived. The headcount ratio (H_k) is expressed as:

$$H_k = \frac{q_k}{n_a} \quad (2)$$

where $q_k = \sum_{i=1}^n y_k$, y_k = deprivation status of a child i with the cut-off (k) and n_a = the total number of children in the age group a . Meanwhile, the average intensity of deprivation (A) is expressed as:

$$A = \frac{\sum_{i=1}^{q_k} C_k}{q_k \times d} \quad (3)$$

where $\sum_{i=1}^{q_k} c_k$ refers to a sum of the number of deprivations among children who are deprived with the cut-off value of k , and d refers to the total number of dimensions. The average

²The MODA method used in this study was consistent with Chzhen et al., (2016), except for not including the analysis of the overlaps among dimensions.

intensity of deprivation (A) reflects the difference between one child with k deprived dimensions and another child with $k + 1$ deprived dimensions among children who are deprived with the cut-off of k . Thus, the adjusted headcount ratio (M_0) is preferable than the headcount ratio (H_k) because the former includes the difference among children who are deprived but with different number of deprived dimensions (Alkire & Foster, 2011; de Neubourg et al., 2012, p. 31).

In step two, in order to indicate how each element (i.e., dimension) uniquely contributes to the overall number (i.e., overall deprivation level), the adjusted headcount ratio (M_0) is expressed as:

$$M_o = M_{o1} \times \frac{n_1}{n} + \dots + M_{oj} \times \frac{n_j}{n} \quad (4)$$

where M_{oj} = the absolute contribution by the j th dimension ($j = 1, \dots, d$), d = the total number of dimensions, n_j = the number of children who are deprived in the j th dimension, and n = the total number of children in the sample. Thus, the relative contribution of the j th dimension (P_j) is given as:

$$P_j = \frac{M_{oj} \times \frac{n_j}{n}}{M_o} = \frac{H_j \times A_j \times \frac{n_j}{n}}{M_o} = \frac{\sum_{i=1}^n (y_j \times y_k)}{n_a \times d \times M_o} \quad (5)$$

where y_j = deprivation status of a child i in j th dimension, y_k = deprivation status of a child i depending on the cut-off value of k , n_a = the total number of children in the age group a , d = the total number of dimensions, M_o = the adjusted headcount ratio (de Neubourg et al., 2012, p. 33). Decision for the presence or absence of overall multidimensional deprivation is made by the intermediate cut-off approach suggested by the MODA toolkit (de Neubourg et al., 2012, p. 25). The intermediate cut-off approach is to identify a child as multidimensionally deprived if he or she experiences a specified number of deprivations (de Neubourg et al., 2012, p. 25). The present study assumes that persons who are deprived of at least three out of eight dimensions are deprived (de Neubourg et al., 2012, p. 25), which is consistent with the benchmark suggested by Dhongde et al., 2019 study in the U.S., although acknowledging there are various ways to determine the cut-off value, for example, a method of combining multidimensional material deprivation and low income (Gordon & Nandy, 2012; Kim & Nandy, 2018). The key advantage of the decomposition analysis is that it provides the individual contribution rate of each dimension to the overall deprivation level given that the overall deprivation level equals to 100%. It means that we can quantify the contribution of each dimension to the overall deprivation, thereby yielding evidence for which dimension plays a greater role in shaping the overall deprivation.

In step three, the overlap analysis allows us to identify children who are exposed to greater levels of risk in poverty. This is achieved by drawing a Venn diagram of deprivation (set A) and income poverty (set B). The intersection of the Venn diagram ($A \cap B$) that is an overlap between deprivation and income poverty, indicates a proportion of children who are both deprived and income poor. In addition, the difference between deprivation and income poverty ($A-B$), an area belonging to deprivation but not to income poverty, represents a

proportion of children who are only deprived. This area of A-B is considered as a blind spot not captured by the U.S. official poverty measure, implying hidden inequity in child poverty policy (de Neubourg et al., 2012, p. 34). All statistical analyses were conducted using Stata (version 15.1) (Stata-Corp., 2017). In particular, a proportional Venn diagram using `pvenn2` command was made to examine the extent of the overlap between deprivation and income poverty (Gong & Ostermann, 2011). In this study, income poverty status is determined using a threshold of 120% Federal Poverty Level (FPL), which is defined as “near poverty” (Fox, 2020; Short, 2013). If a child’s family income is less than 120% FPL, the child is considered monetarily poor. This study analyzed differences in demographic characteristics and household socioeconomic resources by children’s multidimensional deprivation groups (deprivation only, income poverty only, deprivation and income poverty, and no deprivation and income poverty). Detailed information is provided in the Appendix Tables A1 and A2. Additionally, the sensitivity of the proportions of multidimensional deprivation groups to the different treatment of cut-offs for overall deprivation was checked (See the Appendix Table A4).

4. Results

4.1. Sample characteristics

Table 3 presents descriptive statistics of children aged 9 and their mothers. Less than half of the children in the sample were girls (43.06%). The average age of the mothers was 36 years. More than half of the mothers were non-White (63.18%): Latinx (29.58%), Black (26.86%), and other mixed race/ethnicity (6.74%). More than a fifth of the mothers in the sample were non-U.S.-born (21.15%). Nearly half of the mothers were married (46.58%) and about two thirds of them completed a college degree or more (60.13%). More than a third of the mothers were unemployed (37.75%) and approximately a third of them were below the Federal Poverty Line (i.e., income-to-poverty ratio: 0–99%) (32.72%). More than two thirds of mothers were tenants (67.69%).

Table 4 presents the percentages of children experiencing individual indicators used for constructing multiple dimensions of deprivation. For food security dimension, about 7% children reported to feel hungry but did not eat due to not enough money. In healthcare dimension, nearly one tenth of the children did not receive regular check-up for medical conditions (10.22%) and less than one tenth of them did not see a dentist on a regular basis (more than 1 year since the last check-up) (8.04%). In addition, approximately one in twenty children were uninsured (private or public insurance) (4.61%). Regarding housing security dimension, about 17.36% of children experienced skipping a rent or mortgage payment, followed by doubling up with other people (6.58%), eviction (3.39%), and homelessness (0.93%). In regard to environmental exposures in environmental safety dimension, about 9.57% of children lived in poor condition of buildings on the block, followed by vacant, abandoned, or boarded-up buildings on the block (8.76%). Regarding social cohesion and trust of neighborhood collective efficacy, nearly one tenth of primary caregivers agreed this is not a close-knit neighborhood. For informal social control of neighborhood collective efficacy, about 16.21% of primary caregivers answered they would not get involved if children were skipping school and hanging out on the street. In terms of

education dimension, nearly one in ten children reported to feel unsafe at school (10.91%). With regard to leisure dimension, more than one third of children had little time to spend in playing sports or outdoor activities with family (less than once per week) (34.12%), followed by reading or talking about books (16.40%) and watching TV or videos (9.37%). With respect to protection from violence dimension, approximately 60% of children were shouted/ yelled/ screamed/ swore/ cursed by mother; about 48% of children were picked on or heard mean things from peers; nearly 15% of children reported to observe a person get hit/slapped/punched in neighborhood. In respect to information dimension, nearly 18% of children did not have a computer, followed by having no access to ten books (4.42%).

Table 5 presents percentages of deprived children in individual dimensions. Overall, nearly 35% of children were deprived of environment safety dimension. About 22.38% of children were deprived of housing security dimension, followed by those deprived of healthcare (20.20%), information (19.79%), protection from violence (18.39%), and leisure (15.68%). Meanwhile, the two least deprived dimensions were food security (6.57%) and education (11.53%).

4.2. Estimating adjusted headcount ratio

Table 6 presents percentages of deprived children by cut-off. Overall, nearly 71% of children were deprived in one or more dimensions. Meanwhile, about 43% of children were deprived in two or more dimensions. Approximately 20% of children were deprived in three or more dimensions; about 8% were deprived in four or more dimensions; approximately 2% were deprived in five or more dimensions. As the cut-off (k) increases, both headcount ratio (H) and the adjusted headcount ratio (M_0) decrease whereas the average intensity of deprivation (A) increases. As previously discussed, this study used the cut-off of three ($k = 3$), yielding 8.89% as adjusted headcount ratio (M_0).

4.3. Decomposing the adjusted headcount ratio

Fig. 2 presents decomposition results of adjusted headcount ratio (M_0) by dimension. Considering the adjusted headcount ratio with the cut-off of three (8.89%) as 100, individual dimensions' contribution rates were computed. Overall, the contribution of environmental safety dimension to the adjusted headcount ratio was the highest (20.36%), followed by information (15.94%), housing security (14.23%), healthcare (12.19%), protection from violence (12.01%), and leisure (10.10%). Meanwhile, the remaining three dimensions' contribution rates were less than 10%: education (9.11%), and food security (6.09%).

4.4. Overlap analysis result

Fig. 3 presents the overlaps between deprivation and income poverty. Overall, nearly half of children were either deprived or income poor (44.43%). The percentage of children in the overlap between deprivation and income poverty was 12.83%. Meanwhile, the percentage of children deprived only in deprivation was 7.29%; whereas, the percentage of children only in income poverty was 24.32%.

5. Discussion

The present study provides a significant contribution to the literature on multidimensional child deprivation by incorporating a child's rights-based perspective into the analysis of child deprivation. This study is among the first to apply UNICEF's MODA methodology to estimate an overall percentage of deprivation among children in the U.S.

First, results indicate that 8.89% of children were deprived using a cut-off of three out of eight dimensions. This multidimensional deprivation rate was less than the rate (20.4%) using a cut-off of five out of thirteen dimensions suggested by Ciula and Skinner (2015). This difference may be in part due to different age ranges of the sample used (i.e., children aged 9 vs. those aged 10 to 19). Meanwhile, this study's finding was less than the multidimensional deprivation rate for adults aged 15 and over (15.4%) (Glassman, 2019).

Second, decomposition results indicate that contribution of individual dimensions to the overall multidimensional deprivation rate differed. Environmental safety (20.36%), Information (15.94%), and housing security (14.23%) contribute the highest to the overall multidimensional deprivation. This raises the possibility that deprivations in environmental safety, information, and housing security dimensions may be relatively severe for children in the U.S., which is in line with results from previous studies on U.S. child well-being indicators (Children's Defense Fund, 2021; The Annie E. Casey Foundation, 2021). In this vein, designing and implementing policies directed at guaranteeing the right to be protected from the risk of environmental degradation (e.g., cleaning and greening of vacant land), to live in a supportive and protective neighborhood (e.g., developing collective efficacy enhancement programs), to have access to various media (e.g., providing high-speed internet access), and to have a safe and affordable place to live (e.g., increasing the supply of affordable housing) may be crucial to reduce multidimensional child deprivation in the U.S. (Abdullah et al., 2020; Branas et al., 2018; Cutts et al., 2011; Kershner & Silverthorn, 2021). Research suggests addressing the multifaceted nature of child well-being within a multicultural multidisciplinary framework is key to reduce severe deprivation (Ben-Arieh et al., 2014).

Third, results indicate that the overlap between deprivation and income poverty was 12.83%. This suggests that effective social welfare policy interventions are urgently needed to deal with this overlap because it is the most severe area where children simultaneously experience income poverty and deprivation. This finding may align with the argument for the existence of extreme poverty made by Edin and Shaefer (2016). Comparing with several previous studies, the present study's relative proportion of the overlap to income poverty is smaller than the rates by Chzhen et al. (2016), Dhongde and Haveman (2019), or Glassman (2019). These differences may be in part due to the choice of the age group, the cut-off for multidimensional deprivation, or the national context (See the Appendix Table A3 for details). Some may argue that the present study's overall child deprivation rate seemed to be underestimated; however, the seemingly low deprivation rate in this study may be in part due to the differences in child's age selection (only age 9) and child's economic status, i.e., the inclusion of middle- and high-income children in addition to low-income children in the analytic sample, although the FFCWS itself focuses on more disadvantaged children. In

addition, results indicate an area of deprivation (7.29%) that does not overlap with income poverty. This rate was more than the rate (5.50%) suggested by Mitra and Brucker (2017) although the latter is based on the total Americans with all ages. This means that there are children who are not captured by traditional income poverty measure in the U.S., which is underexplored in previous research (Ciula & Skinner, 2015). This implies an area of hidden inequity or a blind spot in the U.S. child welfare policy, as discussed earlier (Ciula & Skinner, 2015; Edin & Shaefer, 2016; Mitra & Brucker, 2017).

Despite its key contributions, the study is not without limitations. First, due to the data availability, this study used eight dimensions of child deprivation, although the CRC suggests many other detailed dimensions. Future research may benefit from the measurement of other child deprivation dimensions (e.g., cultural activity, freedom of expression) if that information is available in the FFCWS. Second, this study's findings should be interpreted with cautions because the sample (wave 5) used in this study is not based on a probability sample, thereby undermining the representativeness of the initial baseline sample (wave 1). In fact, the FFCWS initial data is representative of urban areas, in particular, either the 20 cities or all the cities with populations of 200,000 or more; however, this study is based on a follow-up wave. Thus, this study's findings may not be generalizable to all the U.S. regions. Third, this study used a cut-off of three to estimate an overall deprivation level based on eight dimensions. Although using a cut-off of three to decide the overall deprivation status is based on previous research in the U.S. (Dhongde et al., 2019), using different cut-offs may change the findings. Fourth, this study used a few indicators to construct one dimension. For example, food security dimension is based on only one indicator; thus, it may be limited to adequately represent the nutrition dimension. Fifth, the present study's analytic sample was collected between 2007 and 2009, which was the Great Recession. Thus, this external shock may impact the health and well-being of children, thereby yielding more severe results of deprivation compared with those results in the normal economic situation (Pilkaukas et al., 2012; Thomas, 2022).

In conclusion, this study emphasizes a multidimensional child deprivation approach based on a rights-based perspective in the U.S. This study offers a detailed picture of multidimensional child deprivation, in particular, the extent to which children at risk are not captured by traditional income-based measures. Although the U.S. is the one and only country not to ratify the CRC and so the rights-based approach is not broadly adopted within the U.S. context, increased attempts to apply the rights-based approach to children in the most vulnerable positions (e.g., children who are disabled, exposed to domestic violence, or living in homeless families) can help strengthen the evidence base to support more preventive and integrative child welfare policies. Thus, this study provides the foundation for future research to consider multifaceted and interrelated child deprivation contexts. For instance, the inclusion of area-level deprivation can be a new way to understand the various forms of deprivation. Area-level deprivation refers to level of socioeconomic disadvantage at neighborhood-level by considering local socioeconomic factors (e.g., unemployment rate, median household income level, median housing rent cost, having a green park, or appropriate facility for leisure near the house) (Coulton & Spilsbury, 2014). Future research based on both individual- and area-level deprivation may advance the understanding of

how multidimensional levels of deprivation negatively affect healthy development among children.

Data availability

Data will be made available on request.

Appendices.

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Table A1
Demographic Characteristics across Multidimensional Child Deprivation Groups.

	Sample				Multidimensional Child Deprivation Groups+				F or χ^2
	Col %	Col %	Col %	Col %	Deprivation Only (N = 301)	Income Poverty Only (N = 1,032)	Deprivation & Income Poverty (N = 539)	No Deprivation & Income Poverty (N = 3,026)	
Child's Sex									
		56.94	69.27	54.51	53.83	57.10	57.10	57.10	$\chi^2(3) = 13.99$
		43.06	30.73	45.49	46.17	42.90	42.90	42.90	
Mother's race/ ethnicity <i>c, e, f</i>									
		36.81	23.83	23.87	13.29	49.65	49.65	49.65	
		26.86	35.50	36.70	34.02	19.74	19.74	19.74	
		29.58	34.77	34.02	47.89	22.72	22.72	22.72	
		6.74	5.89	5.41	4.79	7.89	7.89	7.89	
Mother's U.S.-born status									
		78.85	78.04	74.60	70.60	82.73	82.73	82.73	$\chi^2(3) = 32.13$
		21.15	21.96	25.40	29.40	17.27	17.27	17.27	
Mother's marital status <i>c, e, f</i>									
		46.58	36.88	32.57	19.09	60.65	60.65	60.65	
		6.66	3.98	9.18	7.39	5.67	5.67	5.67	
		46.76	59.13	58.25	73.53	33.68	33.68	33.68	
									$\chi^2(6) = 259.50$ ***

* $p < .05$,

** $p < .01$,

*** $p < .001$; +Group labels refer to Deprivation/Income Poverty.

Note: Group differences based on Bonferroni post-hoc test.

^a Significant difference at 0.05 level between Deprivation Only and Income Poverty Only.

^b Significant difference at 0.05 level between Deprivation Only and Deprivation/Income Poverty.

^c Significant difference at 0.05 level between Deprivation Only and No Deprivation/Income Poverty.

^d Significant difference at 0.05 level between Income Poverty Only and Deprivation/Income Poverty.

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Significant difference at 0.05 level between Income Poverty Only and No Deprivation/Income Poverty.

Significant difference at 0.05 level between Deprivation/Income Poverty and No Deprivation/Income Poverty.

Table A2
Household Socioeconomic Resources across Multidimensional Child Deprivation Groups.

	Sample	Multidimensional Child Deprivation Groups+				F or χ^2
		Deprivation Only (N = 301)	Income Poverty Only (N = 1,032)	Deprivation & Income Poverty (N = 539)	No Deprivation & Income Poverty (N = 3,026)	
	Col %	Col %	Col %	Col %	Col %	
Mother's education level <i>b, c, d, e, f</i>						$\chi^2(9) = 526.75$ ****
Less than high school	18.92	19.39	30.60	45.13	7.43	
High school or equivalent	20.94	30.62	25.81	28.35	15.84	
Some college or technical school	33.38	35.44	32.77	22.71	35.93	
College or graduate level	26.75	15.55	10.82	3.81	40.79	
Mother's work status <i>d,</i> <i>b, d, e</i>						$\chi^2(3) = 334.66$ ****
Employed	62.25	87.15	39.31	39.96	74.17	
Unemployed	37.75	12.85	60.69	60.04	25.83	
Mother's income-to- poverty ratio <i>d, b, c, e,</i> <i>f</i>						$\chi^2(12) = 2052.33$ ****
0-49%	15.05	-	39.53	38.76	-	
50-99%	17.67	-	43.14	51.72	-	
100-199%	24.28	56.76	17.33	9.53	27.05	
200-299%	14.26	22.34	-	-	23.21	
300%+	28.75	20.84	-	-	49.73	
Mother's housing status <i>e, f</i>						$\chi^2(6) = 373.80$ ****
Own	28.48	10.46	4.93	8.91	52.55	
Rent	67.69	81.94	87.67	88.71	45.72	
Other (group shelter, temporary housing, etc.)	3.83	7.60	7.40	2.39	1.73	
	Avg. (se.)	Avg. (se.)	Avg. (se.)	Avg. (se.)	Avg. (se.)	
Mother's Age <i>e, f</i>	36.01(0.28)	36.19(1.37)	33.94(0.60)	34.11(0.74)	37.37(0.33)	F(3, 23) = 14.06****

* $p < .05$.

 $p < .01$,

$p < .001$; +Group labels refer to Deprivation/Income Poverty.

Note: Group differences based on Bonferroni post-hoc test.

^a Significant difference at 0.05 level between Deprivation Only and Income Poverty Only.

^b Significant difference at 0.05 level between Deprivation Only and Deprivation/Income Poverty.

^c Significant difference at 0.05 level between Deprivation Only and No Deprivation/Income Poverty.

^d Significant difference at 0.05 level between Income Poverty Only and Deprivation/Income Poverty.

^e Significant difference at 0.05 level between Income Poverty Only and No Deprivation/Income Poverty.

^f Significant difference at 0.05 level between Deprivation/Income Poverty and No Deprivation/Income Poverty.

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Table A3

Studies of Multidimensional Child Deprivation and Income Poverty: Existing Findings.

A.	Number of Dimensions	Glassman (2019)	Dhongde & Haveman (2019)	Chzhen et al. (2016)	Present Study
B.	Cut-off for Multidimensional Deprivation	6	6	6	8
C1.	Rate of Overall Multidimensional Deprivation (MD)	<ul style="list-style-type: none"> •Standard of living •Education •Health •Economic security •Housing quality •Neighborhood quality 	<ul style="list-style-type: none"> •Health •Education •Standard of living •Economic security •Social connections •Housing quality 	<ul style="list-style-type: none"> •Nutrition •Clothing •Early childhood education and care (ECEC) •Child development •Information •Housing 	<ul style="list-style-type: none"> •Food security •Healthcare •Housing security •Environmental safety •Education •Leisure •Protection from violence •Information
C2.	Rate of Income Poverty (IP)	2 or more	2 or more	1 or more	3 or more
C3.	Rate of the Overlap between MD and IP	15.4%	13.5%	55.2%	20.12%
C4.	Relative proportion of the overlap to MD = C3/C1*100	13.4%	12.8%	27.1%	37.15%
C5.	Relative proportion of the overlap to IP = C3/C2*100	10.7%	5.6%	16.9%	12.83%
D	Age	69.48%	41.48%	30.62%	63.77%
E.	Data source	79.85%	43.75%	62.36%	34.54%
F.	Time period	All ages	Ages 18–64	Ages 3–4 (Preschool-age)	Age 9
G.	Country	ACS	ACS	EU-SILC	FFCWS
		2017	2008–2017	2009	2007–2009
		U.S.	U.S.	U.K.	U.S.

Note: ACS = American Community Survey, EU-SILC = European Union-Statistics on Income and Living Conditions, FFCWS = Future of Families and Child Well-being Study.

Table A4
Sensitivity of the Proportions of Multidimensional Deprivation Groups to the Treatment of Cut-offs for Deprivation.

Cut-off (k)	Children's Multidimensional Deprivation Groups				Total
	Deprivation Only (%)	Income Poverty Only (%)	Deprivation & Income Poverty (%)	No Deprivation & Income Poverty (%)	
1 or more	38.56	5.13	32.02	24.29	100.00
2 or more	19.76	13.88	23.27	43.10	100.00
3 or more	7.29	24.32	12.83	55.57	100.00
4 or more	2.07	30.74	6.40	60.78	100.00
5 or more	0.38	35.57	1.57	62.47	100.00
6 or more	0.00	36.84	0.31	62.84	100.00
7 or more	0.00	37.10	0.05	62.86	100.00

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Concept	Dimension	Indicator
Multidimensional Child Deprivation	Food Security	Felt hungry but did not eat due to not enough money
	Healthcare	Regular check-ups for medical/dental conditions; Health insurance (public/private)
	Housing Security	Housing hardships (Skipping a rent or mortgage payment, eviction, doubling up with other people, homelessness)
	Environmental Safety	Environmental exposures (Exposure to poor condition of the buildings, graffiti, vacant buildings, abandoned vehicles); Neighborhood collective efficacy (Social cohesion & trust, informal social control)
	Education	School connectedness (Inclusiveness, closeness, happiness, and safety at school)
	Leisure	Activity (Outdoor, watching TV/video, reading books)
	Protection from Violence	Parental violence at home; Peer violence at school; Neighborhood violence
	Information	Information divide (Having no access to ten books at home, having no computer at home)
	Income	Total family income (annual)

Fig. 1.
Conceptual Model for Multidimensional Child Deprivation.

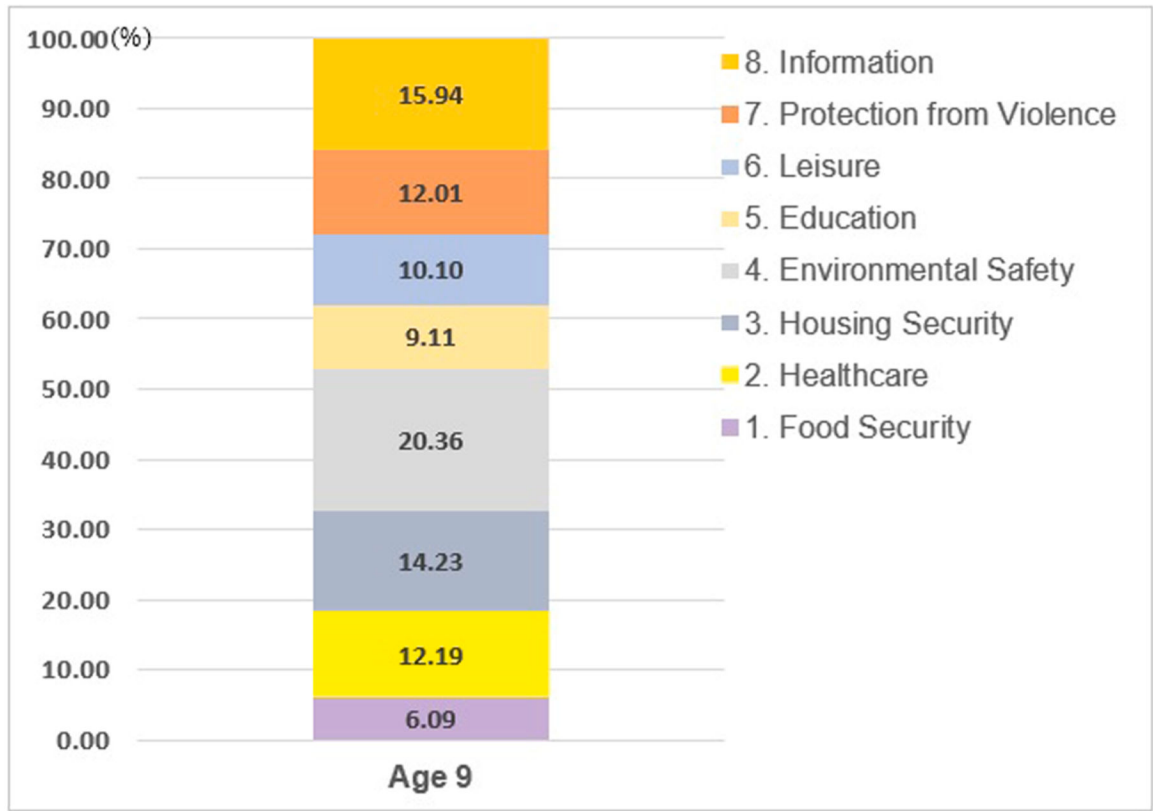


Fig. 2. Decomposition of Adjusted Headcount Ratio (M_0) by Dimension.

Note: 1) Multidimensional deprivation is determined with the cut-off of three ($k=3$).

2) FFCWS individual-level sampling weights are applied.

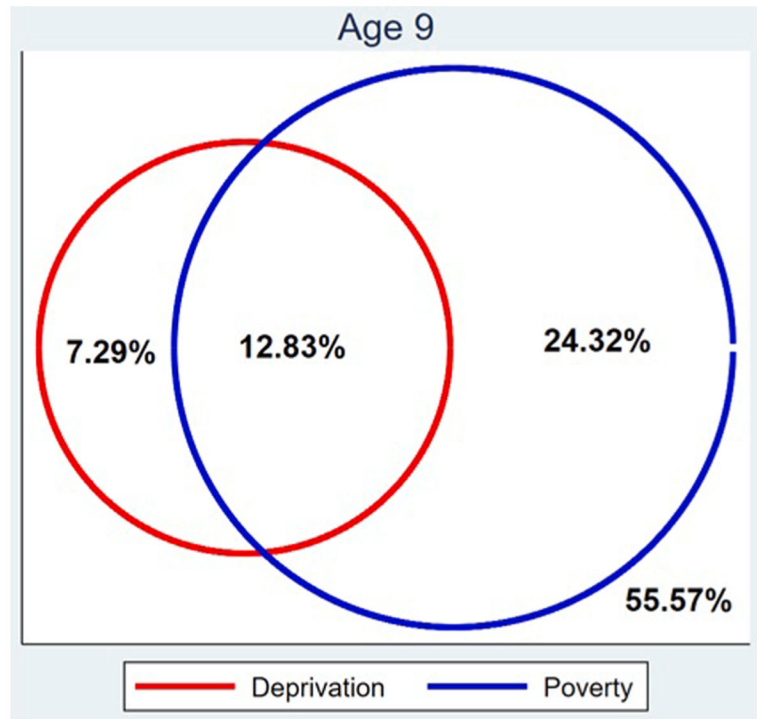


Fig. 3. Overlap Analysis between Deprivation and Income Poverty.

Note: 1) Multidimensional deprivation is determined with the cut-off of three ($k=3$).
2) FFCWS individual-level sampling weights are applied.

Table 1

Studies of Multidimensional Child Deprivation in the United States.

Dimension/ Indicator	FIFCFS (2021)	CAHMI (2021)	Moore et al. (2008)	Ciula & Skimmer (2015)
1. Food Security				
Felt hungry but did not eat due to not enough money	✓			
2. Healthcare				
Regular check-ups for medical/dental conditions		✓	✓	
Health insurance (public/private)	✓	✓	✓	✓
3. Housing Security Housing hardships	✓			
4. Environmental Safety				
Environmental exposures		✓	✓	✓
Neighborhood collective efficacy		✓	✓	
5. Education				
School connectedness			✓	
6. Leisure				
Activity		✓	✓	
7. Protection from Violence				
Parental violence at home	✓			
Peer violence at school			✓	✓
Neighborhood violence			✓	✓
8. Information				
Information divide				
Data Source	Combined data	NSCH	NSCH	PSID-CDS
Time Period	1997–2020	2003–2020	2003	2007

Note: 1) **Housing hardships** include skipping a rent or mortgage payment, eviction, doubling up with other people, homelessness. **Environmental exposures** include exposure to poor condition of the buildings, graffiti, vacant buildings, abandoned vehicles. **Neighborhood collective efficacy** includes *social cohesion and trust* (willingness to help neighbors; a close-knit neighborhood; getting along with neighbors; sharing the same values), *informal social control* (willingness to get involved in the situation where children were skipping school and hanging out on the street; spray-painting buildings with graffiti; showing disrespect to an adult; a fight broke out in front of the house or building; the fire station closest to the neighborhood was threatened). **School connectedness** includes inclusiveness, closeness, happiness, and safety at school. **Activity** includes outdoor, watching TV/video, reading books. **Information divide** means having no access to books and computer at home.

2) Combined data is based on 21 surveys including Decennial Census Data.

3) FIFCFS = Federal Interagency Forum on Child and Family Statistics, CAHMI = Child and Adolescent Health Measurement Initiative, NSCH = National Survey of Children’s Health.

Table 2

Selected Dimensions based on the Convention on the Rights of the Child (CRC).

Dimension	CRC Article
1. Food Security	Right to the highest attainable standard of health (Article 24)
2. Healthcare	Right to the highest attainable standard of health (Article 24)
3. Housing Security	Right to adequate standard of living (Article 27)
4. Environmental Safety	Right to the highest attainable standard of health (Article 24)
5. Education	Right to education (Article 29)
6. Leisure	Right to rest and leisure (Article 31)
7. Protection from Violence	Right to be protected from all forms of violence (Article 19)
8. Information	Right to access information (Article 17)

Note: Author's selected dimensions are based on Convention on the Rights of the Child (UN, 1989). For detailed information about CRC Articles, see UNICEF (2016).

Table 3

Sample Characteristics (Weighted to Represent 77 U.S. cities).

Variables	Children at age 9 (Unweighted N = 4,898; Weighted N = 1,131,033)	
	Percentage	SE
Demographic Characteristics		
Child sex (girl)	43.06	2.76
Mother's race and ethnicity		
White, non-Latinx	36.81	3.49
Black, non-Latinx	26.86	2.52
Latinx	29.58	2.14
Other race, non-Latinx	6.74	0.77
Mother's Not U.S.-born	21.15	4.72
Mother's marital status		
Married	46.58	2.83
Cohabiting	6.66	1.52
Other (separated, divorced, etc.)	46.76	3.29
Mother's education level		
Less than high school	18.92	1.27
High school or equivalent	20.94	1.79
Some college or technical school	33.38	1.33
College or graduate degree	26.75	1.17
Mother's work status (unemployed)	37.75	1.93
Mother's income-to-poverty ratio		
0–49%	15.05	1.03
50–99%	17.67	1.51
100–199%	24.28	2.25
200–299%	14.26	1.76
300%+	28.75	1.76
Mother's housing status		
Own	28.48	3.13
Rent	67.69	3.68
Other (group shelter, temporary housing, etc.)	3.83	1.05
	Mean	SE
Mother's age	36.01	0.28

Note. Percentages and means are weighted by the FFCWS individual-level sampling weights.

Table 4

Indicators for Constructing Dimensions (Weighted to Represent 77 U.S. cities).

Indicators	Children at age 9 (Unweighted N = 4,898; Weighted N = 1,131,033)	
	Percentage	SE
Food Security Dimension		
Felt hungry but did not eat due to not enough money	6.57	1.17
Healthcare Dimension		
Regular check-up for medical conditions in the last 12 months		
None	10.22	2.41
1–3 times	83.85	2.62
4 or more times	5.92	1.43
Last time child saw a dentist for regular check-up		
6 months or less	71.40	3.62
More than 6 months but less than 1 year	20.56	2.50
More than 1 year but less than 2 years	5.37	1.04
More than 2 years	2.09	0.63
Never	0.58	0.26
Uninsured by private or public health insurance	4.61	1.13
Housing Security Dimension		
Skipping a rent or mortgage payment	17.36	1.81
Eviction due to not paying the rent/mortgage	3.39	1.23
Doubling up with other people	6.58	1.39
Homelessness (including staying at a shelter)	0.93	0.21
Environmental Safety Dimension		
Environmental Exposures		
Poor condition of most of the buildings on the block	9.57	2.14
Graffiti on the buildings or walls of buildings on the block	6.60	1.24
Vacant, abandoned, or boarded-up buildings on the block	8.76	2.20
Abandoned vehicles on the block	4.26	1.50
Neighborhood Collective Efficacy		
Social Cohesion and Trust		

Children at age 9 (Unweighted N = 4,898; Weighted N = 1,131,033)		
Indicators	Percentage	SE
People are not willing to help neighbors	5.47	0.63
This is not a close-knit neighborhood	9.61	1.20
People are not getting along with each other	3.54	0.63
People are not sharing the same values	7.31	0.69
Informal Social Control		
Unlikely to get involved if ...		
Children were skipping school and hanging out on the street	16.21	1.85
Children were spray-painting buildings with graffiti	8.42	0.96
Children were showing disrespect to an adult	10.04	1.08
A fight broke out in front of the house/building	8.29	0.78
The fire station closest was threatened and its budget was cut	10.30	1.41
Education Dimension		
School connectedness		
Did not feel like you were part of your school	16.38	1.66
Did not feel close to people at your school	19.60	1.52
Did not feel happy to be at your school	16.10	1.24
Did not feel safe at your school	10.91	0.89
Leisure Dimension		
Playing sports/outdoor activities with family (once a week or less)	34.12	1.84
Watching TV/videos with family (once a week or less)	9.37	2.12
Reading /talking about books with family (once a week or less)	16.40	1.62
Protection from Violence Dimension		
Parental violence at home		
Being shouted/yelled/screamed/swore/cursed by mother	59.89	2.76
Being spanked/hit by mother	46.52	2.12
Peer violence at school		
Being picked on or heard mean things in school	48.40	2.24
Being hit in school	18.75	1.97
Being stolen (money or lunch) in school	11.75	1.41
Being purposely left out of activities in school	29.41	1.51

Indicators		
	Percentage	SE
Neighborhood violence		
Observing a person get hit/slapped/punched in neighborhood	15.34	2.28
Observing a person get attacked with weapon in neighborhood	5.51	0.79
Observing a person get shot in neighborhood	4.38	0.95
Information Dimension		
Having no access to ten books at home	4.42	0.59
Having no computer at home	17.75	1.71

Note: Percentages and means are weighted by the FFCWS individual-level sampling weights.

Table 5

Percentages of Deprived Children in Individual Dimensions.

Dimension	Children at age 9	
	Percentage	SE
1. Food Security	6.57	1.17
2. Healthcare	20.20	2.47
3. Housing Security	22.38	2.31
4. Environmental Safety	34.85	2.08
5. Education	11.53	0.99
6. Leisure	15.68	1.80
7. Protection from Violence	18.39	1.12
8. Information	19.79	1.87

Note: Percentages are weighted by the FFCWS individual-level sampling weights.

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Table 6

Percentages of Deprived Children by Cut-off.

Cut-off (k)	Children at age 9		
	H	A	$M_0=H \times A$
1 or more ¹⁾	70.58	0.26	18.06
2 or more	43.02	0.34	14.61
3 or more	20.11	0.44	8.89
4 or more	8.47	0.53	4.52
5 or more	1.95	0.65	1.26
6 or more	0.32	0.76	0.24
7 or more	0.05	0.82	0.04

Note: 1) Number of deprived dimensions ≥ 1 , H = headcount ratio, A = average intensity of deprivation, M_0 = adjusted headcount ratio (the product of H and A).

2) FFCWS individual-level sampling weights are applied.