The impact of material deprivation and socioeconomic inequalities on the mental health outcomes of children and adolescents



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Abstract

Poverty and inequality are well-evidenced risk factors for mental health, though most of what we know is based on adults in high-income settings. This thesis contributes to efforts to better understand these risks for children and adolescents globally, for whom early intervention might be particularly important. Through a series of mixed-method studies in diverse datasets, the work in this thesis advances our understanding of how poverty and inequality are conceptualized, how they may impact mental health, and what potential interventions may be suitable to address both problems simultaneously. First, Chapter 1 provides a theoretical overview of the concepts of poverty and inequality and the potential mechanisms through which they may affect mental health, with a particular focus on children and adolescents. Second, Chapter 2 charts how the concept of socioeconomic status is defined and operationalized in a critical literature review, arguing that the wide heterogeneity of specific measures used poses important challenges for transparency, understanding of mechanisms, and ultimately appropriate intervention selection. Next, in a large cross-national survey, Chapter 3 zooms in on hunger as a measure for individual-level deprivation and investigates its relationship with mental health, providing evidence for the negative associations between hunger and worrying and suicidality, in addition to stable gender differences, with girls reporting more mental health problems. Then, Chapter 4 broadens out beyond the individual level and examines how country-level indexes for inequality and poverty relate to children and adolescents' mental health through a multiverse analysis, further corroborating the negative associations between hunger and mental health, and higher frequencies of reporting mental health problems for girls. Finally, Chapter 5 explores one candidate intervention to improve mental health: cash transfers and monetary programs. A systematic review and meta-analysis support small but positive and significant effects of these programs on child and adolescent mental health. Overall, I argue that poverty and inequality can be captured via different specific measures, though relationships may differ in magnitude and significance; that consideration of sub-group effects, such as by gender, is important; that children and adolescents' own perspectives are often critically left out from informing such choices and their further inclusion should be a priority. Across my work, I find that poverty and inequality are neither unmeasurable, nor unmodifiable. There are effective interventions, such as cash transfers, that can not

only improve the material circumstances of young people, but also improve their mental health. As such, I hope my work can contribute to broader efforts that bring us closer to a world without childhood poverty and with better mental health for all.

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1 Introduction

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1.1 Introduction

I study how poverty and inequality affect children and adolescents' mental health. That poverty and inequality pose significant global challenges to health and development is perhaps apparent nowadays, though the extent and manners through

which they do so may be less clear. Despite effective and increased efforts to tackle poverty, today nearly 1 in 2 people (47%) globally live on less than $6.85 a day and more than 700 million people live in extreme poverty, defined as living on less than $2.15 per day (World Bank 2023). Children and adolescents are disproportionately affected, representing slightly over half of those living in extreme poverty (356 million), despite comprising one third of the global population (UNICEF 2023). When moving beyond income thresholds, such as by considering lack of appropriate sanitation, health care, nutrition, these numbers become even more worrying, as over 1.1 billion children and adolescents currently live in multidimensional poverty (UNICEF 2023). Children are not only more likely to live in poverty, but they are also more vulnerable to its harmful effects which can persist and exacerbate over the lifecourse (Evans and English 2002; Duncan et al. 1998; Evans and Cassells 2014; Yoshikawa, Aber, et al. 2012).

Global efforts to tackle inequality have also been pronounced. According to the International Monetary Fund, global income inequality has been decreasing since the 1990s, though differences between income growth have been slower and more challenging in regions such as Africa and Asia (International Monetary Fund 2023). Despite optimistic global trends, within-country income inequalities have been rising in the majority of countries around the world, most notably so for high-income countries (International Monetary Fund 2023). The descriptive statistics beneath such broad-strokes trends can be surprising and cover metrics beyond income: the poorest half of the global population owns €2,900 per adult, while this figure is approximately 190 times higher for the top 10% of the global population; indeed approximately 10% of the global population own 76% of the global wealth, earn 52% of the global income, and account for almost half of the global carbon emissions (Stanley 2022). Recently, researchers have expressed worry that since the Covid-19 pandemic, global inequality trends have reversed and inequality around the world has exacerbated (Ferreira 2021). For children, inequality is associated with notable health, developmental, and educational gaps from very early on (UNICEF 2019).

Indeed, adversity, such as poverty and inequality, can have profound and all encompassing negative impacts on a young person's life. Children and adolescents in poverty tend to suffer worse health and die younger, they experience higher levels of diseases while simultaneously having more limited access to health care or social protection (UNICEF 2023; Gupta, de Wit, et al. 2007; Aber et al. 1997). Poverty is unfortunately also a well established risk factor for poor mental health, and has been robustly linked to increased prevalence of depression, anxiety, suicidal behaviors and ideation over the course of an individual's life (Evans and Cassells 2014; Das et al. 2007). Worryingly still, there is compelling evidence such as from meta-analyses of randomized controlled trials, that it is not only deprivation in absolute terms (poverty) that is a risk factor for young people's health, but also that deprivation in distributional terms (inequality) can operate in similar ways (Ribeiro et al. 2017; Patel, Burns, et al. 2018). This holds true across a variety of measures, including unequal distributions of access to education, nutrition, healthcare, legal protections and rights and for a variety of outcomes in general and mental health (Walker et al. 2011; Reiss 2013; Yu 2018). Inequality, particularly economic or income inequality, is robustly associated with ill health, though we know more about this relationship at macro-levels. It has been well replicated, across a variety of countries, that unequal relative distributions of income are linked with worse population health (Wilkinson 1996; Wilkinson and Pickett 2006; Subramanian and Kawachi 2004; Burns 2015). This is also true for common mental disorders (Ahern and Galea 2006; Chiavegatto Filho et al. 2013; Lund 2014; Burns 2015). Though, importantly, despite the abundance of evidence for the risks of poverty and inequality, replicated in different contexts, both poverty and (especially) inequality are still understudied risk factors for mental health and are even less often examined in younger populations, such as children and adolescents (Cohen 2002; Pickett and Wilkinson 2010; Merz et al. 2018).

Mental health outcomes are particularly important, as there is evidence that poor mental health may prevent people from improving their lives, such as through seeking healthcare, educational or economic mobility opportunities. This creates a

'vicious cycle' where adversity and poor mental health feed into each other (Ridley et al. 2020). At a larger policy scale, this vicious cycle poses a tremendous challenge in terms of loss of health, loss of productivity, and diminished quality of life. Given this potentially reinforcing relationship between the experience of inequality and/or poverty on one hand, and mental ill health on the other, early intervention such as during childhood and adolescence, is particularly important.

Although the relationship between adversity (particularly poverty) and mental health is now widely considered to be bidirectional (Lepiège et al. 2015), this thesis concerns itself with poverty and inequality as the primary risk factors of interest and mental health as the primary outcome of interest. This is because it is unlikely that very young people's mental ill health has determined their socioeconomic life circumstances. In this light, this thesis broadly aims to contribute to efforts to break this vicious cycle but focuses particularly on efforts that alleviate poverty and/or inequality with a view to then consequently also positively impact mental health. From a public health perspective such efforts may also be prudent given that addressing poverty or inequality may have larger public health impacts than treating individual problems as they arise (Rose 2001).

1.1.1 Challenges within the field and thesis contributions

To alleviate poverty and inequality in the context of global mental health efforts, finding effective and acceptable evidence-based interventional approaches is warranted. However, the underlying evidence base should be robust in order to ensure effectiveness and appropriateness and key methodological and theoretical issues remain. My research presented here speaks to both the need for a methodologically rigorous field (Chapters 2 - 4) and further evaluation of candidate interventions (Chapter 5). I position my doctoral work in the context of five key challenges I perceive in our field: 1) lack of diverse data and lack of data for young people, 2) theoretical difficulties in defining and clarifying the differences between poverty and inequality, 3) measurement problems relating to precision, heterogeneity, 4) appropriate choice of level, and 5) need for sub-group disaggregation.

First, at the broad level, a significant challenge is the comparative lack of data for younger populations. Importantly, this is further complicated by the lack of diverse cross-national data and its associated difficulty of interpreting and generalizing findings across different settings. While the field considering social determinants of mental health, such as poverty and inequality, has a long research tradition in high-income settings dating from the start 20th century (Rowntree 1901), the study of these risk factors in low- and middle-income countries (LMICs) is comparatively younger. For instance, a systematic review examining studies of poverty and common mental disorders in LMICs suggested few rigorous studies in LMICs exist prior to 1990, and indeed even in the two decades following (up to 2009) only 17 studies on the topic were found (Lund 2014). I aim to address these gaps in our field by contributing four studies that consider child and adolescent mental health in global data. Two of my studies (Chapter 2 and Chapter 5) are reviews which include data from low-, middle-, and high-income countries and thus allow for head-to-head comparisons and further consideration about potential (lack of) generalizability. A further two use a diverse cross-national dataset capturing predominantly low- and middle-income countries (Chapter 3 and Chapter 4).

Second, a further crucial theoretical challenge is one that asks about the boundaries between poverty and inequality as concepts. There has been longstanding acknowledgment that both concepts share core features (in that they broadly aim to capture individuals' positions or experience regarding socioeconomic resources) and that in practice it may sometimes be difficult to parse or arbitrate between them (Atkinson 1987; Grusky et al. 2006). My first contribution to this challenge is within this introductory chapter which aims to provide a cohesive overview of definitions for both concepts as well as a discussion of concrete measures and mechanisms for impact on mental health outcomes, with a particular sensitivity for children and adolescents where possible. Further, in Chapter 2 I survey definitions and operationalizations of the concept of socioeconomic status, which can capture both poverty and inequality and thus illustrates some of the ongoing tension between the two concepts.

Third, a related important challenge is that of how best to measure poverty and inequality. Two specific measurement issues are the need for precision and the presence of heterogeneity in possible definitions and operationalizations. As others have argued before, measures for poverty and inequality can vary widely and it is not always possible to 'break down' the contributions of potentially separable factors, such as income, education, employment, and food security; this issue has previously been discussed as a challenge to accurate representation of the degree and type of deprivation one experiences (Burns 2015). My contribution in relation to this challenge is both theoretical and empirical. In Chapter 2 I survey the extent to which precision and heterogeneity do exist in our field, using the concept of socioeconomic status as an opportunity for a contained critical review. There, I find not only a tremendous degree in heterogeneity and imprecision but am also able to discuss further problems of these measurement practices beyond the issues of accurate representation, such as problems for understanding mechanisms and finding effective interventions, as well as challenges to reproducibility and methodological rigor. Further, in Chapter 4 through a multiverse analysis, I am able to directly compare different measures, for both poverty and inequality, to provide a more quantitative comparisons of how these concepts and their varied operationalizations carry different implications for mental health outcomes.

Fourth, a further difficulty in our field, with both theoretical and measurement uncertainties, is found in the choice of appropriate level selection. Researchers have argued for the need to consider poverty and inequality at different levels, ranging from micro (individual) to macro-levels such as regions or countries (Lund 2014). My work in Chapter 2 evidences some of the difficulties researchers face in understanding which concept and which particular measures for it are appropriately operationalized at different levels. Although there are multiple plausible measures for poverty at a variety of levels, my work broadly advocates for the clear consideration of inequality as a relational measures best understood at meso- or macro-levels, as well as for the need to incorporate multilevel considerations when studying poverty and inequality.

Quantitatively, I provide such multilevel models in Chapter 3 and Chapter 4, illustrating how higher-order levels can further contextualize individual experiences.

Fifth, although there have been calls for stratification to better understand the relationship between poverty or inequality and mental health, such recommendations have so far been limited (for instance, to stratify by income to clarify how poverty-mental health differs at different levels of wealth, Lund 2014). Although consideration of factors such as age and gender likely seem trivial in clinical psychology, such disaggregation has often been missed, including in otherwise high-quality large-effort systematic reviews in global mental health (Lund, De Silva, et al. 2011; McGuire et al. 2022). All three quantitative studies I present here (Chapter 3, Chapter 4, Chapter 5) provide data on how poverty and inequality's effects differ between boys and girls, and across age.

Taken together, I hope my work can provide a modest but tangible contribution to global mental health efforts. The remainder of this introductory chapter defines and discusses the key risk factors (poverty and inequality), outcomes (mental health), population characteristics (children and adolescents, with consideration of gender), and interventional efforts (monetary and non-monetary) considered throughout this thesis.

1.2 Risk factors: defining poverty and inequality

1.2.1 Poverty

Poverty can be defined as a state of deprivation and lack of essential resources, capabilities, and opportunities that are required to lead a dignified life (Ravallion 2015). Historically, poverty has most often been measured through so-called objective measures relating to income or consumption-based approaches. Income thresholds are a popular measure of the former kind, such as the World Bank's poverty line which currently defines extreme poverty as living on less than $2.15 per day (based on 2017 purchasing power) (World Bank 2023). By contrast, consumption based approaches estimate poverty by assessing the level of consumption expenditure or the

value of goods and services consumed by individuals, and so for instance a household whose expenditure on a given year falls below a certain threshold (e.g. below a certain standard or below median household expenditure in a given country) could be considered poor (Cutillo et al. 2020). Both income and consumption-based measures could relate to absolute or relative poverty. Measures similar to the World Bank's threshold that rely on a specifically determined "poverty line" are referred to as measures of absolute poverty (as they are defined in absolute terms). By contrast, measures that can factor in the distribution of income or wealth within a society and can examine the extent to which individuals or households fall below a certain proportion of, for instance, the median consumption or the average income, are considered to capture relative poverty (as they are defined in relational terms).

There is still ongoing debate about the (dis)advantages of measuring poverty via either absolute or relative measures (dos Santos 2017; Decerf 2022). Absolute definitions of poverty first emerged in the 20th century (Rowntree 1901) and have generally been linked to the idea of subsistence, that is the minimum needed to sustain a life (dos Santos 2017). In this perspective, people who live below a given subsistence level (such as below a certain income cut-off) are absolutely poor as they do not have the means to independently sustain their life (Alcock 2006; Lister 2004). For instance, in economics, thresholds around food expenditure and insecurity have been widely used as proxies for poverty particularly in low-income countries (Callan and Nolan 1991). While proxies related to the experience of hunger track with the subsistence view, it still is an open question whether food security and hunger operate through the same mechanisms as poverty does on mental health. More broadly, proponents of relative measures of poverty have argued that policies that aim to prevent subsistence poverty are ineffective in regards to improving the overall conditions and circumstances of the poor (Alcock 2006) and have hence advocated for measures that incorporate relational considerations. A popular definition of relative poverty is advocated by Townsend, who suggests that poverty can be viewed as lacking resources to obtain standards of living (including diet, activities, amenities) that are customary in one's society (Townsend 1979). This view, however,

is not without opposition either, as some argue such relative definitions obfuscate the core idea of poverty and are more similar to measures of inequality (Alcock 2006).

Another popular approach to assessing poverty, that somewhat marries absolute and relative notions, is known as the 'capabilities approach', initially proposed by Amartya Sen (Sen 1999). According to the capabilities view, poverty is not simply a lack of income or resources but instead should be conceptualized as an inability of individuals to achieve certain essential 'functioning and capabilities'. Here, functionings refers to various valuable activities or states in a person's life, such as being well nourished, literate, having access to healthcare, participating in a community, having personal and political freedoms and capabilities refers to a person's actual opportunities to achieve these functionings. In the capabilities view, there is an essential absolute core regarding to functionings, but resources that are necessary to meet a fixed level of functionings may be relative and depend on one's context. For instance, the cost of accessing healthcare may increase with income standards. Hence, an absolute threshold in the space of functionings could also be accompanied by a relative threshold in the space of income (Decerf 2022).

Sen's capabilities approach was one of the first theoretical views that conceived of poverty in more multidimensional fashion. Indeed increasingly, there is a growing awareness of poverty as a dynamic (rather than static) multifaceted phenomenon influenced by structural, economic and political factors and that can encompass dimensions beyond income or expenditure, such as social exclusion, lack of education or job opportunities, limited access to healthcare and social services, food insecurity, macro-level influences from policies that relate to living wage standards, trade, taxation (Brady 2003; Reeves et al. 2021; Barlow et al. 2020). Concordantly with the theoretical awareness of poverty as a polysemic concept, there has been an increase in multidimensional, dynamic measures and subjective measures to assess poverty. Multidimensional measures, such as the Multidimensional Poverty Index (MPI, Alkire and Foster 2011) or the Human Development Index (HDI, Sagar and Najam 1998) incorporate various dimensions in assessing poverty, including education, health, living standards, in order to better capture the complex experiences of

poverty. Dynamic measures, such as the persistent poverty rate, move away from single timepoint cut-offs and assessments for poverty but instead examine longer period trends and so may better capture changes or (in)stability of trends (Jenkins and Van Kerm 2014). Subjective measures are typically obtained through self-report and capture individual's personal experiences with deprivation. Historically, particularly in work emerging during the 80s-90s the most common subjective measures relate to income (such as the Income Evaluation Question, Piedmont and Michalos 2014; Van Praag et al. 1982; or the Minimum Income Question Goedhart et al. 1977), though in more recent times subjective socioeconomic status measures, such as the MacArthur Scale have become more common (Adler et al. 1994).

It is important to also note that different measures of poverty may be conceptually distinct (e.g. absolute vs relative views), may capture different individuals or segments of the same population (e.g. those living below a certain income cut-off may be different from those whose income is below the average income in their state) and can have different implications for different outcomes, including mental health, particularly in regards to mechanisms (e.g. chronic stress vs social exclusion), the magnitude and significance of the relationships (Kakwani 1993; Notten and De Neubourg 2011; Jolliffe 2001; Ravallion and Chen 2011; Yoshikawa, Aber, et al. 2012) and so different measures should not be considered interchangeable even if they underpin the same umbrella construct. The use of potentially different indicators of poverty is discussed again the Chapters 3 and 4. More broadly, the wide variety of different measures and conceptualizations of poverty speaks to its complexity and the challenges of most appropriately capturing it and its effects. This issue is further discussed in the specific context of variable operationalizations in Chapter 2.

1.2.2 Inequality

As a concept, inequality aims to describe the (unequal) distribution of resources, including opportunities, wealth, power, within a given context or society. Inequality can be measured using a variety of indicators, with ones based on income and wealth being the most commonly employed. Income inequality is most often assessed using

the Gini coefficient which describes income dispersion in a population (Dorfman 1979; Atkinson 1970) or the Palma ratio which compares the income share of the richest 10% to the poorest 40% in a given population (Palma and Stiglitz 2016). Wealth inequality, on the other hand, focuses on the unequal distribution of assets and property ownership (Suisse 2013) and can be measured via percentages of wealth shares between different populations or further mathematically quantified via a Pareto distribution. This type of distribution is suitable for fitting data where large portions of wealth are held by small segments of the population (Wold and Whittle 1957). Unlike measures of poverty, which tend to be measured at more proximal, micro-levels (i.e. individual or household), measures of inequality are by definition relational and so can only ever be viewed at group levels; often measured at meso- or macro-levels, such as neighborhoods or countries. The implications of using different level-variables is treated theoretically in Chapter 2 and later leveraged empirically in Chapter 4.

Similar to trends in the literature examining poverty, there has been a recent move to consider measures beyond the more traditional approaches centered on income, productivity, and output (wealth)-based inequality. There is an increased awareness of the multidimensional aspects of inequality, and so there has been a recent wider adoption of inequality indicators related to education, health, social mobility, rights among others. One such example is the Gender Inequality Index (GII) which is a composite measures tracking reproductive health, empowerment, and the labour market to provide an overall score that indicates the degree of (in)equality between women and men in a given population (Amin and Sabermahani 2017). Other popular measures include the Education Gini and the Opportunity Gini, both of which estimate inequality in the same core way as the Gini coefficient for income inequality, although these focus on inequality in educational attainment and presence of opportunities and choices respectively (Thomas et al. 2001; Weymark 2003).

In sum, poverty measures typically primarily focus on the condition of individuals or households lacking basic necessities and opportunities and are thus able to capture the (in)adequacy of resources required for a decent standard of living. Poverty is

often measured through absolute or relative thresholds, indicating the proportion of individuals or households falling below specific income or consumption levels. In contrast, inequality measures typically describe the (un)equal distribution of resources and opportunities across an entire population or specific subgroups, highlighting variations in outcomes and disparities between different social groups. Inequality measurement aims to quantify dispersion and so is able to focus on the distributional patterns of resources or outcomes. The issue of how these different measures relate to children and adolescents' mental health is further discussed in Chapter 4.

Socioeconomic status

Socioeconomic status (SES) is an important concept within the family of measures that describe individuals' socioeconomic experiences and (access to) resources, like poverty and inequality. It is a very commonly used measure in the child and adolescent mental health literature, where low SES is an established risk factor for poor mental health (Reiss 2013). However, there are challenges in understanding how SES relates to poverty and inequality and what it specifically captures. At a broad level, it can often be treated as a multidimensional construct that refers to an individual's position in society based on various economic and social factors and is often measured using a combination of indicators such as income, education level, occupation, and sometimes additional factors like housing conditions and neighborhood characteristics. Nevertheless, there is still significant disagreement in how researchers theoretically view SES. Some define its central aim as capturing absolute levels of resources (Bukowski et al. 2020) and so as such position SES as more closely relating to poverty measures. Others see SES as more centrally aligned to the aim of positioning individuals in a socioeconomic gradient relative to others, and in that regard treat SES as more closely related to measures of inequality (Quon and McGrath 2015). I query in more detail the implications of such theoretical and measurement heterogeneity in Chapter 2.

1.3 Outcomes: defining mental health

The World Health Organization (WHO) defines mental health as 'a state of well-being in which every individual realizes their own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to their community' (World Health Organization 2023b). It involves consideration of the emotional, psychological, and social aspects of a person's life that can shape their thoughts, feelings, and behaviors. Mental health is not merely the absence of mental disorders but can describe a positive state of functioning, resilience, and overall well-being. It is a dynamic concept that varies across individuals, cultures, and contexts, influenced by biological, psychological, and social factors (Keyes 2002). In this light, understanding mental health as a multidimensional construct that can be shaped by various social determinants is relevant for comprehensive assessment, promotion, and support of individuals' mental wellbeing.

The global burden of mental health problems is substantial, with an estimated 1 in 8 people in the world living with a mental disorder (or approximately 1 billion people) (World Health Organization 2022), underscoring the importance of addressing mental health as a significant public health concern. Worldwide, some of the most common mental health problems include depression, anxiety disorders, bipolar disorder, and schizophrenia (Lewis and Hayes 2019). In children and adolescents, prevalent mental health issues encompass attention-deficit/hyperactivity disorder (ADHD), conduct disorders, anxiety disorders, and mood disorders like depression (Polanczyk et al. 2015). To measure mental health problems, various assessment tools are used, such as diagnostic interviews, symptom rating scales, and self-report questionnaires. These measures evaluate the presence and severity of symptoms, functional impairment, and overall psychological wellbeing.

There is ongoing academic debate about the most appropriate ways to define and conceptually approach mental health, with two particularly prominent views at present: the p factor model and the network model of mental health. In the p

factor view, a common factor (the p factor) underlies mental disorders, paralleling the conceptualization of a g factor for general intelligence (Caspi et al. 2014). By contrast, the network view does not assume as shared common factor underlying mental health symptomatology but instead posits that psychopathology is better understood as a causal interplay of symptoms (Boschloo et al. 2015). For the purposes of this thesis, I do not aim to arbitrate between these two views but rather take an inclusive approach that captures a broad range of measures that can track one's mental health, including clinical diagnoses (e.g. PTSD, depression) and specific symptomatology (e.g internalizing symptoms, behavioral or emotional problems), regardless of the context of obtaining these measures (e.g. clinical setting, self-report). At the same time, this thesis focuses exclusively on mental health measures and does not consider general wellbeing measures, such as those assessing life satisfaction, happiness or positive affective states. While I see these measures as complementary and related, I take a more narrow focus here for the purpose of limiting heterogeneity and improving precision, as well as clinically-oriented relevance for policy.

While mental health measures are popular in the clinical and epidemiological literatures, historically this family of measures has not been particularly prevalent within economic research and interventions in the context of poverty alleviation and global health. This is in part due to the historical preference for 'objective' measures, particularly easily verifiable biologically based measures such as height, weight, vaccination status. Such commonly used economic measures can tell us if beneficiaries of interventions are able to buy textbooks for school, obtain nutritious food, or secure their home from environmental impacts. These measures cannot tell us what it feels like to learn in a classroom, to eat well and not be hungry, to know that you are safe and protected. But mental health measures can help to this end: they can tell us about the lives of beneficiaries, how worried they are, if they can sleep well or not, if they have experienced low mood or distress, and if any of the interventional efforts have made their lives better in any of these regards. Despite their importance, mental health outcomes are rarely the key focus of global health interventions today. When they are present, they are a secondary outcome

and the interventions are not necessarily designed with a (primary) consideration on improving mental health (Zaneva et al. 2022). Global poverty alleviation efforts that disregard the importance of mental health may be mis-allocating resources or missing out on important ways to improve people's lives or leaving them vulnerable to the effects of the vicious cycle between poverty and mental ill health.

1.3.1 Mechanisms for mental health risk

Multiple mechanisms have been suggested through which poverty and inequality may impact mental health outcomes and there is still ongoing discussion regarding some of these pathways, their direction, strength, and malleability, and in turn, their overall suitability in terms of potential interventional targets. At a broad level, two key ideas have been proposed to explain how mental health and social factors, such as poverty or inequality, can impact each other: social drift and social causation. Social drift refers to the a process whereby individuals with mental health problems tend to experience downward social mobility over time, such as for instance being more likely to live in impoverished neighborhoods, less likely to maintain a stable job or complete their education (Bhui et al. 2012). Social causation suggests that social factors, such as poverty, inequality, discrimination, can lead to or exacerbate mental health problems; thus suggesting, for instance, that people who face discrimination based on race, gender or sexual identity may experience chronic stress, higher rates of anxiety or depression (Gupta, de Wit, et al. 2007). Together, social causation and social drift describe how mental health and poverty or inequality can build into a vicious cycle: social drift models suggest that mental health problems can negative impact a person's social and economic position, and in turn, exacerbate their mental health, whereas social causation suggests that social circumstances and experiences can lead to mental health problems and further trap people into poverty.

Poverty and mental health

One well-evidenced mechanism for poverty's impacts on mental health relates to chronic stress. There is a wide consideration of a variety of chronic stressors

linked with poverty, which approximately relate to either limited access to essential resources (such as healthcare, education, nutritious food, safe housing), or stressors which pertain more to one's social position, perception (including lack of safety in one's neighborhood, stigma and social disadvantage, which is sometimes captured through low socioeconomic status). Prolonged exposure to these factors has been associated with chronic stress and increases in risk for mental health problems (particularly internalizing problems). A lot of high-quality and causal evidence for this relationship, such as from randomized controlled trials, is in adult populations (Haushofer and Fehr 2014), though in the last 10-15 years it has also been robustly supported for children and adolescents via a mixed-methods body of work, including various longitudinal surveys, quasiexperimental and experimental or interventional work (Evans and Kim 2013). Evidence on this relationship in young people has considered how poverty impacts mental health via measures of stress that are subjective, such as increases in self, parental, or teacher- reported stress (Evans and English 2002), as well as biological markers, including elevated blood pressure, dysregulated cortisol, greater degree of inflammation (Miller et al. 2011; Evans and Kim 2013). Further, there is evidence for a longitudinal relationship between childhood poverty and elevated allostatic load, a measure of chronic wear and tear in the body caused by responses to environmental changes such as stress, in young adults (Blair et al. 2011; Evans and Kim 2013).

As a related mechanism, it has also been suggested that prolonged exposure to poverty and its associated risks and stressors may prevent children and youth from developing healthy, adaptive coping and self-regulation behaviors and so may pose risks to mental health. Indeed there is some limited evidence that low-income adolescents tend to rely on disengagement coping strategies which are associated with greater levels of internalizing and externalizing problems (Wolff et al. 2010). There is also some evidence that many of the processes that underpin self-regulation, such as attention and inhibitory control, delay of gratification, can be negatively impacted by chronic stress, and so perhaps comprised in young people who experience poverty (Blair et al. 2011). This seems like an important deficit, as complementary work

has indicated that, in low-income children, those with better self-regulatory skills tend to be more resilient to mental ill health (Blair 2010; Evans and Kim 2013).

Independent of the contributions of stress, social exclusion and stigma associated with poverty can both adversely affect mental health. In particular, feelings of shame, low self-esteem and limited social support, can be contributors to psychological distress and mental ill health (Pescosolido et al. 2008). Evidence seems very limited for children and adolescence at present, though some cohort studies suggest higher scores on indicators of social exclusion are associated with significant increases in internalizing and externalizing problems in 7-11 year olds (González et al. 2023). Others have also suggested that the limited opportunities for social mobility associated with poverty, particularly in regards to education and employment, can lead to feelings of hopelessness and a sense of feeling trapped in challenging circumstances, and so negatively impact mental health (Simandan 2018). Understandably, this is better evidenced in adults, though there is emerging evidence that a positive perception of possible upward social mobility tracks with a decreased likelihood of substance use and externalizing problems including fighting (Ritterman Weintraub et al. 2015).

Inequality and mental health

Since inequality is by definition a relational concept, researchers have argued that the mechanisms for the relationship between inequality and mental health can be more appropriately described in a framework that considers the level or unit of measurement, with some mechanisms only operating on some levels and others being shared or similar across levels (Patel, Burns, et al. 2018).

At a meso-level, such as neighborhood or area-level analyses, two widely discussed mechanisms are the status anxiety hypothesis and the social capital hypothesis. First, status anxiety pertains to the idea of social comparison, namely that comparing one's position relative to others, who are better off in terms of, for instance wealth, status, freedoms or opportunities, can create feelings of injustice, frustration or social defeat (Pickett and Wilkinson 2015). This in turn is associated with negative

mental health outcomes, including for adolescents, though the evidence base is more limited (Novick et al. 2011). Second, the social capital hypothesis posits that income inequality erodes key forms of social capital, such as social trust and structures that support social interaction and cooperation (e.g. opportunities to participate in community life as an in-group member). In this fashion, income inequality can operate as a risk factor for social isolation, loneliness, and alienation. Perception of group membership and belonging may be particularly important during adolescence as there is evidence that belonging and a sense of secure group membership during this important developmental period are linked to better mental health and higher self-esteem (Greig 2003).

At a macro-level, such as regional or country-level analyses, one of the most widely debated mechanisms is the so-called neo-material hypothesis. This denotes the idea that greater inequality co-occurs with material deprivation, such as unsafe housing or insufficient availability of trained psychiatrists in a given country. This neo-material view should be considered with caution, given a contradicting analysis suggesting that American states with greater degree of inequality do not spend less on health care (Zimmerman and Bell 2006). Indeed, evidence that supports the neo-material hypothesis also comes from the comparison of American states (specifically adults with physical illness and depression, Muramatsu 2003) and so we know little outside this context, such as whether this holds across low- and middle-income countries. Moreover, a recent review was unable to find any cross-national analyses that test this hypothesis and compare different countries head-to-head (Patel, Burns, et al. 2018), so while this hypothesis may appear theoretically plausible, it necessitates further empirical support. It is also worth noting that in the context of general and mental health, this mechanism is plausible only at higher-levels, since relevant policies, spending decisions, or resource allocation are more often determined at macro-levels (Fone et al. 2013).

At the same time, it is also important to consider how some mechanisms may operate similarly at different (meso and macro) levels. For instance, some have posited that unequal distributions of resources (e.g. within local communities or

countries) are at the heart of social stratification, discrimination, and marginalization, which are all in turn linked with worse mental health, particularly for those who are disadvantaged (McLeod 2013). At more pronounced levels of inequality, lack of social cohesion can be eroded and trust in local councils or state governments can diminish; social cohesion in turn is linked to increased rates of mental health problems (Kawachi et al. 1999; Chuang et al. 2013; Delhey and Dragolov 2014). Overall, the consideration of the level of measurement is theoretically important for justifying a plausible mechanism. On the basis of a review on the relationship between inequality and depression, which found more null effects at the district levels and more pronounced effects at national levels, researchers have also argued that a practical consideration of geographical level as a moderator may be appropriate (Patel, Burns, et al. 2018). Indeed, as others have suggested, neighborhoods may tend to be fairly homogenous and so less unequal, whereas broader levels, such as states, may capture more heterogenous groups and thus stronger contrasts of inequality(Ahern and Galea 2006).

For completeness, it is worth reflecting that poverty and inequality may also share similar mechanisms. In particular, the experience of shame, stigma, social isolation could likely be shared mechanisms. These candidate mechanisms likely hold not only in unequal contexts but in fairly equal contexts. For instance, there is evidence from interventional cash transfer trials in low-income contexts that people who live on comparably (low) incomes (and in that sense fairly economically equal areas) still report experiencing negative effects of poverty through social comparison and stigma (Hochfeld and Plagerson 2011). In other words, even in cases where there is poverty but little inequality, poverty can act through mechanisms that are not exclusively about the experience of material deprivation or lack of resources.

1.4 Population: defining childhood and adolescence

1.4.1 Childhood

Childhood refers to one of earliest stage of human life, preceding adolescence and adulthood. It is a pivotal phase characterized by significant development in terms of physical growth, cognitive, social, emotional capacities and skills (Clark 2004; Mascolo and Griffin 2013; Smith and Hart 2022). Childhood is often divided into two periods, namely early childhood (infancy to 6 years of age) and middle childhood or pre-adolescence (6 to 12 years of age) (National Research Council 1984). In early childhood there is rapid physical growth and significant developmental milestones typically occur, such as learning to walk and speak (Moore et al. 2019). In the later period, more sophisticated skills develop. Language development progresses rapidly, enabling children to communicate, think, and learn about the world around them (McCarthy 1946; Oates and Grayson 2004). Additionally, childhood is when individuals develop reasoning skills, problem-solving abilities, and abstract thinking abilities (Meadows 2006). In young age, children also learn essential social skills, including empathy, cooperation, and conflict resolution (Selman 1971). These skills form the basis for healthy relationships and societal interactions throughout the life course and as such childhood is a deeply important period when considering life outcomes.

Childhood and mental health

There is ongoing debate regarding the exact ages where different mental health problems emerge (and to what extent different mental disorders are separable at early ages), though there is wider agreement that childhood and adolescence are broadly the key developmental periods for most common mental health disorders (Seligman and Ollendick 1998). In childhood, consensus suggests that specific types of anxiety can develop very early on, such as separation anxiety disorders and some specific phobias, such as those related to fear of animals and environmental stressors,

like thunderstorms (Morris and Kratochwill 1998; Muris et al. 1998), where most cases emerge before the age of 12 years. Precision in obtaining estimates for onset depends on key challenges, including the availability of age-appropriate assessment tools for mental health, as well as the availability of data that considers sufficiently broad age ranges. As others have argued before, it is possible that some estimates for the onset of different mental health problems may not be precise, as surveys tend to more often include older children and adolescents (Beesdo et al. 2009) and it may be that children are thus a neglected population (Cartwright-Hatton et al. 2006). It is thus important to consider age in the context of mental health problems.

Complementary research has shown that early experiences and environments play a crucial role in shaping different outcomes throughout life, including mental health outcomes. Adverse childhood experiences, such as trauma, neglect, or abuse, have been linked to an increased risk of mental health issues, including anxiety, depression, and behavioral disorders (Felitti et al. 1998; Green et al. 2010). Conversely, positive relationships, supportive environments, and access to quality healthcare and education can be protective, promote resilience and foster positive mental health in children (World Health Organization 2015). Recognizing the significance of life experiences in the context of mental health in childhood is essential for promoting healthy development and laying the foundation for lifelong health.

In this dissertation, the risk factors of interest are deprivation and inequality. Children growing up in disadvantaged circumstances often face increased vulnerabilities to mental health problems. Socioeconomic inequalities and poverty can have profound impacts on children's mental health outcomes, including increased stress, higher prevalences of internalizing and externalizing problems, as well as increased risk for development of clinically significant mental health conditions (McLaughlin et al. 2012; Yoshikawa, Aber, et al. 2012). A growing body of work leveraging different methodologies and empirical designs, including natural experiments (Costello et al. 2003), interventional (Huston et al. 2003), experimental (Gennetian et al. 2008; Kling et al. 2007) and quasi-experimental studies (Akee et al. 2010) suggests that the impact of poverty on childhood mental health are

causal. Evidence of a causal relationship is particularly strong for family poverty, most often measured through household income, followed to a slightly lesser degree by neighborhood-level poverty (most often measures as mean area income or area level inequality, Harding 2003; Yoshikawa, Aber, et al. 2012). This means that effective poverty-alleviation interventions can lead to improvements in mental health for children. However, beyond the direct and causal effect of poverty and inequality, there is mounting evidence for cumulative impacts of poverty and poverty-related factors. Such related factors can manifest as disparities in access to quality healthcare, education, and supportive environments, which are crucial for fostering positive mental health in childhood and can all in turn function as risk factors for mental health problems. This means it is very unlikely to find single 'magic bullet' intervention that can target all the effects and mechanisms of poverty and its associated risk factors (Yoshikawa, Aber, et al. 2012; Gassman-Pines and Yoshikawa 2006). A careful consideration of the most impactful mechanisms and most malleable interventional targets are needed in order to provide appropriate and effective social protection for children.

1.4.2 Adolescence

Defining adolescence

Adolescence denotes a transitional period between childhood and adulthood. It is a formative period where individuals develop a richer sense of personal identity and society (Blakemore and Mills 2014). Moreover, it is an important developmental period associated with a number of physical and psychological changes, including brain development, the acquisition of more advanced cognitive and social competences, the ability to attribute complex mental states to others (Blakemore 2008), emotional perspective taking (Choudhury et al. 2006), among others. Some of the most common and widely used definitions of adolescences have been linked with the onset of puberty (around 12 years) and legal definitions of adulthood associated with independence for decision-making (18 years) (Dahl 2004). In the series of work that follows in the next chapters, we rely on one of the most

widely used definitions of adolescence in global health as our starting point, namely the one used by the World Health Organization (WHO), which captures the period between 10 to 19 years of age (World Health Organization 2023a). Nevertheless, increasingly, there is growing awareness and recognition that biological development as well as psychological, social, and cultural expression may vary and begin earlier or later for individuals and, equally, may continue for longer or shorter periods of time. In fact some have argued that the definition of adolescence should be expanded to include those up to 25 years of age (Jaworska and MacQueen 2015). Advocates for this approach generally point to the biological maturation that continues until 25-26 years (Arain et al. 2013), as well as to more recent societal changes and trends, including increases in young adults living with their parents or caregivers and delays in starting their own families (Sawyer et al. 2018). With this in mind, for the purposes of the current projects, we consider that any sample of young people whose mean age range falls between 10-19 are considered adolescence, even if part of the sample extend beyond 19 but not above 26 years of age.

Adolescence and mental health

Adolescence is not only a critically important period of rapid changes and development but, some have argued, a period associated with particular risks and vulnerabilities. Several mental health disorders tend to emerge or develop during this developmental stage. Both empirical work and literature reviews suggest that approximately half of all lifetime mental disorders develop by mid-teens and about 75% before 25 years of age (Kessler et al. 2007). Different clinical problems emerge at different periods, with phobias and impulse control disorders emerging from childhood to mid-adolescence, and anxiety disorders, mood disorders, substance disorders typically first emerging for most in older adolescence (Kessler et al. 2007; Vaingankar et al. 2013), though there is evidence that for some this can happen much earlier in childhood as well (Edwards et al. 2010). Globally, during adolescence a stable pattern of gender differences in mental health emerges such that girls tend to report higher levels of internalizing problems (Campbell et al. 2021). Notably as

well, the presence of risk factors such as poverty and inequality during adolescence can exacerbate the vulnerability to mental health problems. Numerous studies have highlighted the detrimental effects of socioeconomic disadvantage on adolescent mental health. Adolescents from low-income backgrounds are at a higher risk of developing mental health disorders, including depression, anxiety, and conduct disorders (McLaughlin et al. 2012; Reiss 2013). Persistent poverty and material deprivation, combined with factors associated with poverty such as limited access to healthcare, stigma can impede individuals' ability to seek and receive appropriate mental health support (Heflinger and Hinshaw 2010). Moreover, social inequality, characterized by disparities in wealth, education, and social status, can contribute to feelings of social exclusion and decreased self-esteem, further increasing the risk of mental health problems (Wilkinson and Pickett 2010; Lorant et al. 2003).

1.4.3 Gender and mental health

In light of the need for careful thinking in understanding how risk factors such as poverty and inequality for mental health operate across development, nuance about vulnerable populations is warranted. For instance, in the broader economic literature, there is a growing awareness of how spatial and geographic context can be associated with further deprivation, oftentimes leaving rural or indigenous populations particularly vulnerable and so calling attention for the need to disaggregate data and consider sub-group effects (Cookson 2018). Within this thesis, a risk factor of particular interest is gender. This is because of the already discussed existing gaps in mental health between boys and girls (Campbell et al. 2021), as well as girls' (and later on, women's) increased vulnerability to the effects of multidimensional poverty which likely further exacerbates risks to mental health (Bastos et al. 2009; Jones et al. 2010). In the face of gender bias, particularly in patriarchal contexts, girls may face certain expectations, such as for early marriage including child marriage, and are more likely to experience gender-based violence including sexual exploitation, in addition to barriers to accessing or continuing education, and more restricted opportunities for employment (Yunus 2021; Ellsberg

et al. 2015; Nour 2009). There is further evidence that girls are more likely to work in more hazardous labor environments than boys and also face greater exploitation in those environments (Blunch and Verner 2001; Mazurana and McKay 2001). At the same time, boys' experiences of poverty seem understudied and there is limited but worrying evidence that adolescent boys living in persistent poverty are more likely than girls to report behavioral problems (Wilkins et al. 2004) and that they benefit less from certain interventions, such as relocation away from high risk areas (Clampet-Lundquist et al. 2011). Another understudied population is trans and genderqueer youth. Recent evidence has highlighted the particularly vulnerabilities for trans youth, as studies indicate being trans is associated with higher likelihood of reporting mental ill health in adolescence (Connolly et al. 2016) and of experiencing poverty, in particular homelessness (Kia et al. 2020). Unfortunately, global health efforts, including large cross-national surveys and population health monitoring rarely capture and assess the wellbeing and needs of trans adults and youth (Reisner et al. 2016). Indeed, in unfortunate alignment with this lack of inclusion, none of the data used in this thesis surveyed trans youth's experiences.

1.5 Interventions and social protections

1.5.1 Mental health interventions and their importance

Intervention during childhood and adolescence can play a pivotal role in mitigating the detrimental effects of mental health risks and promoting positive well-being. Some have argued these early life stages are sensitive (or critical) periods in development for later on adult cognition, mental health, education, and overall health (Van den Berg et al. 2014). Hence, these developmental stages provide a unique opportunity to ensure appropriate maturation for health and wellbeing throughout the lifecourse. Moreover, early identification and intervention are crucial, as untreated mental health problems in adolescence can persist into adulthood and lead to long-term impairment (Copeland et al. 2009). Effective interventions targeting mental health problems can help alleviate negative symptoms, improve

coping mechanisms, and enhance resilience among children and adolescents – though there is still discussion about what form such interventions should optimally take.

Traditionally, popular approaches to mental ill health have been informed by either biomedical or biopsychosocial views, with proponents of the former suggesting that mental problems can be assessed as brain diseases (and thus treated in a clinically or pharmacologically informed manner) and proponents of the latter advocating that mental health problems are better explained in a wider social and environmental context (and so might benefit from integration of a wider array of social support) (Deacon 2013). Well-known and effective treatment approaches include drug prescriptions and talking therapy (Amick et al. 2015), though medications such as antidepressants are rarely a first line treatment and particularly so for children and adolescents (Cheung et al. 2006). There is a mixed body of evidence for school-based interventions, such as mental health promotion programs and targeted interventions for at-risk individuals, including mindfulness activities, anti-bullying interventions, programs that build prosocial norms. Some school-based interventions show promising results in reducing the prevalence and severity of mental health problems (Kieling et al. 2011; Weare and Nind 2011; Guzman-Holst et al. 2022), and others, including interventional trials and meta-analyses of interventions suggesting overall inefectiveness or very small positive effects that likely fall below clinical significance (Guzman-Holst et al. 2022) or, in some cases, that there may also be evidence for harm relative to control arms, particularly for students who are already vulnerable (Foulkes and Stringaris 2023). The majority of higher-quality evidence for these kinds of school-based efforts comes from high-income settings and there remains an outstanding question about the generalizability of such findings. More broadly, and perhaps more importantly, there is a further question about the appropriateness of such interventions that, for instance, target social relationships or norms, or teach mindfulness, in other settings, particularly when trying to promote better mental health in children and adolescents living in poverty. Indeed, the history of developmental economics illustrates this poignantly: when economists first began deploying randomized controlled trials at

larger scale in East Africa in the 1990s with the aim of promoting school attendance and child and adolescent wellbeing, many conventional school-based approaches, such as the provision of textbooks or altering the student to teacher ratios, were ineffective. The single most effective intervention for both educational attainment and overall health, which is now a widely popular intervention, was found to be deworming (Miguel and Kremer 2004; Duflo and Banerjee 2011). This highlights the need for careful assessment of appropriateness and lived experience, before the provision of services or interventional support. Furthermore, in this regard psychologists have argued for the need to integrate mental health support into primary healthcare, education, and communities as a way to enhance accessibility and ensure timely support for adolescents in need (Patel, Flisher, et al. 2007). Multidisciplinary approaches, involving collaboration between healthcare providers, educators, families, and community organizations, seem essential for comprehensive intervention efforts and for a better, more holistic, understanding of needs.

1.5.2 Mental health interventions in the context of poverty and inequality

Interventions targeting adolescent mental health in the context of poverty and inequality face unique challenges that require careful consideration. First, young people from disadvantaged backgrounds often encounter barriers to accessing mental health services, such as limited financial resources, lack of transportation, and inadequate healthcare infrastructure (Cookson 2018). In the context of public health, this circumstance is sometimes referred to as the 'inverse care law' describing the tendency that those who most need care are often most deprived of access to it (Hart 1971). While there is a treatment gap everywhere in the world today, needs are more unequally (un)met in certain geographical areas. For instance, estimates from the last decade suggest there is approximately 1 psychiatrist per 2.5 million people in Africa and 1 psychiatrist per 435,000 people in South East Asia, whereas in the UK the NHS estimates there is 1 psychiatrist per 12,567 people (Crick Lund et al. 2012).

Such systemic barriers to access to care can hinder the reach and effectiveness of interventions, as many children and adolescents in poverty-stricken areas may not receive the necessary support and resources to address their mental health needs. Additionally, some have argued that cultural (including urban-rural divides), social and linguistic factors, along with the stigma surrounding mental health issues, can further impede help-seeking behaviors within marginalized communities (Memon et al. 2016; Goodman, Pugach, et al. 2013; Kirmayer et al. 2011; Virupaksha et al. 2014; González 2005). Moreover, interventions aimed at addressing mental health in the context of poverty and inequality require a comprehensive and multidimensional approach that takes into account the social determinants of mental health, including housing, education, and employment (Alegría et al. 2018). Overcoming these challenges likely necessitates collaboration among various stakeholders, including policymakers, community organizations, and healthcare providers, to develop culturally sensitive, accessible, and contextually relevant interventions that address the specific needs and circumstances of adolescents facing poverty and inequality. Without a consideration of the social determinants and lived experiences of young people living in poverty, interventions that primarily target mental health but are not responsive to the environment in which people live, could potentially leave people vulnerable and once again facing the same adverse conditions. With this in mind, some have argued that economic interventions, such as those providing monetary support in the form of cash transfers or grants, could be suitable interventions not only for poverty alleviation but for protecting young people's mental health (Lund, De Silva, et al. 2011). This claim is further evaluated in Chapter 5.

1.6 Thesis outline

This thesis explores what poverty and inequality are, how they are measured, how different operationalizations of both may impact child and adolescent mental health. It sits in relation to five key challenges in the field of child and adolescent global mental health: 1) lack of diverse data and lack of data for young people, 2) theoretical difficulties in defining and clarifying the differences between poverty

and inequality, 3) measurement problems relating to precision, heterogeneity, 4) appropriate choice of level, and 5) need for sub-group disaggregation.

Poverty and inequality are both established risk factors for mental ill health, though they are most often measured at different levels, with poverty more commonly tracking individual-level experience or related proximal experiences at slightly broader levels (such as household poverty) and inequality more often assessing meso- or macro-levels (such as neighborhood or country-level inequality). Both concepts can be assessed through a wide array of different possible measures. This wide heterogeneity in measurement, as well as difference in levels for mechanisms of impact, pose challenges for clarifying any impacts on mental health. Beyond transparent and robust measurement and reporting practices, careful analytical approaches are needed to ensure the robustness of results. This can include moving beyond single-model analytical strategies and instead mapping multiple possible analytical decisions, or more nuanced consideration of impacts of risks or interventions, such as by moving beyond overall impacts but also considering the nuance that potential disaggregation by sub-groups can offer (e.g. children vs adolescents, boys vs girls).

In a critical literature review, Chapter 2 charts the definitional space of the concept of socioeconomic status and assess potentials implications of heterogenous operationalizations, particularly for different mechanisms and interventions in the context of young people's mental health. Chapter 3 zooms in on hunger as a measure for individual-level deprivation and investigates its relationship with mental health in a large cross-national sample. Chapter 4 broadens out beyond the individual level and examines how country-level indeces for inequality and poverty related to children and adolescents' mental health through a multiverse analysis. Through a systematic review and meta-analysis, Chapter 5 turns to investigating the impact of one candidate interventional approach, cash transfers, on mental health outcomes.

2

What do we mean when we talk about socioeconomic status (SES)?

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Low socioeconomic status (SES) has been well established as an important risk factor for a variety of general and mental health outcomes. But what this claim means in practice is unclear because there is no single widely accepted definition or operationalization for SES. Instead, this concept comprises multiple definitions and has been represented through a variety of distinct factors and variables in empirical research. The current study aims to map the definitions and operationalizations of socioeconomic status in the literature on child and adolescent mental health through a preregistered literature review. We searched the PsycINFO database for relevant publications from 2013 until 2021. Two reviewers independently screened results and

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we included 246 relevant papers. We synthesize the different types of SES measures represented in this literature and find an extraordinary degree of variability in the way SES is operationalized. Our work queries the implications of this heterogeneity in measures underpinning the same concept and raises questions about the policy implications of this literature. We point to fundamental problems, including lack of clear definitions or sufficient detail regarding which variables are used or how measures are constructed. Further, we query the lack of measures that are directly reported from adolescents or are more targeted to capturing children and adolescents' socioeconomic experiences. We also discuss issues pertaining to measurement and mechanisms (such as use of proxies, composite measures, dichomatization, etc.) as well as their relevance for computational and conceptual reproducibility, policy and intervention design. On the basis of our review, we encourage a stronger consideration and use of SES measures that more directly assess the socioeconomic position of children and adolescents. We recommend increased transparency and specificity in reporting which measures are used and why they were selected. The wide variety of distinct measures used to represent SES, without sufficient transparency in reporting, may prevent our understanding of what truly drives observed effects and may obfuscate further work on establishing causal relationships, in turn making the path to effective intervention more difficult.

2.1 Introduction

There is a robust, well-established literature indicating that low socioeconomic status (SES) is a risk factor for general and mental health outcomes (Marmot and Bell 2012; Wilkinson and Pickett 2010; Lund, Brooke-Sumner, et al. 2018). With reports of inequality globally on the rise (Nolan et al. 2019; Ravallion 2014) and the recent Covid-19 pandemic putting increased numbers of people below poverty thresholds (UNICEF 2023) we urgently need evidence on the mechanisms through which socioeconomic status affects mental health, and particularly, how they do so for young people. Mental ill health in childhood and adolescence can lead to

lifelong psychological problems and material deprivation, and so early intervention is key for breaking the vicious cycle of poverty and mental ill health.

However, knowing how to intervene may prove difficult, as there is no universal definition of SES (Saegert et al. 2006; Shavers 2007). Different studies and researchers employ different operationalizations. In their latest review, the APA taskforce on socioeconomic status (Saegert et al. 2006) considered varied measures corresponding to education, income, occupation, social class, and material inequality. A systematic review focusing on the effect of SES on child and adolescent mental health similarly included a wide range of possible SES measures (conceptualizing socioeconomic status with a range of search terms including "socioeconomic", "poverty", "social inequality", "income") (Reiss et al. 2019). This heterogeneity in measurement is grounded in the fact that SES is a broad concept which is designed to capture access to a range of opportunities and resources (e.g. cultural capital, housing quality).

Nevertheless, the varied operationalizations of SES are a challenge to aggregating evidence and identifying paths to intervention. Different SES facets (e.g. income vs educational attainment) can yield distinct effects on child and adolescent mental health and taking them together may produce inconclusive results. In particular, a recent meta-analysis of evidence in the US (Peverill et al. 2021) found that effects on child mental health varied across five different operationalizations of SES, and further across different groups of participants. For intervention, it is important to understand the most impactful facets of SES. For instance, there is some empirical evidence that different measures that serve as proxies for SES have varying relationships with adolescents' health such that correlations between SES and the various SES indicators could range from weak to moderate (Moor et al. 2019).

Worryingly, at the same time we are still lacking a more fundamental survey of the literature to understand how cohesive or varied SES operationalizations are in practice, as well at the potential implications of different operationalizations. As a related sub-question, we also query the extent to which researchers theoretically motivate their specific choices of measures. One particular problem in this regard is

whether socioeconomic status should be a measure more closely associated with theories and measures of poverty or inequality and there is currently no cohesively established view on this. Some researchers define the central aim of socioeconomic status as capturing absolute levels of resources (Bukowski et al. 2020) and so as such position SES as more closely relating to poverty measures. Others, however, see SES as more centrally aligned to the aim of understanding where individuals fall in a socioeconomic gradient relative to others, and in that regard treat SES as more closely related to measures of inequality (Quon and McGrath 2015).

Here, we focus on the topic of measuring SES within the child and adolescent mental health literature. This is particularly important as early intervention can prevent various adverse outcomes over the lifecourse (e.g. clustering of health, crime and social welfare inequality, Richmond-Rakerd et al. 2020). Concurrently, measuring and conceptualizing the SES of young people, especially adolescents and children, is notably challenging. Previous work has done so through varied measures including parental or household income, job status and education level of family members, perceived neighborhood safety or area-level deprivation among others. As some researchers have cautioned about missing data and the validity of such measures when they are reported by children or adolescents, it remains common for these SES proxies to be widely caregiver reported (Currie et al. 1997). However, it is not always clear which facets of parentally-reported or other higher-level (e.g. neighborhood or school-level) measures are most relevant to adolescents' lives and mental health, or how well differing aspects are captured under varied SES measures (Potter et al. 2005). Here, we chart the definitional space of SES within the child and adolescent mental health literature with a view to examine the operationalizations of this concept in practice and provide recommendations for transparent reporting to facilitate social policy and intervention work.

2.2 Methods

We conducted a preregistered literature review of published papers that investigate the impact of SES on child and adolescent health. We searched the PsycINFO database for relevant publications from 2013 until 2021. In our search strategy, we used subject headings to specify the topics of interest (socioeconomic status and mental health) as well as keywords to specify the relevant age group (children and adolescents). Our syntax was: (child* OR adolescent*) AND 'socioeconomic status' AND ('mental health' OR 'mental status' OR 'internalizing symptoms' OR 'externalizing symptoms' OR 'behavior problems' OR 'behavior disorders' OR 'emotional disturbances' OR 'child psychopathology'). This search yielded 1062 unique papers. We note that while we used a variety of terms to capture different facets of mental health, we only used 'socioeconomic status' as a term to query for SES as we are interested in unraveling the heterogeneity underneath this specific and exact term rather than any related ones. Similarly, in terms of exclusion criteria, we did not include papers that only discussed associated concepts such as 'socioeconomic background', 'socioeconomic position', 'socioeconomic disadvantage', 'income inequality', etc. Thus, we strived to limit the heterogeneity that would be associated with the inclusion of related terms, and to keep our review focused on the specific concept of SES. Here, we take the position that socioeconomic status should describe the experiences of individuals, whereas related terms like socioeconomic disadvantage or socioeconomic inequalities may contain greater heterogeneity in measurement levels. We required that papers specifically focus on the effects of socioeconomic status on mental health and provide quantitative estimates for these. There were no inclusion criteria related to study design. Further, we included empirical papers with children or adolescents (0-18 years old). If the age range extended beyond 18 years, we included papers as long as the majority (>50%) of participants were 18 or younger. The language of the paper did not serve as an exclusion criterion.

2. What do we mean when we talk about socioeconomic status (SES)?

We had originally preregistered that the first reviewer would conduct a title and abstract screening, following which both the first and second reviewers would carry out a full text screening on the remaining papers. Instead, given the small sample of retrieved papers (n=1062), both reviewers agreed to full text screen the entire set of papers. Inter-rater reliability was high (Cohen's kappa k = 0.95) and discrepancies were resolved with a consensus meeting between the two reviewers. We retained 246 papers that met all our inclusion criteria. Both reviewers extracted the description of the SES variable(s), the description of the mental health variable(s), whether SES was a main (direct) effect or moderator. Based on the extracted descriptions, we coded the SES variable(s) in terms of type (e.g. income, education, etc.) and corresponding level (e.g. individual, neighborhood, etc.) The degree of provided detail and clarity regarding wording varied substantially. We strived to apply a consistent criterion for categorization across all papers. Note that in some cases, this led to disagreements between the authors' wording and how we coded the variable. For instance, if a paper called their SES measure 'family SES' but used a neighborhood disadvantage index as a proxy, we coded this as a neighborhood-level measure rather than a household-level one. Employment (i.e. is the individual employed?), occupation (i.e. what is the individual's occupation?), and full-time vs part-time job status were sometimes used interchangeably. Thus, we have coded all of these as "occupation", although we appreciate that they track different concepts. Relatedly, it was not always possible to discern whether a paper uses a measure of the number of years of education or the type of educational degree; we have coded both as "education".

If a paper included more than one SES measure, we coded this as "multiple" metrics and additionally, recorded the type and level of each metric included. If a paper included a composite SES measure, calculated using several metrics (for example an index based on education and occupation), we coded this as "composite". Again, we recorded the type and level of each metric included in the composite. If this composite variable was calculated based on an existing index, we recorded its name (e.g. Hollingshead index). We note that we coded income

as a household-level metric unless it was specified in the paper that solely the income of a particular family member was used (e.g. mother's income was coded as maternal level). Hence, many composite metrics including parental education and income were thus categorized as comprising multiple levels (parental and household). The study preregistration can be found on OSF: https://osf.io/5anrz/. Data and code are available within the same project: https://osf.io/cnfsb/?view_only=20ab403d56ba4d15ac0e7a9a203181f7.

2.3 Results

2.3.1 Quantitative synthesis

We included a total of 246 papers. These papers investigated the effect of socioeconomic status on different facets of child and adolescent mental health. The included mental health measures captured internalizing and externalizing problems, behavioral problems, and specific diagnoses (most commonly anxiety, depression, and PTSD). Commonly used questionnaires included the Strength and Difficulties Questionnaire (SDQ), The Child Behavior Checklist (CBCL) the Youth Self Report (YSR), the Center for Epidemiological Studies Depression Scale (CES-D), the Behavioral Problems Index (BPI), and the General Health Questionnaire (GHQ). Of the included papers, 221 examined direct effects of SES on mental health, including both cases where SES was the factor of main interest and cases where SES was used as a control in regression models[1]. In 36 of the papers SES was used as moderator for the relationship of interest. Overall, as a main finding we note a high degree of variation in the ways SES is operationalized.

Type of SES measure

Next, we report the types of SES measures in our sample along with the total number of papers featuring each type in parentheses (this information is also visualized in Figure 2.1A). The papers we included most commonly used composite

[1]Note that in all cases SES was either mentioned in the paper abstract, title, and/or keywords, suggesting theoretical focus on the relationship between SES and mental health.

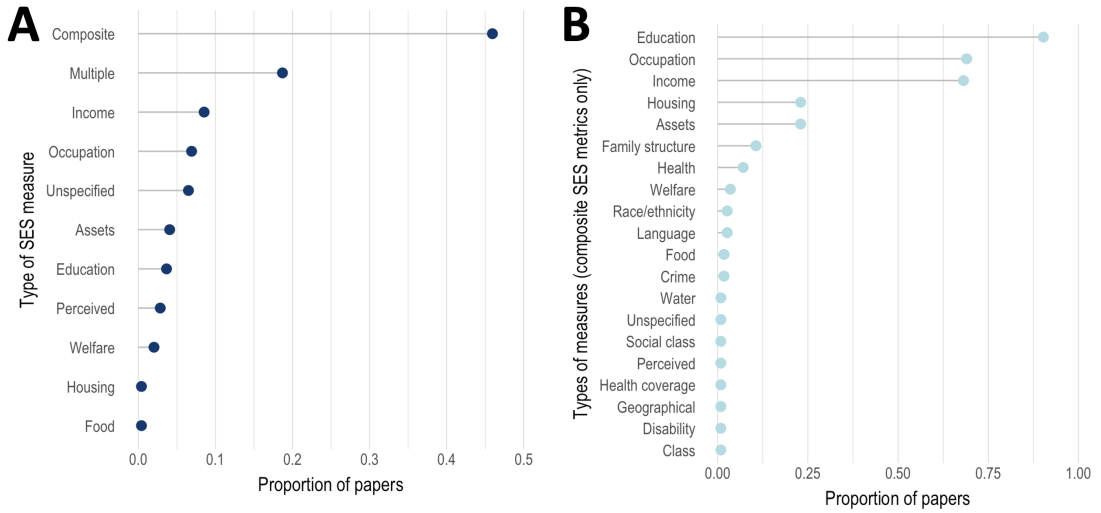

Figure 2.1: A. Proportion of papers using a different type of SES measure from our included sample. B. Proportion of papers using different types of measures from the papers using composite metrics for SES. As composite metrics include more than one measure, summing the proportions of all the measures exceeds 1.

SES measures featuring multiple metrics (113 papers) or they included multiple SES metrics separately in their analysis (46). We detail the types of metrics included in papers featuring composite and multiple metrics below. Among the papers that used a single SES metric, income (21), occupation (10) assets and education (9) were most common. We also included papers using a perceived (or subjective) metric of SES (7), metrics based on welfare receipt or eligibility (5), metrics based on food (2) and housing (1). We note that 16 of the included papers did not specify the type of SES measure used.

Level of SES measure

Regarding the level of SES measures (Figure 2.2A), many papers used SES measures comprising multiple levels (97). Commonly, papers used SES measures on the parental level (56), the level of the household (53) or neighborhood (18). Less often, papers included SES measures on the level of the mother (3), school (2) or father (1). 16 papers did not specify the level of SES measure used. Of the 97 papers using metrics comprising multiple levels (Fig. 2b), the vast majority included household-level (91), and parental level (68) measurements. Often, multi-level

SES measures included maternal level (25) and neighborhood level (10) measures. Less often, multi-level SES measures included paternal level (6), school level (2), grandparental level (1) and provincial level (1) measures.

Composite metrics

We included 113 papers featuring composite metrics (Figure 2.2B). The majority of those included measures of education (102), occupation (78) and income (77). Often, composite metrics of SES included measures of assets (26), housing (26), family structure (12) and health (8). Less commonly, composite metrics of SES included measures of welfare eligibility or receipt (4), language proficiency (3), race or ethnicity (3), crime rate (2), social class (2), food (2), water (2), disabilities (1), health insurance coverage (1), geography (1) and perceived (or subjective) SES. We note that 1 paper did not specify the types of measures included in its composite metric.

The majority of the composite metrics were based on established SES indices. Those included the Hollingshead Index (18), The Family Affluence Scale (11), ABEP Critério de Classificação Econômica Brasil (10), Income-to-Needs Ratio (7), the Winkler Index (6), the MacArthur Scale of Subjective Socioeconomic Status (5), Socio-economic Indexes for Areas Index of Relative Socioeconomic-Disadvantage (SEIFA IRSD) (4), Socio-economic Indexes for Areas Index of Relative Socioeconomic Advantage and Disadvantage (SEIFA IRSAD) (2), Acorn (2), Social Economic Indexes for Areas (2), the Kuppuswamy Scale (2), Erikson-Goldthorpe-Portocarero Index (1), the Townsend Index of Disadvantage and Deprivation (1), and the Laucht Index (1).

Multiple measures

We included 46 papers using multiple SES measures in their analyses. The majority of those included education (39) and income (33) measures. Often, the multiple measures featured occupation (12) and assets (12) metrics. Less commonly, the multiple measures included composite measures (5), measures of family structure

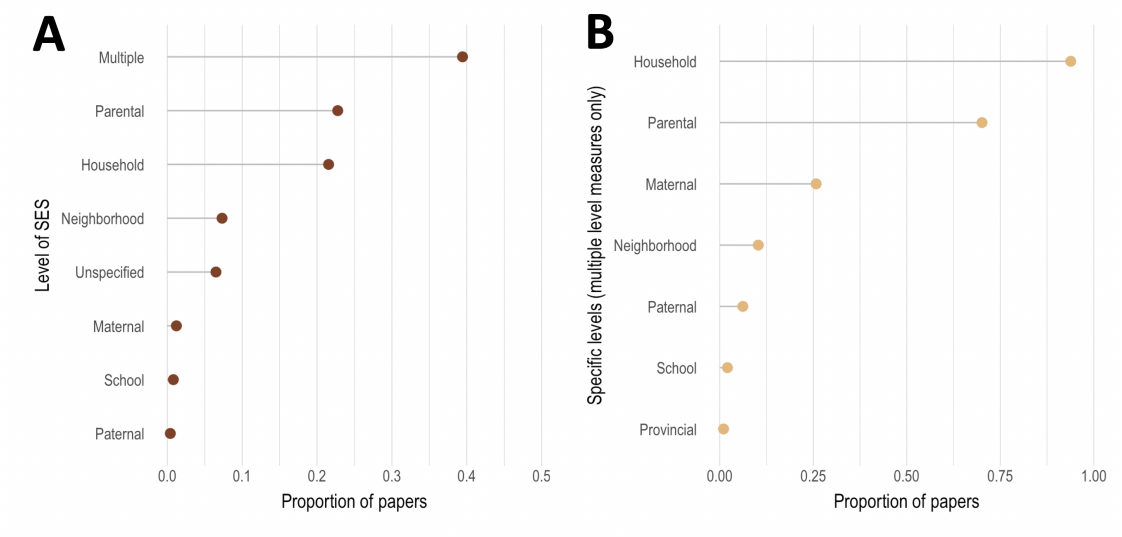

Figure 2.2: A. Proportion of papers using SES variables on different levels from our included sample. B. Proportion of papers using different levels from the papers using multiple levels.

(5), welfare eligibility or receipt (5), housing (4), perceived (or subjective) SES (4), race/ethnicity (2), food (2), adversity (1), immigration status (1), age (1). Two of the papers featured multiple metrics that were not specified.

2.3.2 Narrative synthesis

In many cases, definitions for SES were limited, unclear or not present (Ezpeleta et al. 2014; Capaldi et al. 2020; Lee and Choi 2015; Hunter et al. 2019; Macul Ferreira de Barros et al. 2020; Hong and Peltzer 2017; Tomoda et al. 2013; Theunissen et al. 2014). Less than 20 papers provided a clear justification for using a given SES metric, whether that's theoretical (Coley et al. 2019), practical (Thornton et al. 2021), or based on established convention such as previously used similar methods (Sweenie et al. 2020). Definitions were especially scarce when SES was used as a control variable in regression models, even though the fact that SES was controlled for was typically highlighted in the abstract. SES variables were sometimes missing from the methods section and were instead specified in results tables and footnotes (Theunissen et al. 2014; Wlodarczyk et al. 2016).

Notably, the choice of SES operationalization in some of our included papers was

driven by practical considerations. These considerations included the availability of suitable variables in the dataset(s) of interest (Thornton et al. 2021) or the requirements of the statistical analysis. For instance, Nepomnyaschy and colleagues investigate how the effect of father's involvement on adolescent mental health differs across the SES gradient (Nepomnyaschy et al. 2020). The authors use maternal and grandparental (on the mother's side) measures as proxies of SES, as they consider that paternal socioeconomic characteristics will likely be confounded with father's involvement. A related consideration shaped Wang et al.'s analysis; the authors report that their sample was homogenous in terms of parental occupation and education, and heterogeneity was restricted to household income (Wang et al. 2020).

Income indicators

Income was among the most commonly used indicators or proxies for SES, sometimes chosen without a justification (Nelson et al. 2021; Navarrete et al. 2018). Income-based metrics varied in regards of frequency (e.g. monthly or annual income), level (e.g. parent or household) and whether they were reported in absolute or relative terms. For relative income measures, the reference point was often determined by the proximal context (e.g. household federal poverty level in the USA, Tran 2014; purchasing power of consumer groups in Brazil, Saur and Loureiro 2014). Similar relativity was embedded in other proxies for income, such as eligibility for welfare programs (e.g. free school meals, McKay and Cole 2017; Medicaid program participation, Peinado et al. 2014; receipt of public assistance, Peinado et al. 2014) and financial difficulties (e.g. "trouble paying utility bills in the past year", Patler and Laster Pirtle 2018). While using measures relating to medical coverage as proxies for SES were few, we note that these generally tended to come from America.

Regional variability

In many of our included papers, contextual and cultural factors seemed entwined with the operationalization of socioeconomic status measures. For instance, in low- and middle-income countries many SES metrics tended to include measures

concerning living conditions, housing and material assets related to the home, such as whether or not families live in brick houses (e.g. Congo, Verelst et al. 2014; South Africa Pappin et al. 2015), if they have access to water supply (e.g. Ecuador, Perez-Marfil et al. 2020; Uganda, Ssenkusu et al. 2016), if they have food security or experience hunger (Haiti, Li, Betancourt, et al. 2015; Caribbean countries, Pengpid and Peltzer 2018a; and Pacific Islands, Pengpid and Peltzer 2018b), if they have cooking resources including food, access electricity, ownership of a stove and refrigerator, (Uganda, Ssenkusu et al. 2016; South Africa, Pappin et al. 2015; Profe and Wild 2017; Egypt, McNeilly et al. 2021), if they have access to sewage and garbage disposal (Ecuador, Perez-Marfil et al. 2020), and if they have access to a latrine, a toilet, or flush toilet (Haiti, Li, Betancourt, et al. 2015; Ecuador, Perez-Marfil et al. 2020; South Africa, Pappin et al. 2015). In China, Zhu et al. (Zhu et al. 2016) included the characteristics of the geographical area in their measure of SES, where living in a metropolis denoted a high SES and living in a rural area denoted a low SES.

Overcrowding was another commonly used measure of SES in low- and middle-income countries relating to housing. It is often conceived as a proxy for the physical conditions in which children grow up. In Jamaica, Samms-Vaughan et al.'s (Samms-Vaughan and Lambert 2017) measure of crowding was calculated by dividing the number of rooms used for sleeping by the number of people living in the home. In Malaysia, Zahir Izuan and colleagues (Zahir Izuan et al. 2018) assessed neighborhood SES via the Townsend index, which splits neighborhoods into high or low SES based on the percentage of unemployment, car ownership, households that are owner occupied, and percentage of households with more than one person per room as an overcrowding measure. Some household-level composite metrics were specifically developed for specific settings (i.e. country: Iran, Nik-Azin et al. 2013; Germany, Winkler Index, Herrmann et al. 2018; Winkler and Stolzenberg 1999).

Parental and household measures

Different approaches have been taken when measuring SES via parental variables. In our included sample, we found papers that combined the same SES data for mothers and fathers into one measure (Moreso et al. 2013), as well as a variety of papers that only work with data from one parent (Choi et al. 2019) and others that combine different data from each parent (Maneta et al. 2017; Ryan et al. 2016) or combine data from a parent and their partner (Smith, Eryigit-Madzwamuse, et al. 2013). In two-parent households, we found remarkable variability in terms of operationalizing SES, including papers that use "the highest ranking parent" (e.g. according to occupation, Damsgaard et al. 2014; Eisman et al. 2015; Meilstrup et al. 2020; Middeldorp et al. 2014; according to education, Evans, Huizink, et al. 2020; Gate et al. 2013; Hendriks et al. 2020; Wu et al. 2015), and "the lowest ranking parent" (Coley et al. 2019). Rodriguez and colleagues (Rodriguez et al. 2015) considered the occupation and education of up to two family members who financially contributed to the household. Some SES measures featured distinct maternal and paternal characteristics, such as father's occupation and mother's education (Samms-Vaughan and Lambert 2017; Haag et al. 2015). Some of the articles referred to the head of the household in their operationalization of SES (Perez-Marfil et al. 2020; Acosta et al. 2020; Fatori et al. 2013; Fidalgo et al. 2018; Fortes et al. 2016; Paula et al. 2018; Sama et al. 2021) or to the individual who is the "main source of income" in the household (Kakaje et al. 2020), sometimes explicitly specifying that this is most commonly the father (Sama et al. 2021; Kakaje et al. 2020).

In some cases, parental and household levels were conflated and treated as theoretically similar by authors. Some papers used family level SES composites by including one parent in addition to a family or household variable (e.g. Herbert et al. (2013): number of years of father's education and family income were standardized and average to create a single SES measure; Gerstein et al. (2017): maternal education and family income standardized and averaged into a single SES measure). Household-level SES measures most commonly tracked household income, although there was significant variability in how this was defined, ranging from the income of

one parent or caregiver to any two adults or the income of anyone residing in the household and not solely blood related family members (Mills et al. 2018).

A number of papers examining household level SES did so through variables about the family's structure. For instance, in India, Sama et al. (Sama et al. 2021) distinguished between "nuclear" and "joint" families when evaluating family SES, as they considered the head of the family would differ between the father of the child or an elder family member. In Russia, Kozlova et al. (Kozlova et al. 2014) similarly included family structure as a SES measure by assessing whether a family was nuclear, comprised a single parent only, or included a new partner. In Japan, Kachi et al. (Kachi et al. 2017) classified family SES through family structure as well, specifically by asking whether families included two parents, a single parent, whether the family was a three-generation family or another type of multi-person family. Family structure emerged as a metric included in some composite neighborhood socioeconomic disadvantage indices, e.g. as "% of female-headed families" (Anderson et al. 2019), and in the 4-factor version of the Hollingshead index, "marital status".

Perceived or subjective SES

Finally, our sample also included subjective measures of SES. Some of the papers considered subjective SES as a distinct concept from "objective" SES and sought to contrast the effect of subjective SES with measures tracking income and/or education (Macul Ferreira de Barros et al. 2020; Gerstein et al. 2017). By contrast, some papers used subjective SES as their only measure of SES or as part of a composite metric (Sivertsen et al. 2015; Weinberg et al. 2021; Russell and Odgers 2019; Roy et al. 2019). The MacArthur Scale was the most commonly used questionnaire of subjective SES; one paper used the Schor's Consumer Involvement Scale. We found only 5 papers (2% of our included sample of papers) where adolescents themselves were asked to report their perception of their SES. We note in passing that in some cases, there is a lack of clarity regarding what constitutes a subjective or perceived metric of SES. For instance, Novak et al. (Novak and Kawachi 2015) describe their measure based on parental occupations (classified as

high SES – managers and professionals, middle SES – white collar and low SES – blue collar workers) as 'self-perceived' SES.

2.4 Discussion

Our findings demonstrate that there is a staggering degree of heterogeneity in the way SES is operationalized in the literature on child and adolescent mental health. This heterogeneity is reflected in the types of measures (e.g. based on income, education, occupation, etc.), as well as on the level of the measures (e.g. parental, neighborhood). It may reflect, in part, varied disciplinary conventions (e.g. consideration of what is an appropriate proxy measure), as the topic of SES gradients in mental health crosses disciplinary boundaries and includes psychology, sociology, epidemiology, economics among others. To minimize this potential source of heterogeneity, we had searched for results in only one database (PsycINFO); nevertheless, our results captured articles from different disciplines. Further, we had constrained our search to query exclusively for the term 'socioeconomic status' as we wanted to obtain precision in understanding one cohesive concept. We initially considered that related terms would still contain important conceptual differences (such as for instance, that terms like 'socioeconomic disadvantages' and 'socioeconomic inequalities' would be associated with greater heterogeneity in measurement levels). However, importantly, it is likely that some researchers still utilize or treat these concepts in functionally equivalent ways (e.g. 'socioeconomic position'), and that by excluding them, we missed out on a further set of relevant papers. We consider it likely that the inclusion of further papers with such more broadened related terms to SES would have increased the heterogeneity in measurement we uncovered, and so would not have changed our overarching conclusions.

In particular, it is crucial to address the heterogeneity in SES operationalization. Using heterogenous measures may be prudent when trying to understand the relative importance or malleability of different facets of SES. However, without transparent reporting regarding the specific definition and construction of each

individual measure, the wide heterogeneity in measurement may lead to inconsistent results in the literature and obfuscate pathways to intervention, as different proxies for SES impact child and adolescent health through different causal mechanisms. If we are not able to disentangle different indicators of SES but only consider SES as a monolith, it may prove difficult to establish specific effects or replicate them in the future. Below, we discuss the main issues surrounding the operationalization of SES in the literature more granularly and outline practical recommendations (see Table 2.1 for summary).

Definition and measurement

It is important to clearly describe the methodology and any motivation for the choice of SES measure. Providing the operationalization of SES is necessary for the computational reproducibility and (conceptual) replication of the analysis. For this purpose, it is also necessary to provide details on the measurement of the variable(s) used. For instance, in the case of income, it should be specified whose income is captured, if it is measured on a monthly or annual basis, etc.

Further, the operationalization is crucial for the interpretation of the results from a theoretical standpoint. In many of the included papers, the effect of SES was not the main factor in the analysis; rather, it was used as a control variable to partial out variance driven by socioeconomic differences which are (presumably) independent of the main effect of interest. Similarly, sometimes, the choice of SES metric was constrained by what variables were available in the dataset of interest. In both those scenarios, nevertheless, it is important to clearly outline the considerations driving the choice of the SES measures, and clearly state which variable(s) were used. A question that arises is if, for instance, household income was used as a proxy for SES, why not frame the results and discussion in terms of the relationship between income and children and adolescents' mental health, rather than the relationship between SES and children and adolescents' mental health? More broadly, without a specific definition, the validity of the construct used will be hard to ascertain.

Theoretical underpinning

Although we wanted to better understand what theories most commonly motivated the choice of different SES measures, this was not possible due to the paucity of theoretical motivation in the included sample of papers. This may be understandable in some cases, for instance when there is an explicit recognition of practical constraints (single variable as the only plausible SES candidate). Similarly, perhaps when working with established indeces with a longstanding history (e.g. Hollingshead Index) authors may carry an assumption that further motivation is not needed. This, however, does not necessarily mean measures are theoretically sound in their applied context.

We also aimed to position specific operationalizations of SES in relation to the literature distinguishing between poverty and inequality. We initially aimed to do so by tallying up authors' theoretical motivation, although we find that authors' rarely report any theoretical motivation, yet alone more specific ones that would allow such a categorization. Inference regarding where specific measures fall regarding different econometric theories is difficult and may not align with the primary researchers' own views. Instead, we highlight the fact that we have captured a range of measures that could relate to theories of poverty either explicitly through their intended original purposes (e.g. The Townsend Index of Disadvantage and Deprivation is a measure that aims to capture material deprivation) or plausibly so, at face validity (e.g. assets, income thresholds, eligibility for welfare programs). We find the same in regards to SES measures that could more closely relate to inequality (e.g. percentage employment between neighborhoods, measures of perceived social inequality). There are, as well, measures which do not immediately fall into such categorization between poverty and inequality (e.g. family composition).

Here, we do not advocate that SES should be considered more closely aligned with either poverty and inequality; indeed SES may be better treated as a complementary, independent concept that further addresses individuals' socioeconomic realities. Rather, we use the poverty vs. inequality comparison as a framework to better

contextualize and illustrate the multidimensional nature of SES and the need for theoretical justification of its specific operationalizations.

Composite metrics

In the case of composite metrics (e.g. established indices and latent/combined variables), it is crucial to transparently report what measures are included. Many of the existing indices carry assumptions that are tied to their specific original purpose and/or context, such as a particular point in time or region. For instance, the 4-factor Hollingshead index includes a measure of marital status, and some of the neighborhood indices we found included measures of race/ethnicity (e.g. high proportion of African Americans living in the area considered as low SES). It is important to interrogate the assumptions of the metrics (why should we classify unmarried and minority ethnicity/race individuals as lower SES?) and their relevance for child and adolescent mental health.

Some existing recommendations warn against using composite measures (Saegert et al. 2006; Martel 2013) as aggregating several different variables into one composite SES measure can make it difficult to uncover the mechanism through which SES affects child and adolescent mental health. For instance, specific facets of SES may impact child and adolescent mental health through distinct mechanisms and have different effects; combining measures tracking those facets would conflate their influence. On the other hand, composite metrics may also be more robust and valid. Constructing a latent SES variable (e.g. via a data-driven approach such as principal component analysis, PCA) reduces the dimensionality of the data (i.e. number of measurements: income, education, occupation, etc.) and decreases the measurement error, thus, making the analysis more robust (i.e. reducing noise in the predictor(s) to capture more variance in the outcome, which may be pertinent in cases when SES is considered to function as a "covariate" or "control" in the model). Similarly, some measurements may not meaningfully capture SES on their own (e.g. crime rates, food insecurity, welfare receipt), but their combination may more reliably track SES. As with existing indices and formulas, it is important to scrutinize the

assumptions embedded in latent analyses (e.g. the composition of the resulting factors) to ensure the composite is a theoretically valid measure of SES.

Dichomatizaiton

Further, there is an important yet often overlooked choice in deciding whether to use SES as a continuous or categorical variable. Dichotomizing SES measures (e.g. into high vs low SES) can illustrate a contrast between the ends of the distribution. However, there are caveats. Collapsing a continuous scale onto a binary classification necessarily reduces the level of nuance. This can limit the conclusions we can draw from an analysis. For instance, a negative effect of a binary SES measure on mental health may be driven by the protective influence of high SES versus the effect of low SES as a risk factor for mental ill health (e.g. see trichotomization analysis in Hendriks et al. 2020).

Level of variable

The concept of SES refers to the individual. Thus, it can straightforwardly correspond to individual-level or perhaps even household variables. However, beyond these proximal levels, we found a variety of other higher order level, such as measures at the neighborhood or province-level. First, we question the appropriateness of labeling variables at these levels as socioeconomic status as their correspondence to an individual's circumstances is likely less direct. The links between higher order deprivation and inequality and low-individual level SES have not extensively been studied. Second, we question the usefulness of examining macro-level variables in isolation. One critical review of 25 multilevel studies examining neighborhood socioeconomic context warned that attributing (mental) health disparities to neighborhood social context would first require the isolation of individual-level socioeconomic influence (Pickett and Pearl 2001). Further, a meta-analysis examining the impact of income inequality on depression found trends suggesting null effects at district and national levels (Patel, Burns, et al. 2018). This

could also because higher order levels may include strong contrasts of individuals with of high and low SES (Ahern and Galea 2006).

Thus, it is important to accurately specify the level at which the SES metric is constructed, as this is crucial for the interpretation and contextualization of the observed effects. For instance, if a neighborhood-level measure (e.g. metric based on postcode) is used for the analysis, it is inappropriate to frame the discussion in terms of family or household SES as we found in our review (Wade et al. 2015; Mulraney et al. 2018). The mechanisms through which neighborhood-level disadvantage affects mental health likely differ from the mechanisms through which socioeconomic deprivation of the family does. It may also be that there is inequality between those two levels, which has been identified as an important determinant of adolescent mental ill health (Odgers 2015).

Child & adolescent focused measures of SES

In the present review, we found only 5 papers with adolescents reporting their perception of their SES. Including such adolescent reported SES measures may be particularly important. For instance, previous research has evidenced that measures capturing adolescents' experiences have strong associations with their health and health behaviors and that, moreover, inequalities in adolescent health outcomes were stronger when measured through variables capturing adolescents own education and perceived relative family SES as opposed to objective measures of family affluence or parents' education (Moor et al. 2019). Relatedly, a recent twin study has indicated that twins' differential perceptions of their family's social standing underpins differential mental health outcomes (Rivenbark et al. 2020).

More broadly, not including child and adolescent focused measures of SES may mean we focus on addressing risk factors that are not most salient to their lives, and perhaps, have less of a direct effect on their health. In a separate systematic review we suggest that even in interventions that aim to alleviate poverty experienced by children and adolescents, financial support such as cash transfers is most commonly given to caregivers rather than adolescents' themselves (Zaneva et al. 2022), see

Chapter 5 . Taking this together, we recommend that more consideration is upfront to plausible mechanisms for improving children and adolescents' lives, including the use of more focused measures of SES.

Table 2.1: Summary of specific recommendations.

Domain	**Reccommendations**
Definition	- Provide a clear definition of SES in the context of your work - Specify what the corresponding variable(s) for SES are - Justify relevance of these variables (how do they relate to the construct of SES?) - State how variables are coded, when/where data was collected and further survey details if applicable
Selection of measure	- Report what considerations guided the selection of each variable (e.g. describe relevant theories, previous research, practical constraints) - Consider any limitations or assumptions embedded in the measure, particularly for measures coming from different cultural or historical contexts; if relevant – justify their use - Provide information regarding validity and reliability - Use child and adolescent reported measures of SES, where possible
Construction of measure	- Clearly report any quantitative adjustments or manipulations (combining, transforming or creating new variables) - Justify why these manipulations were necessary and appropriate
Level of measure	- Provide sufficient detail about the level of reported variables (e.g. parental vs household) - Justify the appropriateness of the level of the variable(s) or discuss relevant limitations - Do not use higher-order measures (e.g. at neighborhood or country level) of inequality or deprivation as measures for SES
Discussion	- Present results and discussion in correspondence to your selected variables' type and levels - State any relevant (causal) mechanisms for SES given your specific measures in the context of your research question - Evaluate the strength of evidence in the context of your variable(s) strengths and limitations

Mechanisms and interventions

The considerations regarding transparency in definition and measurement, composite metrics, and the level of the variables may all pose challenges in understanding the causal mechanisms through which SES may impact mental health. In Table 2.2, we present an overview of plausible, distinct mechanisms for different specific measures that have all been considered to represent SES (many of these mechanisms have been discussed in greater depth in the APA Taskforce on SES, Saegert et al. 2006).

To design effective interventions for child and adolescent mental health, it is important to not only understand the strength and direction of the effect(s) but understand the exact mechanism (direct or indirect effect? mediation?), how malleable the relationship is, and at what level it operates. For instance, a specific mechanism (differential exposure to environmental hazards, e.g. toxins) could operate at two different levels (e.g. through parent's occupation or through neighborhood characteristics, see Table 2.2); different interventions will be suitable to target the risk factor at each level. Further consideration is also needed to distinguish the impacts of subjective versus objective measures of SES in terms of their implications for child and adolescent mental health.

Effective interventions will also require a deeper understanding of whether SES is a genuinely multidimensional concept and whether specific aspects of SES are separable from the others. For example, can increases in income affect mental health without altering other aspects of the social world in which these young people live? Is it even possible to increase income while holding all other aspects of SES constant? Theoretically, this may boost the effectiveness of interventions if increasing income may improve other aspects of SES too.

Finally, we caution that SES is by definition shaped by the social context and is sensitive to the context in which the individual is embedded. The same definition/operationalization may not be appropriate across different regions and across different times (e.g. see regional variability in narrative synthesis). Further, the effect of SES may interact with the social context and/or the characteristics

of the individual. In considering the mechanisms through which SES may yield an influence on child and adolescent mental health, it is important to investigate how different subgroups may be differentially affected (Peverill et al. 2021). These subgroup effects need not be additive, different characteristics may intersect (e.g. for a multilevel analysis of individual heterogeneity and discriminatory accuracy, see Evans and Erickson 2019).

2.5 Conclusion

In this critical review, we found a tremendous degree of heterogeneity in the different measures used as proxies for socioeconomic status. The wide variety of distinct measures may prevent our understanding of what truly drives observed effects and may obfuscate further work on establishing causal relationships, in turn making the path to effective intervention more difficult. On the basis of our review, we recommend improved clarity and specificity when defining SES (e.g. specific variables, how they are measured, at what level etc.), as well as improved transparency in the motivation for selecting a given SES measure. Rather than advocating for the use of any specific individual or composite levels, we encourage the more fundamental transparent disclosure of variable selection and construction, with theoretical or practical justification. Further, methodological decisions, such as dichomatization, need to be carefully considered and justified. Similarly, researchers should ensure the level of a given variable appropriate for their proposed mechanisms and that their results are framed with consideration of the relevant level. While we have specifically examined the case of socioeconomic status within the mental health literature, these implications can extend to other disciplines and be considered in regards to guidelines for variable reporting and measurement more broadly.

2.6 Acknowledgments

This Chapter is under peer review and I express my gratitude to the anonymous peer reviewers for thoughtful feedback. The work here was supervised by Professor

Lucy Bowes and Professor Aaron Reeves. I am further thankful to Dr Tsvetomira Dumbalska who served as the second reviewer.

Table 2.2: A survey of different broad SES categories, related specific SES measures, and potential plausible mechanisms for impact on child and adolescent mental health. While many of these potential mechanisms have been previously discussed in the literature, we note causal pathways have not been established for all and there may be reverse causality in some cases.

SES category	**SES measure**	**Mechanisms**
Income	(Absolute) Income	- Different ability (of parent, caregiver, family) to invest in education, health, housing, social opportunities for child (e.g. provide adequate nutrition, safe housing, cognitively stimulating opportunities) may be linked to different mental health outcomes for a child. (Bradley et al., 2001; Bradley & Corwyn, 2002) - Different ability to save money and plan for future of child may be linked to different mental health outcomes for a child. (Saegert et al., 2006) - Different access to healthcare (in countries without universal healthcare, e.g. USA) may be linked to different mental health outcomes for a child. (Bradley & Corwyn, 2002)
	Relative Income	- Individuals may be concerned how their income compares relative to the mean of a reference group. Different relative positions may have different mental health implications. (Reference Income Hypothesis; Clark & Oswald, 1996) - Different ranked income position may have different mental health implications. (Income Rank Hypothesis; Boyce et al., 2010; Osafo Hounkpatin et al., 2015) - Relative income may also share mechanisms similar to those of absolute income. Different income ranks likely have different investment, savings, access opportunities. Relatedly, different stress exposure between income groups may lead to different mental health outcomes for a child. (Saegert et al., 2006)

	Perceived Income	- Negative or positive perception of income position may generalize to negative or positive attributions across other domains (e.g. ability to save, invest, health choices; self-perception) and thus may produce different mental health outcomes for a child. (Maison et al., 2019) - Different perception of income may lead to different social comparisons and social (dis)satisfaction which in turn may lead to different mental health outcomes for a child. (Sumarwan & Hira, 1993). This mechanism may operate similarly to the Reference Income Hypothesis for Relative Income. (Clark & Oswald, 1996) - Different perception of income may affect perceived consumption ability, which in turn could impact actual consumption and thus mental health outcomes as well. (Cheon & Hong, 2017; Sim et al., 2018)
	Paternal vs Maternal Income	- Different spending relating to a child, in terms of both the proportion of income spent and type of spending, may lead to different mental health outcomes for a child. (Kenney, 2008)
Occupation	Parent or Caregiver's (Un)employment Status	- Different time availability may lead to different mental health outcomes for a child. (Bradley et al., 2001) - Different impact of (un)employment status on parent may lead to different impacts on their emotion, cognition, wellbeing, stress which in turn may lead to different mental health outcomes for a child. (Davis et al., 2012)
	Type of Occupation	- Caregivers may reproduce normative work practices at home which may differently impact children's mental health outcomes. (Kohn & Schooler, 1982; Mason et al., 1994; Saegert et al., 2006)

	- Different exposure to environmental hazards (e.g. toxins) may impact caregivers' health and may in turn differently impact children's mental health outcomes. (Sargent et al., 1996) - Different opportunities for social contact and support through occupation may lead to different mental health outcomes for children. (Jahoda, 1981) - Different exposure to stress (as linked to different types of occupation) may lead to different mental health outcomes for children. (Saegert et al., 2006)
Full vs Part-time occupation	- Different time availability may lead to different mental health outcomes for a child. (Bradley et al., 2001) - Different exposure to stress (as linked to full vs part-time occupation) may lead to different mental health outcomes for children. (Saegert et al., 2006)
Paternal vs Maternal Occupation	- Paternal vs maternal occupation may differently shape children's behaviors, attitudes, goals and may have an influence on mental health problems. (Burlin, 1976; Tuck et al., 1994) - Degree of job security and benefits (e.g. having parental leave) may have different impacts on caregivers and may lead to different impacts for children. (Heinrich, 2014)
Perception of Occupational Prestige	- Occupational prestige may impact how an individual feels about themselves. (Fujishiro et al., 2010) - Different occupational prestige may be associated with different opportunities and types of social contact, support, and treatment (e.g. discriminatory treatment from healthcare providers; number of social contacts and closeness), which may lead to different mental health outcomes for both caregivers and children. (Fujishiro et al., 2010; Van Der Gaag & Snijders, 2005)

2. What do we mean when we talk about socioeconomic status (SES)?

Education	Number of Years of Education	- Education has been considered as a proxy for intelligence or cognitive skills, thus different years of education may be associated with different health related behaviors (e.g. choosing healthier behaviors, providing better self-care or care for others, complying with complex treatment plants, a voiding injury), which in turn may lead to different mental health outcomes for children. (Bradley & Corwyn, 2002) - Number of years of education has been considered as an imperfect proxy for income and thus may share similar mechanism with income. (Tamborini et al., 2015) - The number of years of education may underpin an opportunity for expanding one's social network and developing one's social skills, which may lead to different mental health outcomes for children. (Huang et al., 2009)
	Highest Educational Degree	- Differences in obtained educational degrees may be associated to different level of self-confidence and estimation of personal competency, which may lead to different mental health outcomes for children.(Bachman & O'Malley, 1977) - Likely also operates through similar mechanisms as years of education.
	Paternal vs Maternal Education	- Different education experiences may relate to different health behaviors, in the case of mothers this may directly relate to children's mental health (given that mothers give birth and are also more likely to spend more time with children in many countries). May be mediated with time spent with child rather than sex of caregiver. (Bradley & Corwyn, 2002; Mercy & Steelman, 1982)
Neighborhood	Environmental Risks	- Different exposure to environmental risks (e.g. toxins, unclean air, appropriate waste disposal) may lead to different mental health outcomes for children. (Sargent et al., 1996)

2. What do we mean when we talk about socioeconomic status (SES)?

Access to Services	- Different access to important community, health, and social services (e.g. hospitals, banks, schools, administrative offices, recreational areas) may lead to different mental health outcomes for children.(Butler et al., 2012; Kirby & Kaneda, 2005) - Different degree of difficulty to access may impose different time and stress burdens (e.g. long or unsafe commutes), which may lead to different mental health outcomes for children.(Karan et al., 2021)
Crime and Safety	- Different access to opportunities for positive collective socialization may lead to different mental health outcomes for children. (Jencks & Mayer, 1990) - May operate with mechanisms similar to environmental risks, where safety concerns are relevant. - Different exposure to conflict, violence, stress may lead to different mental health outcomes for children. (Saegert et al., 2006)

3

The hunger gap in adolescent mental health: cross-national evidence from the Global School-based Health Survey

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Hunger is a widely established risk factor for poor health outcomes, but less attention has been allocated to understanding its potential impacts on mental health and evidence is particularly lacking for adolescents outside of high-income settings. Here,

we report on the relationship between worrying and suicidal ideation and hunger from a large-scale international dataset, the Global School-based Health Survey (GSHS) in over 80 low- and middle-income countries and 348,000 adolescents (mean age: 14.8; 52.7% girls). We consider age and gender as further important factors that may carry differential implications for the effects of hunger on internalizing problems. In a series of linear, logistic and multinomial regressions, we find consistent evidence that hunger is universally associated with worse mental health outcomes. We find evidence for gender and age differences, such that that girls are more likely to report suicidal ideation and worrying compared to boys, that the likelihood of reporting mental health problems increases over adolescence and with the experience of hunger. Further, we find support for important interactions, such that girls report more worrying and suicidality with age compared to boys, and that hunger is associated with strongers impacts on boys' worrying. Further, we provide evidence for a dose-response relationship between hunger and both worrying and suicidality. We discuss these population-level effects as warranting public health concerns.

3.1 Introduction

This Chapter focuses on the effects of hunger on child and adolescent mental health. One important manifestation of poverty is not being able to sustain a nutritious diet. This means that individuals may go hungry and may lack food security, which describes a state where individuals lack access to sufficient quantities of nutritious food which meets their dietary needs and food preferences according to their lifestyle (Pinstrup-Andersen 2009). As discussed in Chapter 1, the use of hunger and food insecurity as proxy measures for poverty have often related to the subsistence view of poverty, which focuses on the minimum required to sustain one's life. It is likely that hunger and poverty may share some mechanisms in regards to their impact on mental health, such as through stigma and social exclusion. Indeed, as we find in Chapter 2, previous work has used hunger as a proxy for socioeconomic status and others have also relied on it as a proxy for poverty (Pengpid and Peltzer 2012). Importantly, however, hunger and poverty may operate through distinct

mechanisms in terms of their impact on mental health. For instance, hunger bears important physiological implications, including lack of macro- and micro-nutrients necessary for healthy physical and cognitive functioning, which may lead to mental ill health (Kaplan et al. 2007). For this reason, in this Chapter we consider hunger as a measure that tracks a concept that is related but still distinct from poverty.

Numerous systematic reviews have evidenced the deleterious impacts of hunger on a wide range of general health outcomes in adults, including increases in the likelihood of suffering worse health including conditions such as diabetes, blood pressure problems, anemia, heart disease, gum disease, asthma, and more recently, mental health problems such as anxiety and depression (Ziliak and Gundersen 2014; Pourmotabbed et al. 2020). The majority of data evaluated in these studies is from high-income settings, leaving an open question whether the relationship between hunger and mental health translates to younger populations, such as children and adolescents in low- and middle-income countries. Indeed, the vast majority of available evidence on the impacts of hunger hails from high-income countries. As others have argued in the past, more diverse data, both at the population and individual-level is still needed as effects may not generalize across contexts (Campbell et al. 2021; Maselko 2017; Alegría et al. 2018; Polanczyk et al. 2015; Patel 2007). Significant challenges in studying the effects of hunger in low- and middle-income countries remain, including the need for large-scale survey efforts and the inclusion of validated and robust measures (Burns 2015).

For children, we know that hunger and food insecurity are associated with nutritional deficiencies, worse general health and higher prevalence of chronic health conditions (in particular asthma), stunting, more difficulties with learning, decreased productivity in addition to higher prevalence of academic problems (Gundersen and Ziliak 2015; De Onis and Branca 2016; Ke and Ford-Jones 2015; Shankar et al. 2017). The fact that evidence is lacking for hungry children and mental health outcomes is likely underpinned by the overall historic focus on studying nutrient and anthropometric outcomes (such as height and weight) in the context of hunger; as others have previously argued, evidence on hunger's potential impacts on

mental health are urgently needed and particularly so for children and adolescents who are especially understudied (Weaver and Hadley 2009). Early intervention is important, especially in the context of emerging evidence from high-income settings suggesting childhood hunger is associated with outcomes throughout one's life, including likelihood of depression and suicide (McIntyre et al. 2013).

To address these gaps, here, we investigate the relationship between hunger and mental health in a large global and cross-cultural dataset over 80 low- and middle-income countries, the Global School-based Health Survey. We aim to understand how hunger may impact mental health (particularly internalizing problems, such as worrying and suicidality) and whether effects may differ between context (particularly between different countries) and for different groups of young people, especially over the developmental period and across gender. The potentially differential experiences of hunger by gender for young people are still understudied; a comprehensive previous systematic review was unable to assess the impacts of hunger on mental health by gender in combined sample of children and adults (Weaver and Hadley 2009). Given the potential physiological mechanisms through which the effect of hunger on mental health may operate, it is important to consider effects across age and gender. Across different models, we find consistent evidence that hunger is universally linked to higher levels of both worrying and suicidality.

3.2 Methods

We pre-registered our hypotheses and analytic strategy (including any manipulation of measures) on OSF: https://osf.io/3srvn.

3.2.1 Data

This project uses data from the Global School-Based Student Health Survey (GSHS), which is freely and publicly available online. The GSHS is a global collaborative health surveillance initiative carried out by the World Health Organization (WHO) and in partnership with the United Nations' UNICEF, UNESCO, UNAIDS, and

with further technical assistance from the American Centers for Disease Control and Prevention (CDC). The primary aims of this global survey are to assist low- and middle-income countries in measuring and examining health and important health-related behaviors over time in young people. The GSHS is delivered in schools globally and surveys students aged 11-18 years old via standardized self-report forms. The GSHS includes 10 core modules covering topics such as alcohol use, dietary behaviors, drug use, hygiene, mental health, physical activity, protective factors, sexual behaviors, tobacco use, violence and unintentional injury. We note that participating countries are required to select a minimum of six of the 10 available core modules to be used in their country-specific questionnaire. Beyond this requirement, countries are able to add further questions or modules. For the purposes of this project, we focus on items from the mental health module as well as answers to demographic questions. Given that some of the items within the mental health module are considered particularly sensitive in different cultural contexts, some countries have opted out from specific questions (e.g. about suicidality); some countries have also opted out from the hunger question. For an overview of this, see missing data (NA) in Table 3.1.

For the purposes of this project, we included data collected in countries during the period 2010-2018, where both outcome and predictor variables were collected for that country. We choose this time period to attempt to avoid or at least mitigate potential immediate impacts from the 2008 economic crash and the 2019 Covid-19 pandemic. If countries were represented more than once in our included period, we included all entries. We downloaded each individual dataset and then appended these together to create our full dataset. We used a complete case analysis with no imputation given that very few individual observations were missing ($<5\%$).

Table 3.1: Descriptive table. For each country-year we provide the mean age, the proportion of girls, of reported hunger, of worrying, and of suicidality. NA indicates the question was not included for that country-year.

Country	Year	Age	Girls	Hunger	Worry	Suicidality
Afghanistan	2014	15.09	0.58	0.49	0.63	0.19
Algeria	2011	14.12	0.52	0.46	NA	NA
Anguilla	2016	14.71	0.52	0.44	0.61	0.23
Argentina	2012	14.51	0.52	0.37	0.64	0.18
Argentina	2018	14.91	0.52	0.32	0.71	0.22
Bahamas	2013	13.41	0.54	0.48	0.59	0.18
Bahrain	2016	14.13	0.48	0.55	0.67	0.14
Bangladesh	2014	14.20	0.60	0.64	0.60	0.04
Barbados	2011	14.18	0.55	0.42	0.54	NA
Belize	2011	13.83	0.53	0.37	0.60	0.14
Benin	2016	16.38	0.46	0.55	0.72	0.15
Bhutan	2016	15.64	0.55	NA	0.72	0.12
Bolivia	2012	14.36	0.49	0.63	0.71	0.19
Bolivia	2018	15.45	0.48	0.56	0.72	0.22
Brunei Darussalam	2014	14.64	0.53	0.61	0.71	0.10
Cambodia	2013	15.65	0.53	0.54	0.73	0.07
Chile	2013	14.65	0.50	0.28	NA	NA
Cook Islands	2011	14.44	0.52	0.66	0.61	NA
Cook Islands	2015	15.37	0.51	0.69	0.65	0.15
Curacao	2015	15.25	0.55	0.25	0.59	0.11
Dominican Republic	2016	14.91	0.56	0.34	0.63	0.18
Egypt	2011	13.52	0.53	0.46	NA	NA
El Salvador	2013	14.33	0.46	0.35	0.60	0.14
Eswatini	2013	16.04	0.52	0.54	0.54	0.17
Fiji	2010	14.32	0.57	0.66	0.66	0.18
Fiji	2016	15.79	0.51	0.60	0.59	0.13
French Polynesia	2015	15.05	0.54	0.64	0.64	0.15
Ghana	2012	15.99	0.46	0.65	0.67	0.19
Guatemala	2015	14.36	0.51	0.38	0.63	0.21
Honduras	2012	13.91	0.52	0.36	0.63	0.19

Indonesia	2015	14.03	0.54	0.55	0.53	0.06
Iraq	2012	14.32	0.44	0.35	0.63	0.17
Jamaica	2010	14.59	0.51	0.56	0.60	0.22
Jamaica	2017	15.02	0.54	0.49	0.58	0.26
Kiribati	2011	14.32	0.56	0.67	0.56	0.35
Kuwait	2011	14.35	0.50	0.38	0.66	0.20
Kuwait	2015	15.12	0.53	0.49	0.73	0.17
Lao People's Democratic Republic	2015	15.62	0.54	0.50	0.66	0.03
Lebanon	2011	13.91	0.53	0.35	0.63	0.15
Lebanon	2017	14.87	0.59	0.29	0.68	0.14
Liberia	2017	16.64	0.48	0.69	0.76	0.27
Malaysia	2012	14.91	0.50	0.60	0.61	0.07
Maldives	2014	15.51	0.58	0.38	0.68	0.14
Mauritania	2010	14.76	0.53	0.59	0.55	0.18
Mauritius	2011	13.90	0.54	0.26	NA	NA
Mauritius	2017	14.87	0.53	0.42	0.61	0.16
Mongolia	2010	14.67	0.57	0.34	0.57	0.20
Mongolia	2013	14.53	0.53	0.37	0.58	0.23
Morocco	2010	13.98	0.48	0.32	0.54	0.17
Morocco	2016	14.83	0.47	0.34	0.60	0.16
Mozambique	2015	15.89	0.47	0.47	0.65	0.19
Myanmar	2016	14.25	0.54	0.32	0.48	0.09
Namibia	2013	15.77	0.53	0.54	0.64	0.20
Nauru	2011	14.32	0.58	0.72	0.74	0.29
Nepal	2015	14.50	0.53	0.35	0.51	0.13
Niue	2010	14.23	0.41	0.60	NA	0.12
Occupied Palestinian Territory	2010	13.87	0.54	0.37	0.69	0.20
Oman	2010	14.87	0.53	0.42	NA	NA
Oman	2015	15.42	0.52	0.38	0.72	0.22
Panama	2018	15.35	0.55	0.42	0.74	0.19
Paraguay	2017	14.85	0.52	0.29	0.66	0.14
Peru	2010	14.46	0.51	0.52	0.78	0.20
Phillippines	2011	14.50	0.57	0.65	0.77	0.17

Phillippines	2015	14.62	0.54	0.70	0.76	0.10
Qatar	2011	13.31	0.54	0.31	0.59	NA
Saint Kitts and Nevis	2010	14.35	0.56	0.41	0.60	0.17
Saint Lucia	2018	14.36	0.53	0.51	0.59	0.25
Saint Vincent and the Grenadines	2018	15.33	0.53	0.54	0.64	0.27
Samoa	2011	14.04	0.59	0.81	0.72	0.33
Samoa	2017	15.07	0.63	0.73	0.57	0.23
Seychelles	2015	13.84	0.53	0.44	0.61	0.22
Sierra Leone	2017	15.32	0.54	NA	0.65	0.15
Solomon Islands	2011	14.59	0.48	0.83	0.70	0.30
Sri Lanka	2016	14.70	0.56	0.28	0.45	0.09
Sudan	2012	14.84	0.61	0.43	NA	NA
Suriname	2016	14.79	0.51	0.43	0.53	0.16
Syrian Arabic Republic	2010	13.65	0.60	0.53	0.72	NA
Thailand	2015	14.50	0.57	0.56	0.68	0.12
Timor-Leste	2015	15.39	0.54	0.51	0.52	0.10
Tokelau	2014	14.07	0.52	0.65	0.61	0.26
Tonga	2010	14.19	0.54	0.74	0.65	NA
Tonga	2017	14.21	0.54	0.65	0.55	0.12
Trinidad and Tobago	2011	13.61	0.45	0.49	0.48	0.17
Trinidad and Tobago	2017	14.18	0.53	0.52	0.57	0.22
Tuvalu	2013	13.97	0.51	0.53	0.51	0.08
United Arab Emirates	2010	14.09	0.58	0.30	0.73	0.16
United Arab Emirates	2016	14.99	0.52	0.49	0.67	0.15
United Republic of Tanzania	2014	14.26	0.52	0.26	0.40	0.14
Uruguay	2012	14.43	0.54	0.24	0.60	0.12
Vanuatu	2011	13.78	0.56	0.53	0.53	0.18
Vanuatu	2016	14.98	0.56	0.62	0.54	0.15
Viet Nam	2013	15.58	0.53	0.52	NA	0.16
Wallis and Fortuna	2015	14.60	0.52	0.63	0.60	0.23
Yemen	2014	14.82	0.51	0.57	0.68	0.16
Zimbabwe	2013	14.74	0.55	NA	0.64	0.39

3.2.2 Measures

Based on the previous literature (Biswas et al. 2020), we examine the two items that have been interpreted as proxies for worry or anxiety ("During the past 12 months, how often have you been so worried about something that you could not sleep at night?") and for suicide ideation ("During the past 12 months, did you ever seriously consider attempting suicide?"), as well as one item for hunger which has also been considered as a proxy for poverty ("During the past 30 days, how often did you go hungry because there was not enough food in your home?"). In the GSHS, the question for worry is measured on a 5-point scale ('Never', 'Rarely', 'Sometimes', 'Most of the time', 'Always') and the item for suicide ideation is measured on a binary scale ('No' or 'Yes'). Previous researchers have dichotomized variables from the GSHS mental health questionnaire (e.g. Quarshie et al. 2020; Arat and Wong 2017; Seidu et al. 2020) and we similarly dichotomize the anxiety measure ('Never' = 0, all other responses = 1) to ensure correspondence with this relevant body of work. Further, for our confirmatory pre-registered analyses, we have also chosen to dichotomize the measure for hunger ('Never' = 0, all other responses = 1). Prior to downloading the GSHS data, we inspected the summary statistics provided by the WHO for a few countries selected at random and noticed in each the majority of adolescents had reported never experiencing hunger ($> 51\%$). Given that the the measure for hunger is a single item, it is likely that this measure may not be very precise. Thus, dichotomizing this variable could help to reduce the impact of measurement error, which is more common with less precise measures. Nevertheless, we also acknowledge the fact that dichomatization is associated with information loss. With this in mind, we also carry out exploratory robustness analyses without dichomatizing the hunger variable (i.e. where it remains scored on a 5-point scale ranging 'Never' to 'Always').

3.2.3 Analytical approach

Broadly, for our main analyses, we take a linear mixed-effects model approach where we consider individual-level predictors (age, gender, and hunger) and two outcome

variables for mental health (worry and suicidality) in the context of the macro-level context (country and year) when data was collected. We hypothesized that age, gender, and hunger will all be significant predictors for both of our mental health measures. More concretely, we anticipate that older age will be associated with higher levels of worrying and suicidality and that girls will report higher levels of worrying and suicidality than boys. Similarly, we expected that experiencing hunger will be linked to greater levels of reported worry and suicidality.

The first set of our analyses uses multilevel models with random intercepts for country-year. Our models include a random intercept for each country-year pair. We chose this approach rather than including a random intercept for country and a random intercept for year to avoid cross-classified random intercepts. In these models, we look at worry and suicidality separately and we regress on age, gender, and hunger while accounting for the multilevel structure of the data (individuals are nested within different country-year pairs). Further, we consider two interaction terms to investigate whether the relationship between age or gender as well as worry or suicidality varies by gender or hunger.

The second set of analyses uses random-effects models to investigate whether the relationships between the predictor variables (age, gender, hunger) and outcomes (worry, suicidality) vary across country-years. In these models, worry and suicidality are similarly regressed on age, gender, and hunger but with a different random effects structure that allows the slopes for age, gender, and hunger to vary across country-year units.

We note that unlike many other social researchers we do not prefer logit or probit models in this case, even though our outcome variables are binary. Such non-linear models have been criticized as unsuitable when used with interactions terms (Ai and Norton 2003; Greene 2010) or fixed effects in nested data are present (Andersen 1973; Hsiao 2005; Rodríguez and Goldman 1995; Beck 2018; Freedman 2008). Further, the interpretation of logit and probit models does not tend to be straightforward unlike the interpretation of linear models, which tends to be fairly direct. Given more recent recommendations to use linear modeling strategies with

binary outcomes (Gomila 2021), we select this approach here for our confirmatory preregistered analyses. Nevertheless, we do also test the same models as outlined above using logistic regression for completeness and as a first line of robustness check. As further robustness analyses, we also use the categorical version of hunger variable in a multinomial regression with worry (also categorical) and in a logistic regression with suicidality (binary). These latter two models allow us to potentially test for any dose-response effects.

We note that in testing model assumptions, we found evidence for multicollinearity only in our models examining an interaction between age and gender. In those models, we scaled age through z-scoring.

We acknowledge that we are limited by data availability for child or family characteristics which may be confounded with hunger. For instance, more direct measures of poverty or income may affect both hunger and mental health. However, such individual-level measures are not available in the current dataset. In Chapter 4 we address this by considering macro-level indicators for poverty and inequality, which we are able to access from complementary sources.

3.2.4 Software

We have used the free statistical software R version 4.0.5 for the present analyses. We have relied on the packages tidyverse (Wickham, Averick, et al. 2019), broom.mixed (Bolker and Robinson 2020), data.table (Dowle et al. 2019), dplyr (Wickham, Francois, et al. 2014), ggplot2 (Wickham 2006) for data wrangling and visualization. We have used the nlme package (Pinheiro et al. 2017) for the construction of our regressions.

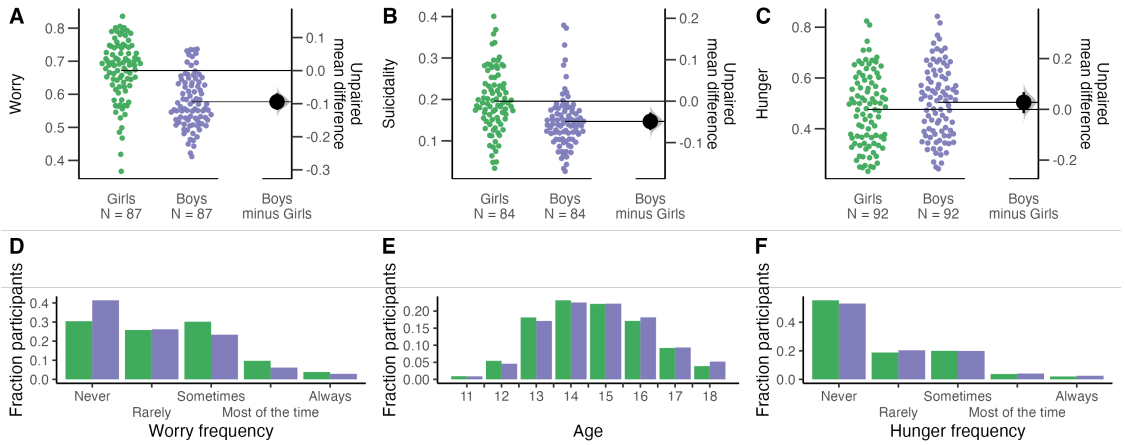

Figure 3.1: Descriptive plots. Each data point represents the fraction of individuals who have reported any worry (A), suicidality (B) or hunger (C) in a single country. A. Fraction of participants reporting worrying by gender. B. Fraction of participants reporting suicidality by gender. C. Fraction of students reporting hunger by gender. D. Fraction of participants reporting different frequencies of worrying. E. Fraction of participants at different ages. F. Fraction of participants reporting different hunger frequency.

3.3 Results

Our omnibus sample includes 410,541 students from 92 countries, although the number of included observations varies for our analyses given that countries could opt out from specific questions. In our sample, mean age was 14.8 years (minimum 11 - maximum 18 years old) and 52.7% of students were girls. 45.8% of our sample reported experiencing hunger (any level higher than never). 64.4% of our sample reported worrying enough to not be able to sleep (any frequency higher than never; henceforth, referred to as worrying); the standard deviation in the percentage of adolescents who reported worrying across different countries was 7.7%. 17% of our sample reported seriously considering suicide (henceforth, referred to as suicidality); the standard deviation in the percentage of adolescents who reported suicidality across different countries is 6.5%. Whilst girls and boys reported similar levels of hunger and were of similar ages (Figure 3.1 C, E-F), more girls reported worrying and suicidality (Figure 3.1 A-B, D; permutation-based t-test on proportions of girls vs boys reporting worry and suicidality across country-year samples, all $p < 0.0001$).

Table 3.2: Linear regression models with worrying as the outcome.

Predictors	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Fixed Effects						
	Beta (S.E.)	*Beta (S.E.)*	*Beta (S.E.)*	*Beta (S.E.)*	*Beta (S.E.)*	*Beta (S.E.)*
Intercept	0.06 (0.1)***	0 (0.01)	0.06 (0.01)***	0.06 (0.01)***	0.06 (0.02)*	0.06 (0.012)***
Age	0.04 (0.00)***	0.04 (0.00)***	0.04 (0.00)***	0.04 (0.00)***	0.04 (0.00)***	0.04 (0.00)***
Gender	-0.12 (0.00)***	0 (0.01)	-0.13 (0.00)***	-0.11 (0.01)***	-0.12 (0.00)***	-0.12 (0.00)***
Hunger	0.14 (0.00)***	0.14 (0.00)***	0.12 (0.00)***	0.14 (0.00)***	0.14 (0.00)***	0.14 (0.00)***
Age:Gender		-0.01 (0.00)***				
Gender:Hunger			0.03 (0.00)***			
Random Effects						
	St. Dev.	*St. Dev.*	*St. Dev.*	*St. Dev.*	*St. Dev.*	*St. Dev.*
Intercept	0.07	0.07	0.07	0.09	0.19	0.08
Age					0.01	
Gender				0.06		
Hunger						0.02
Number of observations	363097	363097	363097	363097	363097	363097
Number of groups	84	84	84	84	84	84

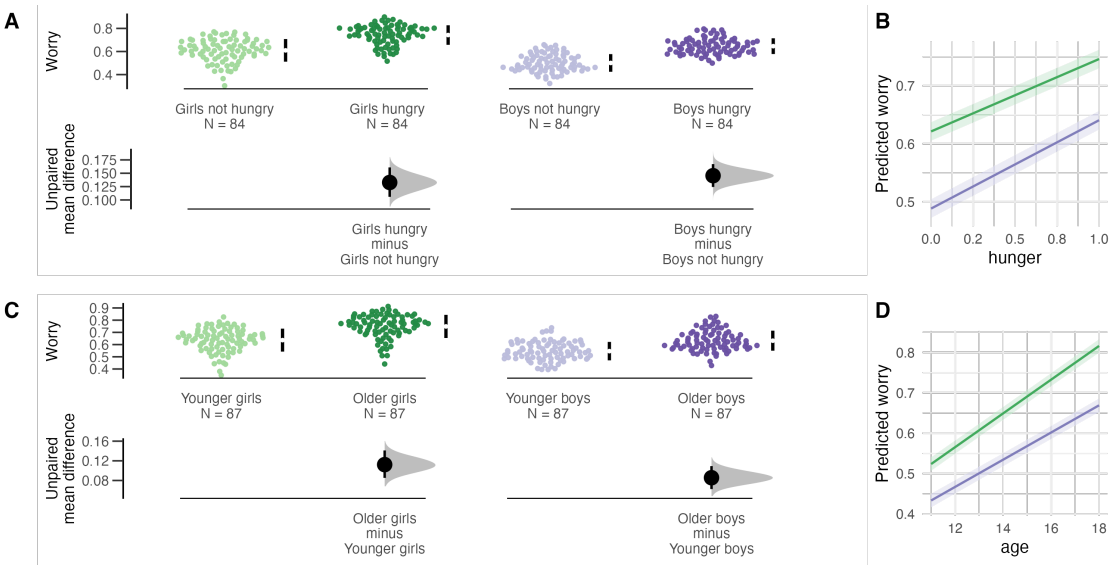

Figure 3.2: Worry: variable interactions. Color indicates gender in all panels (green = girls, purple = boys). A. Interaction between gender and hunger. Each data point represents the fraction of individuals who have reported any worry in a single country. Saturation indicates hunger (faded = no hunger reported, bright = any frequency of hunger reported). B. Marginal effects from regression model with hunger:gender interaction. C. Interaction between age and gender. Saturation indicates age (faded = younger, brighter = older). D. Marginal effects from regression model with age:gender interaction.

3.3.1 Worry

We present the results of our models where we examine worry as an outcome in Table 3.2. Across all three of our models, age, hunger, and gender are significantly ($p < .0001$) associated with worry. Specifically, girls, older students, and those

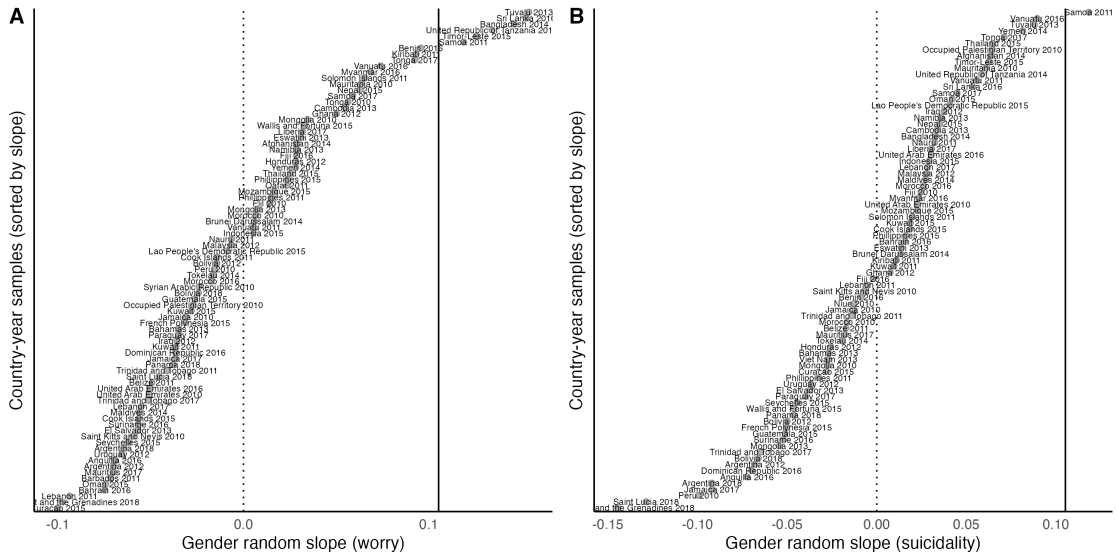

Figure 3.3: Random effects for gender. Dotted line indicates 0, solid line indicates the fixed effect of gender with reversed sign. This suggests that for the majority of countries to the left of this solid line, girls are more likely to report worrying (panel A) or suicidality (panel B) than boys.

who report experiencing hunger are more likely to report worrying. Girls are approximately 12% more likely to report worrying than boys, the likelihood to report worrying increases by approximately 4% with each passing year, and students who have reported experiencing hunger are approximately 14% more likely to report worrying than non-hungry students. We visually contextualize our interactions in Figure 3.2. We found a significant negative interaction between gender and age ($\beta = -0.01 \pm 0.00, p < .0001$), suggesting that each passing year increases the probability of reporting worry 1% more for girls than for boys. Further, we found a significant positive interaction between gender and hunger ($\beta = 0.03 \pm 0.00, p < .0001$), suggesting that experiencing hunger increases the probability of reporting worry 3% more for boys than for girls. Our random effects models suggested variance in the effect of gender on worry across country-year samples. We have visualized the random slopes in Figure 3.3A.

3.3.2 Suicidality

The results of our models examining suicidality as the outcome are presented in Table 3.3. In all three of our models we find that age, hunger, and gender are

Table 3.3: Linear regression models with suicidality as the outcome.

Predictors	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Fixed Effects						
	Beta (S.E.)	*Beta (S.E.)*	*Beta (S.E.)*	*Beta (S.E.)*	*Beta (S.E.)*	*Beta (S.E.)*
Intercept	0.07 (0.01)***	0.03 (0.01)*	0.06 (0.01)***	0.06 (0.01)***	0.04 (0.01)**	0.07 (0.01)***
Age	0.01 (0.00)***	0.01 (0.00)***	0.01 (0.00)***	0.01 (0.00)***	0.01 (0.00)***	0.01 (0.00)***
Gender	-0.07 (0.00)***	0.02 (0.01)	-0.06 (0.00)***	-0.05 (0.01)***	-0.07 (0.00)***	-0.07 (0.00)***
Hunger	0.07 (0.00)***	0.07 (0.00)***	0.07 (0.00)***	0.07 (0.00)***	0.07 (0.00)***	0.06 (0.00)***
Age:Gender		-0.01 (0.00)***				
Gender:Hunger			-0.01 (0.00)***			
Random Effects						
	St. Dev.	*St. Dev.*	*St. Dev.*	*St. Dev.*	*St. Dev.*	*St. Dev.*
Intercept	0.06	0.06	0.06	0.07	0.12	0.05
Age					0.01	
Gender				0.05		
Hunger						0.03
Number of observations	348707	348707	348707	348707	348707	348707
Number of groups	81	81	81	81	81	81

significantly ($p < .0001$) associated with suicidality. More concretely, girls, older students, and those who report experiencing hunger are more likely to report suicidality. Girls are approximately 7% more likely to report suicidality compared to boys, the likelihood to report suicidality increases by approximately 1% with each passing year, and students who have indicated that they have experienced hunger are approximately 7% more likely to report suicidality than those who have not reported experiencing hunger. Further, we found a significant negative interaction between gender and age ($\beta = -0.01 \pm 0.00, p < .0001$), suggesting that each passing year increases the probability of reporting suicidality 1% more for girls than for boys. We also found a significant negative interaction between gender and hunger ($\beta = -0.01 \pm 0.00, p < .0001$) suggesting that experiencing hunger increases the probability of reporting suicidality 1% more for girls than for boys. We note that this effect is in opposite direction of the gender-hunger interaction we found for worry. We visually contextualize our interactions in Figure 3.4. Our random effects models suggested variance in the effect of gender on suicidality across country-year samples. We present the random slopes in Figure 3.3B.

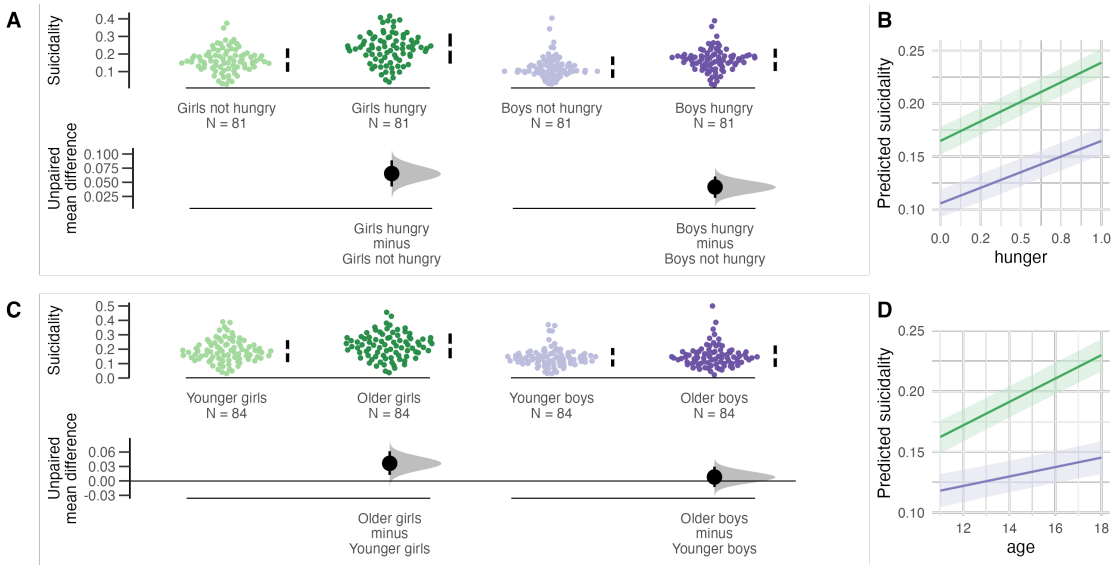

Figure 3.4: Suicidality: variable interactions. Color indicates gender in all panels (green = girls, purple = boys). A. Interaction between gender and hunger. Each data point represents the fraction of individuals who have reported any suicidality in a single country. Saturation indicates hunger (faded = no hunger reported, bright = any frequency of hunger reported). B. Marginal effects from regression model with hunger:gender interaction. C. Interaction between age and gender. Saturation indicates age (faded = younger, bright = older). D. Marginal effects from regression model with age:gender interaction.

3.3.3 Robustness analyses

On the whole, we find the same patterns of results for worry and suicidality in our logistic regressions (see Table 3.4 and 3.5). For worrying, our logistic models indicate age, hunger, and gender are significantly associated with worrying and we also find evidence for a significant negative interaction between age and gender and a positive interaction between gender and hunger, similar to our linear models. For suicidality, we note that the interaction between gender and hunger is no longer significant in the logistic models and so this finding should be interpreted more cautiously. As in our linear models, our logistic models also suggest age, hunger, and gender and significantly associated with suicidality and we also find a significant negative interaction between age and gender.

In a multinomial regression, we also assess the relationship between the categorical measures for worry and hunger, indicating how often individuals experienced worry or hunger. The levels of these variables spanned “Never”, “Rarely”, “Some-

Table 3.4: Logistic regression models with worrying as the outcome.

Predictors	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Fixed Effects						
	Beta (S.E.)	*Beta (S.E.)*	*Beta (S.E.)*	*Beta (S.E.)*	*Beta (S.E.)*	*Beta (S.E.)*
Intercept	-2.10 (0.05)***	0.52 (0.04)***	-2.10 (0.05)***	-2.11 (0.06)***	-2.06 (0.09)***	-2.08 (0.05)***
Age	0.18 (0.00)***	0.33 (0.01)***	0.18 (0.00)***	0.18 (0.00)***	0.17 (0.01)***	0.18 (0.00)***
Gender	-0.56 (0.01)***	-0.57 (0.01)***	-0.57 (0.01)***	-0.49 (0.03)***	-0.56 (0.01)***	-0.576 (0.01)***
Hunger	0.65 (0.01)***	0.65 (0.001)***	0.63 (0.01)***	0.65 (0.01)***	0.65 (0.01)***	0.63 (0.01)***
Age:Gender		-0.10 (0.01)***				
Gender:Hunger			0.04 (0.01)*			
Random Effects						
	St. Dev.	*St. Dev.*	*St. Dev.*	*St. Dev.*	*St. Dev.*	*St. Dev.*
Random Effects Intercept	0.33	0.33	0.33	0.42	0.79	0.33
Age					0.05	
Gender				0.29		
Hunger						0.09
Number of observations	363097	363097	363097	363097	363097	363097
Number of groups	84	84	84	84	84	84

Table 3.5: Logistic regression models with suicidality as the outcome.

Predictors	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Fixed Effects						
	Beta (S.E.)	*Beta (S.E.)*	*Beta (S.E.)*	*Beta (S.E.)*	*Beta (S.E.)*	*Beta (S.E.)*
Intercept	-2.50 (0.07)***	-1.71 (0.05)***	-2.50 (0.07)***	-2.52 (0.07)***	-2.65 (0.13)***	-2.45 (0.07)***
Age	0.05 (0.00)***	0.10 (0.01)***	0.06 (0.00)***	0.05 (0.00)***	0.06 (0.01)***	0.05 (0.00)***
Gender	-0.56 (0.01)***	-0.50 (0.01)***	-0.51 (0.01)***	-0.38 (0.04)***	-0.51 (0.01)***	-0.51 (0.01)***
Hunger	0.65 (0.01)***	0.50 (0.01)***	0.50 (0.01)***	0.50 (0.01)***	0.50(0.01)***	0.43 (0.02)***
Age:Gender		-0.05 (0.01)***				
Gender:Hunger			0.01 (0.02)			
Random Effects						
	St. Dev.	*St. Dev.*	*St. Dev.*	*St. Dev.*	*St. Dev.*	*St. Dev.*
Random Effects Intercept	0.49	0.49	0.49	0.53	0.99	0.48
Age					0.06	
Gender				0.36		
Hunger						0.16
Number of observations	348707	348707	348707	348707	348707	348707
Number of groups	81	81	81	81	81	81

times", "Most of the Time", and "Always". The results are plotted in Figure 3.5A as odds ratios with "Never" as the reference level. Experiencing any level of hunger is associated with an increase in the odds of reporting worrying rarely over reporting never worrying by 100% (OR~2). Rarely experiencing hunger does not seem to be reliably associated with an increase in experiencing worry more often relative to never experiencing hunger. However, more extreme frequencies of hunger are associated with an increase in the odds of reporting worrying most of the time or always by up to 400% relative to never experiencing hunger. These findings appear suggestive of a dose-response effect, whereby higher frequencies of reported

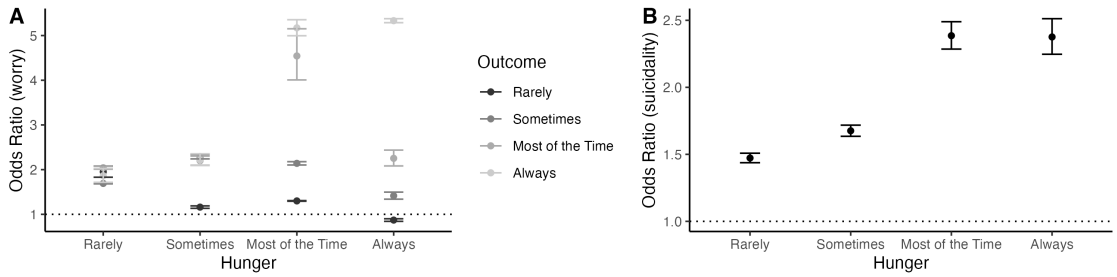

Figure 3.5: Dose-response effects. A. The relationship between different frequencies of experiencing hunger and worrying (Odds Ratio). B. The relationship between different frequencies of experiencing hunger and reporting suicidality (Odds Ratio)

hunger are associated with more frequent worrying.

We also examine the potential of a dose-response effect in a logistic regression with suicidality and find similar trends (Figure 3.5B). Experiencing hunger rarely is associated with an increase in the odds of suicidality by ~50% relative to never experiencing hunger, sometimes experiencing hunger is associated with an increase in the odds of suicidality by ~70% relative to never experiencing hunger, and experiencing hunger most of the time or always is associated with an increase in the odds of suicidality by 140% relative to never experiencing hunger. This suggests that there may be a saturation in the effect of frequency hunger on suicidality such that experiencing hunger most of the time or always have comparable effects.

3.4 Discussion

3.4.1 Main findings

Here, we investigated the relationship between hunger and mental health outcomes in a large-scale, cross-cultural dataset. Across different analytical models and in over 80 countries, we find consistent evidence that hunger is universally associated with higher frequencies of worrying and suicidality. Moreover, we find stable evidence that girls are more likely to report worrying and suicidality than boys, that the likelihood of reporting these mental health problems increases with age and with the experience of hunger. These effects do not solely occur in isolation but can also interact. Importantly, we find that age and hunger have different impacts in relation

to gender. Specifically, girls report more worrying and suicidality with age than boys do, and hunger impacts the worrying of boys to greater extents than girls.

Experiencing hunger is associated with increases in the likelihood of worrying by 14%, and suicidality by 7%. These are fairly large effects particularly when contextualized by looking at the variability across countries in reported worry and suicidality – we find standard deviations of 7.7% and 6.5% respectively for both outcomes across countries. Given that these patterns hold across countries, we can consider them as global or universal patterns of results. This cross-cultural stability, paired with the magnitude of the effects, illustrate the importance of understanding and targeting hunger in interventional efforts aiming to improve young people's mental health.

Our finding that with age girls report more worrying sits within a larger literature on the gender gap in adolescent mental health (Campbell et al. 2021). A large body of research including interventional and non-interventional designs with mixed methods substantiates the claim that girls report worse internalizing mental health problems than boys and that, further, this gender gap increases with age particularly during adolescence (Leadbeater et al. 1995; Galambos et al. 2004; Hankin et al. 2007; Mojtabai et al. 2016; Salavera et al. 2019; Prencipe et al. 2021a). Some have argued that the emerging mental health differences in adolescence may underpin the much higher prevalence of depression in adult women (Albert 2015; Campbell et al. 2021), highlighting the importance of early intervention. Our results indicate that these differences hold across different countries and as such adolescent-oriented interventions are important targets for global public health.

Our finding that hunger has a greater impact on the worrying of boys rather than girls is harder to situate in a broader field. A previous systematic review was unable to assess the impacts of hunger on mental health by gender in combined sample of children and adults (Weaver and Hadley 2009), and this remains a salient topic for further work. In two studies in US adults (Ciciurkaite and Brown 2017) and New Zealand adults (Carter et al. 2011), food insecurity was associated with increased psychological distress for women compared to men. These findings are

somewhat in contrast to ours. One possible explanation could be due to differences in population and context: the adolescents in our sample live in low- and middle-income countries. It is possible that the impacts of hunger on mental health differ over longer (developmental) periods of time and between macro-level contextual characteristics. We examine the impacts of such macro-level influences (such as inequality and poverty) in Chapter 4. Nevertheless, given that our results are stable across over 80 countries and the limited existing literature, we believe it is also possible that risk factors for the mental health of boys have been particularly understudied and that there are opportunities to provide more targeted social protections with increased gender awareness.

We find evidence for a dose-response relationship between hunger and worrying, as well as between hunger and suicidality. This finding is in line with a broader literature that suggests hunger has a dose-response relationship with mental health and wellbeing measures, such as negative experiences (Jones 2017), depression (Trudell et al. 2021), anxiety (Sorsdahl et al. 2011), as well as common mental disorders (Tesfaye et al. 2016), though most of these studies tend to be in adults. Given the current evidence in adolescents is based on a diverse, global dataset we believe efforts to eradicate food insecurity can be particularly important as a form of social protection for young people. The direct involvement of adolescents and consideration of their experiences in such interventions has only recently been more widely recommended (Dush 2020). As adolescents are able to reliably report their experiences and given that they do have unique experiences (separable from those of household members), more consideration should be placed on including them in future food insecurity work.

3.4.2 Limitations

As limitations, we first acknowledge that the current data is cross-sectional and observational, and as such we cannot speak to causal mechanisms. Work on hunger and food insecurity has predominantly focused on adult populations in high-income countries and nutritional impacts (Weaver and Hadley 2009). Providing rigorous

evidence for a potentially causal relationship (including an understanding of direction and mechanisms) between hunger and mental health remains an important future research target for effective future interventions. By contrast, large-scale cross-country surveys, such as the GSHS analyzed here, are needed to illustrate that risk factors such as gender or hunger operate at the population-level (Pearce 2000). Special consideration of these risk factors is warranted in public health efforts, given that even small improvements to population-level effects can produce greater total benefit than large changes at the individual-level (Rose 1985; Carey et al. 2023).

Further limitations of the current study pertain to the available measures. First, it is possible that our self-reported measures for mental health and hunger may carry bias (e.g. students may feel like that have to respond in certain ways) and so effects may be inflated due to common method variance (i.e. variance attributable to the measurement method instead of the construct of interest that the measures should capture). This is a standard limitation for survey research which can be addressed by providing tailored instructions to minimize bias, incorporating objective measures as well as integrating information from further respondents. Second, we recognize that the constructs studied here - worrying, suicidal ideation, hunger - are captured via single item measures. As such we consider these to likely be coarse and imprecise measures. We have tried to address this issue here through dichotomization (no experience = 0, any experience =1). This is in line with previous research with this dataset who that includes the same transformations for mental health measures (e.g. Quarshie et al. 2020; Arat and Wong 2017; Seidu et al. 2020). In the case of hunger, we chose to dichotomize in this fashion, including responses of 'rarely' experiencing hunger, given evidence that even low levels of food insecurity track with poverty (Wight et al. 2014).

An additional limitation related to the available measures pertains to potential confounders. There are a number of plausible causal mechanisms through which hunger and mental health might be positively associated. For instance, living on a lower income may lead to experiencing hunger as well as worse mental health. Whilst we cannot directly assess this here as we lack relevant individual-level information,

in the following Chapter we address this by using macro-level indices of poverty and inequality. This means that we can control for country-level differences in income and material circumstances; the hunger coefficients are unaffected across a wide range of measures and analytical specifications in a multiverse analysis.

Nevertheless, we consider measurement specifics to be an important limitation of the present research and the broader literature. To our knowledge the GSHS is one of the most comprehensive and largest surveys of child and adolescent health globally and we have been unable to find comparable datasets for this population that include more robust measures of mental health and poverty. With this in mind, we find that there is a need to improve global efforts to survey adolescent mental health. Inclusion of clinically meaningful and validated measures is a concrete target for better global surveys of mental health. This can be done while acknowledging practical considerations, such as the need for short and easy to administer questionnaires (e.g. Generalized Anxiety Disorder 2 or GAD-2 is a validated 2 item clinical screening tool). Similarly, we consider the lack of more direct measures of poverty or inequality as a limitation both of the current study and in the broader field of global health surveying. The availability of further measures would allow us to disentangle the impacts on mental health related to hunger from those related to other forms of material deprivation and other shared risk factors.

3.4.3 Mechanisms

Although we are not able to advance causal inference with the current results, it is important to situate our findings in a wider discussion of plausible mechanisms. Despite a lack of high-quality evidence tying hunger and mental health in children together, plausible mechanisms for this relationship have already been discussed. It is possible that a direct dietary link exists, such that diets that lack essential vitamins or minerals could be associated with anxiety and depression; in particular a review has indeed corroborated the link between micronutrient deficiency and mood problems (Kaplan et al. 2007). It is also possible since the experience of food insecurity generates uncertainty (considerations including where and when

food will come from), this is an added stressor and thus risk factor for mental ill health (Kessler 1997). Considerations of the inverse direction are also important, as some may plausible argue that some mental health problems, such as depression for instance, may relate to planning or motivational problems, which in turn could be associated with hunger and food insecurity. Although this seems less likely for children (where caregivers are primarily responsible for their diet), this is may still nevertheless be a plausible mechanism for older adolescents.

3.4.4 Effects in context

Finally, it is important to contextualize the magnitude of our effects. While estimates from our regressions with binary hunger appear small, we make two relevant observations. First, we argue that these are population-level effects and as such have significance for public health interventions. Second, we consider the fact that in our binary hunger measure we have collapsed across any experience of hunger and so this measure includes not only severe levels of deprivation but relatively minor ones as well. When examining the dose-response relationship, we can more concretely understand that higher levels of food insecurity can have very large negative associations with worrying and suicidal ideation. Hunger is associated with worse adolescent mental health in a pronounced, significant, and universal manner.

3.5 Acknowledgments

I am grateful to Professor Lucy Bowes and Professor Aaron Reeves for their supervision of this work.

4

The association between adolescent worrying, suicidal ideation and country-level inequality and deprivation: Evidence from a multiverse analysis.

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What is the association between macro-level indicators for inequality and deprivation and adolescent mental health? A large body of previous research has not been able

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to clarify this relationship. Here, we examine this potential association through a multiverse analytical approach, allowing us to assess various model decisions, in the Global School-based Health Survey and in over 80 low- and middle-income countries. We consider a variety of country-level indicators, including the Gini coefficient, GDP, the Palma ratio, the 20-20 ratio, the Multidimensional Poverty Index (MPI), as well as a variety of plausible statistical choices in model selection, such as the inclusion or exclusion of certain covariates in over 1,200 distinct models. We find some evidence for small and positive associations betwee macro-level measures and mental health, most convincingly for the MPI as a predictor and for worrying as an outcome. We find highly stable and convincing evidence across all model specifications for the negative impacts of hunger on mental health and, further, for greater mental health problems experienced by girls. We discuss these findings as population-level effects in the context of the United Nation's Sustainable Development Goals.

4.1 Introduction

The previous chapter examined the impact of individual-level deprivation, particularly through the experience of hunger, on the mental health of adolescents. As discussed earlier (Chapter 2), deprivation and inequality may operate through different mechanisms at different levels. Here, we take a macro-level perspective and consider the impact of country-level measures of deprivation and inequality and adolescent mental health. Macro-level indicators are widely used across the globe as survey tools for development and economic progress. In more recent years, such indicators have been considered as potential structural and causal determinants for physical and mental health outcomes, both at the population level and at the individual level (McAllister et al. 2018; Rathmann et al. 2015). Previous work indicates that a variety of indexes for country-level inequality, wealth, social and economic policies can influence the distribution of health outcomes between social groups (Diderichsen et al. 2012). In line with increased recent interest in understanding how country-level macroeconomic financial, structural indicators may impact the health varied social groups differently (e.g. such as by the International

Monetary Fund, Georgieva and Weeks-Brown 2023), here we focus on examining how country-level measures of inequality and deprivation relate to adolescent mental health, particularly for worrying and suicidality.

Through a literature review, we find a large body of research that substantiates macro-level inequality (measured on the country or state level) as a risk factor for mortality and poor physical health, predominantly in adult populations (Wolfson et al. 1999; Wilkinson and Pickett 2006; Pickett and Wilkinson 2010; Kondo et al. 2009). However, the impacts of macro-level inequality on *mental* health are not well established in adults and are inconclusive in adolescents. One systematic review (k = 27 studies) and meta-analysis (k = 9 studies) in adults primarily based in high-income countries found that income inequality (at different area levels, varying from neighborhoods to community districts, to areas of residence, to states, and countries) had a small, significant, and negative impact on mental health outcomes (most commonly, measures related to anxiety and depression; Cohen's d = 0.06), though there was pronounced heterogeneity between studies (Ribeiro et al. 2017). Another more recent meta-analysis (k = 12 studies) similarly suggests that higher degrees of income inequality (including measures at the neighborhood, district, municipality, state or country levels) are associated with a greater risk of depression (Patel, Burns, et al. 2018) and that there may be important sub-group effects, particularly that income inequality has greater impacts on the mental health of women and individuals with lower income. This meta-analysis captured individuals primarily based in high-income countries and while the majority of studies were in adult populations, four studies studies examined the effects of inequality specifically on the mental health of adolescents (McLaughlin et al. 2012; Pabayo et al. 2016; Vilhjalmsdottir et al. 2016; Goodman, Huang, et al. 2003). Taken together, these four studies provide mixed evidence from meso-level areas such as neighborhoods or schools with some of the work suggesting higher levels of deprivation were associated with fewer mental health problems (depressive symptoms, Pabayo et al. 2016; Goodman, Huang, et al. 2003), other with more mental health problems (emotional

distress, Vilhjalmsdottir et al. 2016), and some unable to provide evidence for any association (McLaughlin et al. 2012).

In more recent years, further individual studies have provided evidence for the relationship between country-level inequality and adolescent mental health. An analysis of 17 European countries suggests that higher levels of country-level wealth inequality (percentage of wealth calculated by the top two quintiles of the wealth distribution) are associated with fewer psychological and somatic problems and that higher levels of national income inequality (Gini coefficient) are linked with more psychological and somatic problems (Dierckens et al. 2020). A further more varied cross-national survey of over half a million adolescents in 73 countries suggests that higher levels of psychological distress are associated with higher GDP per capita and higher income inequality (via the Gini coefficient) (Campbell et al. 2021).

In terms of the impacts of macro-level deprivation on mental health, we find a high degree of heterogeneity in this literature. This may be underpinned by the wide variability of operationalizations used to capture deprivation or poverty. For instance, one review on the impacts of poverty and common mental disorders (Patel and Kleinman 2003) included a wide variety measures for deprivations such as indicators for education (e.g. school completion or attendance, literacy), income classifications or financial security (including unemployment), material assets and housing (e.g. overcrowding), though it was possible to measure most of these indicators only at individual-levels and in samples where generalization to greater-order areas (e.g. state, country) could not be guaranteed. Many conceptualizations of country-level deprivation have in fact been linked with traditional income or inequality measures, such as the use of the Gini coefficient either with (Yitzhaki 1979; Chakravarty and Chakraborty 1984) or without adjustments (Demsou 2023). However, there is growing recognition of the experience of deprivation as a multidimensional risk beyond the sole consideration of income but in fact including social, cultural, material factors. The most widely used such macro-level indicator is the Multidimensional Poverty Index (MPI), which captures factors mapped onto the Sustainable Development Goals such as education, living standards, food security

(Alkire, Roche, et al. 2015). There is a small but growing body of work that suggests adolescents living in multidimensionally poor areas or countries face greater mental health risks (Díaz et al. 2022; Chzhen et al. 2018).

Overall, the available literature paints an inconclusive picture regarding the impacts of macro-level deprivation and inequality on adolescent mental health, with some indication that meso-level income inequality (most often on the neighborhood level) has negative consequences for mental health. The literature on country-level effects is more constrained, thus warranting further research and clarification. One potential explanation that may underpin the mixed findings in this field pertains to researcher degree of freedom (Silberzahn et al. 2018). Inferences drawn about the impact of macro-level measures of inequality are often derived on the basis of relatively larger survey datasets containing a multitude of potentially relevant variables and so researchers have to make decisions regarding how to process, harmonize and analyze different data with multiple potentially appropriate options. The varied numbers of subjective but defensible choices researchers can make (e.g. which macro index to use, to dichotomize or not, include certain or other combinations of covariates) can produce greater researcher degrees of freedom. Moreover, in the absence of a pre-registered analysis plan and uncertainty regarding the number of analytical paths explored, it is difficult to maintain confidence in the interpretability of alpha and p-values for any confirmatory research (Wagenmakers et al. 2012). A likely useful approach to this challenge can be found in the multiverse analytic strategy. In brief, this method allows researchers to run all 'reasonable' models for a single research question or hypothesis and provide their results in a transparent manner (Simonsohn et al. 2020). Plausible models for the purposes of this work are those that are sensible tests for the questions of whether macro-level inequality and deprivation have an impact on adolescent mental health, that we expect to be statistically valid, and that are not redundant given other models already included in the specification set (Simonsohn et al. 2020). It is important to focus on the inclusion of principled analyses and the exclusion of needless ones, as the inflation of the analytical space may reduce the useful information provided in the

multiverse (e.g. make it more difficult to inspect relevant findings) and exaggerate the perceived exhaustiveness of the multiverse (Del Giudice and Gangestad 2021).

Here, we aim to address both the inconclusive findings in the current literature, the lack of evidence outside of high-income settings, at scales larger than the neighborhood or community, and for young people. We take a principled multiverse approach to examine the potential impacts of deprivation and inequality on adolescents' self-reported worrying and suicidal ideation in a large cross-national sample and combine this with macro-level measures of inequality and deprivation.

4.2 Methods

4.2.1 Data

This research project uses data from adolescents surveyed through the Global School-Based Student Health Survey (GSHS) during 2010-2018. This data is described earlier in Chapter 3. Here, we also use data from the same set of countries during the period 2010-2018 and the same key individual-level variables: age, gender, hunger, worrying, suicidal ideation.

Country-level measures for inequality

In addition to the GSHS data, in this project we further use a variety of measures that capture different facets of country-level inequality or deprivation. First, we use the Gini index (downloaded from the freely accessible World Income Inequality Database, WIID). The Gini index captures the extent to which the distribution of individual's income or consumption in a given country deviates from a perfectly equal distribution. It is more sensitive to inequality in the middle and less sensitive to inequality at the tails of the income distribution (Sitthiyot and Holasut 2020). Lower values represent more equal societies (with 0 representing 'perfect equality') and higher values represent more unequal societies. From the World Income Inequality Database we have also downloaded the Palma ratio and the 20/20 ratio. The Palma ratio represents the ratio between the richest 10% of

a given nation's population share of gross national income divided by the poorest 40%' of a given country's share. As such, the Palma ratio is less affected by changes in the middle of the income distribution but rather by changes in the tails (Cobham et al. 2016). The 20/20 ratio (sometimes called the 'income quintile ratio') compares the ratio of the average income of the richest 20% of a given country's population to the average income of the poorest 20% of the same nation. The 20/20 ratio is similarly more sensitive to changes in the tails of the income distribution (Sitthiyot and Holasut 2020). Through the Standardized World Income Inequality Database (SWIID), which aims to provide greater breadth of inequality measure coverage for country-year pairs, we also download two further measures in the Gini family - one for country-level inequality of disposable and another for country-level inequality for market income. These are both analogous in scale as the main Gini index, where lower values represent a higher degree of equality and higher values represent a higher degree of inequality. Notably, SWIID provides the most complete data, though many of the values are based on imputation (Solt 2020).

Country-level measures for deprivation

We use the Global Multidimensional Poverty Index (MPI), freely accessible from the Oxford Poverty and Human Development Initiative. The MPI is a composite measure that aims to capture acute deprivations in three dimensions of poverty - health, education, and living standards - in over 100 low- and middle-income countries. Each dimension is composed of individual indicators, such that the full MPI includes measures for nutrition, child mortality, years of schooling, school attendance, cooking fuel, sanitation, drinking water, electricity, housing, assets. Each of the three dimensions is equally weighted, and each indicator within a dimension is also equally weighted. For the purposes of our project, we use the global MPI, as well as each individual dimension, and each individual indicator (considering them in separate models). The MPI provides two additional measures, which we also retain for our multiverse. These are, first, the overall incidence of poverty (calculated as the percentage of poor people in the population) and,

second, the intensity of poverty (calculated as the average percentage of weighted deprivations experienced by the poor). Finally, we also use GDP per capita (Gross Domestic Product). We downloaded this from WIID and hencerforth refer to it simply as 'GDP' for brevity. GDP per capita measures the wealth of a nation by the economic output per person in that nation (i.e. per capita income means amount of money earned per person in a nation). GDP is measured in 2017 purchasing power parity US dollars.

4.2.2 Analytical approach

Multiverse analysis

Here, we take a principled multiverse analysis approach where we explore all relevant candidate regression models. Oftentimes, in the published literature, papers report the results of one model or a small selection of related models (e.g. unadjusted and adjusted estimates) but this may introduce bias in the conclusions. In a multiverse analysis, all theoretically plausible models are run and presented in parallel and it is crucial that all models included in the multiverse could stand on their own (i.e. as the single conventionally reported model in a paper). This allows us to capture so-called 'researcher degrees of freedom', that is different defensible and reasonable analytical decisions, such as for instance dichotomizing a variable or not. And so, in a multiverse analysis, a model that dichotomizes a continuous variable will be estimated, alongside one that considers this variable as a continuous measure.

By contrast, a multiverse approach allows us to chart the full landscape of possible results. This is usually presented in a specification curve, a figure that contains a summary of the key result of interest of each model in the multiverse. For instance, the multiverse analysis may center around the effect of a predictor variable (e.g. here, macro-level indicator for poverty or inequality) on a specific outcome (e.g. mental health), and so, the specification curve would plot the estimated coefficient for this across all models. The coefficients are usually sorted according to their value, producing a gradual (oftentimes smooth, sometimes discontinuous) curve. Accompanying the estimates, usually in an adjacent panel of the figure,

are the specifications of each model. Those map onto the different analytical choices distinguishing the models.

The general structure of the multiverse follows a branching tree pattern, where each analytical decision point branches off into different possible choices. For instance, in the dichotomization example, the choices would branch off into a dichotomized binary measure and a continuous measure for the variable of interest.

Multiverse branches: analytical decisions

Our multiverse has six main analytical branches. Our first branch considers analytical decisions regarding covariates, such as the inclusion of no covariates or the inclusion of hunger as a covariate or the adjustment for individual characteristics (gender and age). The second branch pertains to decisions about the construction and choice of macro-level variable. Here, we allow for the possible selection of different inequality measures (including all different Gini indices, the Palma ratio, the 20-20 ratio, GDP) or deprivation measures (MPI and all its family of indicators). We note that we reverse code GDP (such that a value of 30 now becomes -30) for the purposes of cohesive interpretability across all macro-level measures, where lower values indicates less inequality or deprivation and higher values indicated greater levels of inequality or deprivation. The third branch corresponds to analytical decisions for our two outcomes, worrying and suicidality. As in the raw data suicidality is presented as a binary variable, we do not apply further transformations to it. For worrying, in this branch we consider worrying as a continuous and then as a binary variable (no reported worry = 0, any worry = 1, again in correspondence with the previous Chapter 3). The fourth branch corresponds to pre-processing decisions for hunger, that is considering it as a continuous (reported frequency of hunger[1]) or binary variable (where no experience of hunger = 0 and any experience of hunger = 1, in correspondence with the previous Chapter 3). Our fifth branch corresponds to pre-processing decisions for worrying, specifically considering it as

[1]We acknowledge this may more appropriately be considered as an ordinal variable, though for the purposes of our analyses we treat it as continuous, similar to how Likert scales are treated in psychological research.

either continuous or binary (following the same logic as hunger). Finally, our sixth branch corresponds to the inclusion of random structures in our models, such as the inclusion of a random intercept for country-year (see Chapter 3) or random intercept and slope for gender. These branches and the different choices within them are illustrated in the bottom panel of Figure 4.1.

For the purposes of interpretation and comparability of estimates, we normalize all inequality measures prior to adding them to the multiverse analysis; we do this by computing standard scores for each macro-level variable. To ensure comparability in the scale of outcomes, we also rescale the raw measure of frequency of worry, originally on a scale 1-5, to the range 0-1 via min-max scaling. Similarly, we rescaled the raw measure of frequency of hunger, also originally on a scale 1-5, to the range 0-1 via min-max scaling, for comparability of parameter estimates across models where the hunger variable is dichotomized (0/1). Finally, as a general principle, if any of our inequality or deprivation indicators are missing data for a specific country-year pair, we instead use the closest year for which the indicator is available within that country as long as it is no more than 3 years prior/after.

Although we pre-registered our analytical strategy and use multiverse analysis with this data for transparency purposes (https://osf.io/kd4eh), we consider our approach here to be exploratory with the aim of exploring a wide of net of theoretically and statistically plausible models in order to fully map the possible impacts of macro-level inequality and deprivation indicators on adolescent mental health.

Control analysis

A common goal of scientific analyses should be ascertaining whether or not results were obtained by chance. In conventional analytical work, for instance when results are derived from a single regression, researchers can contextualize and examine the stability of their results in different ways, such as through examining a p-value, considering if a given test was appropriately powered, if it was confirmatory (ideally preregistered) or exploratory, and through carrying out further sensitivity analyses. In the context of a multiverse analysis some of the same conventional

strategies have direct cross-over, such as the consideration of p-values, typically presented alongside a specification curve, or of power (where appropriate power can be calculated for each model in a multiverse in the same fashion as it would if the model were presented as a standalone). However, for a multiverse analysis, we also want to know whether the entire pattern of results could be obtained by chance, rather than for any single model alone. Previously, to do so, other researchers have tried to find variables that are unrelated to the predictor and plot this alongside the main specification curve of interest. We searched through the GSHS dataset for such candidate variables (e.g. handedness) but were unable to find any that are theoretically unrelated to measures of macro-level inequality or poverty. With this in mind, for our control analysis here, we opted to generate a null distribution via variable value permutation. More concretely, we did so by using the exact same data, variables and multiverse branches but randomly shuffled the macro-level indicators between different country-years (and so a Gini value for Bhutan 2011 may be assigned to Argentina 2014). This approach allows us to retain the underlying multilevel structure of our data, where individuals are clustered in country-years, and also retain the associations between outcomes and individual level characteristics such as age, gender and huger, while solely permuting the predictor variables of interest. Ultimately, we create a null distribution, where the association between the randomized macro-level measures and the outcomes should be 0, that enables us to estimate what distribution of coefficient estimates we may obtain by chance.

4.2.3 Software

We have used the free statistical software R version 4.0.5 for the present analyses. We have relied on the packages tidyverse (Wickham, Averick, et al. 2019), broom.mixed (Bolker and Robinson 2020), data.table (Dowle et al. 2019), dplyr (Wickham, Francois, et al. 2014), ggplot2 (Wickham 2006) for data wrangling and visualization. We have used the nlme package (Pinheiro et al. 2017) for the construction of our regressions and the multiverse package (Sarma et al. 2023) for the multiverse analysis.

4.3 Results

4.3.1 Descriptives

We present a descriptive summary for the macro-level indicators in corresponding to the country-years captured in our dataset, including the average value of each indicator collapsed across all countries for the full time period (see Table 4.1). Previous literature has categorized Gini coefficients above 35 as indicative of high inequality and those above 50 as indicative of extreme inequality (Luebker 2010). The average Gini in our sample is 41.03, which suggests the presence of high inequality. This is similarly supported by our ratio measures, for instance the average Palma ratio is 1.96 in our sample and Palma values greater than 1 suggest that the top 10% of the population hold a greater share of income than the bottom 40%. According to our MPI measures, the average proportion or incidence of people who experience multiple deprivations is 21.7% across our country-year sample and the average country-level intensity of deprivations is 43.6%. As the availability of indicators varies per countries and over time, we note the total n between indicators varies (maximum 76 indicators, minimum 45 indicators). Further descriptive data per each country-year pair, including mean age, proportion of girls, mean levels of worrying and suicidality is available in the previous chapter, see Table 3.1.

4.3.2 The effect of macro-level variables

Our multiverse comprised 1216 models; 6 models failed to converge, giving us a total of 1210 estimated models. These results are summarized in Figure 4.1. The top panel presents a specification curve for the estimate for the macro-level variable across all model specifications. The lower panel of Figure 4.1 indicates which specific branch options are included in each model. We find that in 814 models (67% of models in our multiverse) the sign of the effect is positive, in the remaining 396 models (33%), it is negative. Turning to statistical significance, in 184 models (15%), the coefficients for the macro-level variable were statistically significant and positive; in 10 models (0.8%), the coefficients were statistically significant and negative, and

Table 4.1: Summary of mean values for macro-level variables in our sample. Mean values (and corresponding standard deviation, min-max values) are calculated across all countries in the full time period of 2010-2018. N denotes the number of country-years for which we have the corresponding macro-level information.

Variable	**Mean**	**Std.dev**	**Min**	**Max**	**N**
GINI	41.03	5.74	31.40	65.20	76
GINI.market	42.66	5.49	33.50	68.20	76
GINI.WIID	40.10	6.82	27.62	59.70	70
Palma	1.96	0.70	0.99	4.04	59
Ratio.2020	8.16	3.60	3.98	19.38	64
MPI	0.11	0.11	0.00	0.39	51
H	21.67	21.40	0.64	71.23	51
A	43.58	5.60	34.22	55.87	51
Health.Nutrition	9.38	10.84	0.26	35.62	45
Health.Child.Mortality	8.66	9.24	0.15	44.91	47
Education.Years	9.08	10.82	0.00	44.34	51
LS.Cooking	19.53	21.11	0.00	71.17	50
LS.Sanitation	17.15	19.60	0.02	64.65	51
LS.Water	10.88	13.69	0.00	50.64	51
LS.Electricity	14.67	19.27	0.01	68.00	50
LS.Housing	13.51	16.90	0.00	61.88	50
LS.Assets	9.63	11.67	0.00	42.45	51
GDP	13288.61	15654.68	1263.00	95500.00	76

in all remaining models (1016, 84%), the coefficients were not significantly different from 0 at $p > 0.05$. In terms of magnitude, overall the effect size tends be relatively small. Further, we present the results of the multiverse analysis disaggregated by outcome (worry and suicidality) in Figure 4.2. We note the results are largely consistent, though of a more modest magnitude for suicidality.

All in all, the pattern of results suggests a small positive effect of macro-level indicators on adolescent mental health; that is, overall, mental health worsens with increased macro-level inequality and deprivation. This appears to be the case for both worrying and suicidality, although to a less pronounced extend for the latter.

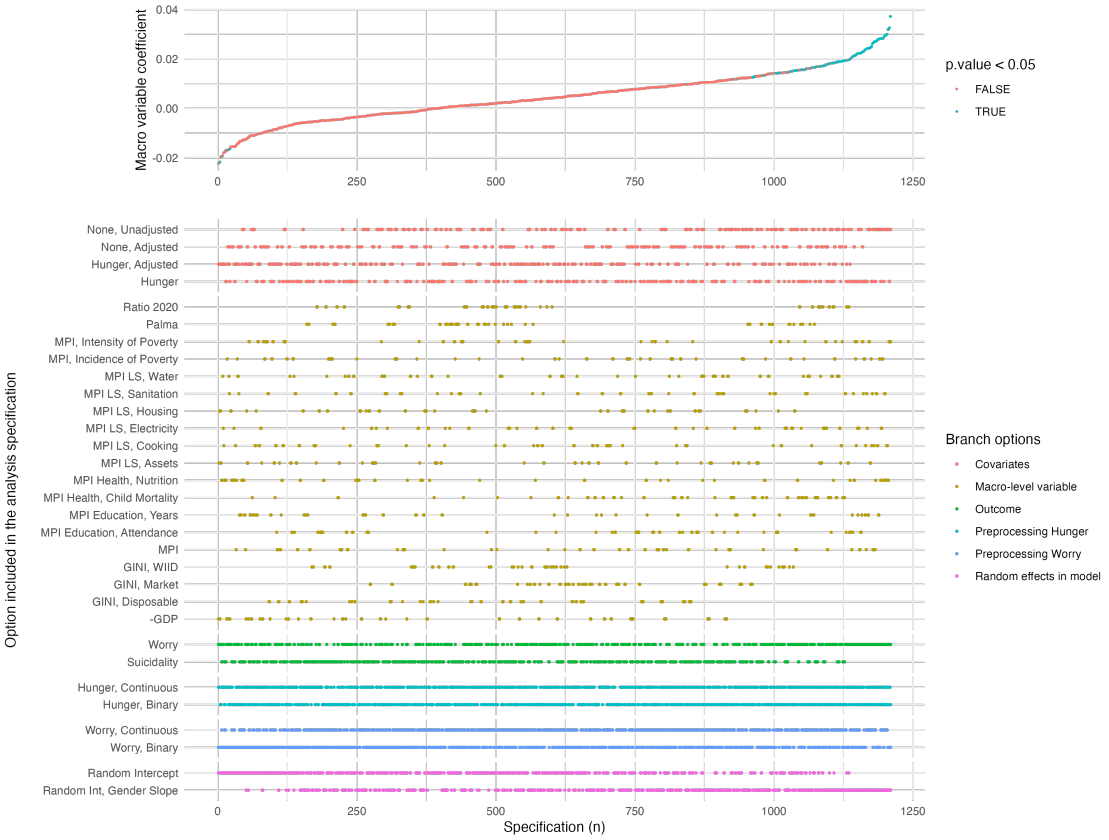

Figure 4.1: The effect of macro-level variables on worry and suicidality. Top panel presents a specification curve for the estimate for the macro-level variable, color denotes significance, with blue denoting p <0.05. The vast majority of significant results are for positive coefficient estimates; there is a small cluster of negative effects with GDP. Bottom panel indicates which analytical options are included in a given model.

Median coefficient estimates

Table 4.2 shows the standardized median estimates across specifications. The median estimate for our suidicality outcome is 0.002 and our median estimate for worry is slightly larger, though still small, 0.007. Our median estimates for our macro-level indicators are also all relative small. Two median estimates are negative, both for indicators in the MPI, Years of Education = -0.001 and Nutrition = -0.002. The rest of the median macro-level indicators are positive, indicative of a predominantly positive association such that higher levels of inequality/poverty are associated with worse mental health.

4. The association between adolescent worrying, suicidal ideation and country-level inequality and deprivation: Evidence from a multiverse analysis.

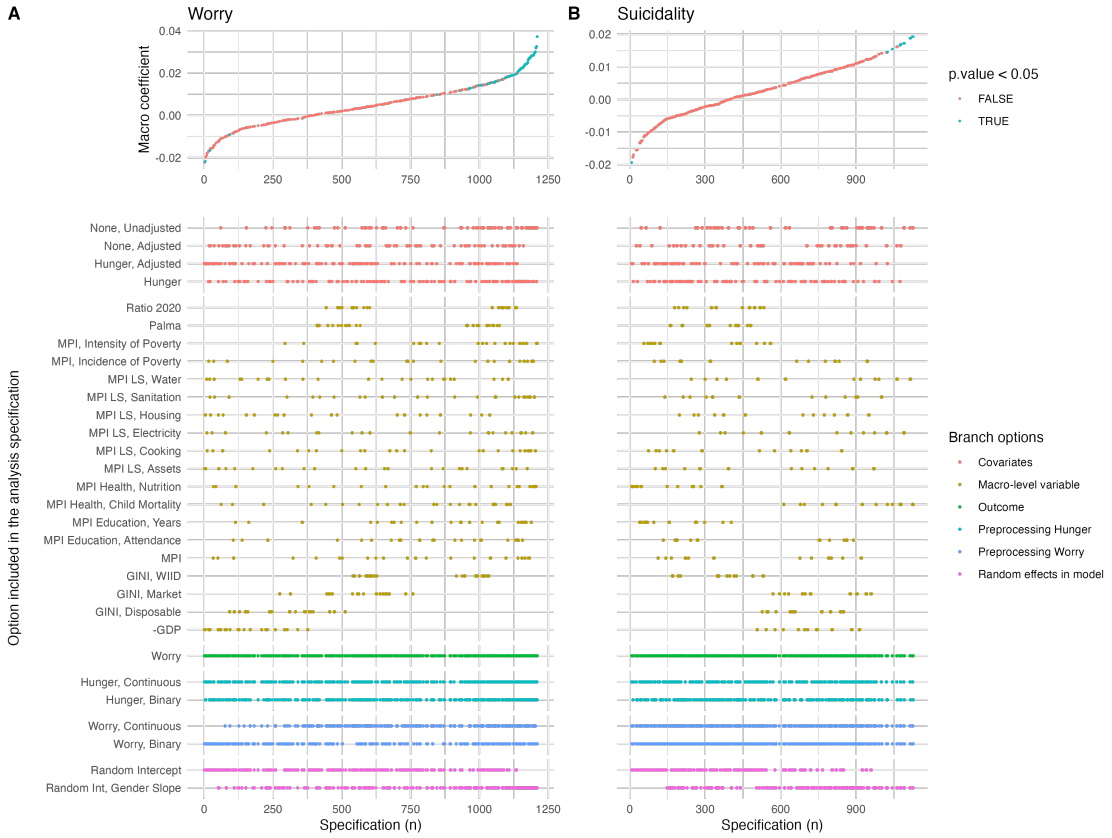

Figure 4.2: The effect of macro-level variables on worry and suicidality as above, but disaggregated by outcome (worry and suicidaliyty)

Significant effects

Next, we focus on the statistically significant effects in our multiverse. Table 4.3 presents how many models had significant estimates for each term, alongside the corresponding median beta and standard error. In terms of our outcome variables, the median significant estimate for suicidality was small and positive, 0.017 and based on 24 models. The median significant estimate for worrying was also positive and small, 0.019, though the evidence for this effect is more convincing as it is based on 170 models.

For each macro-level indicator, we had 64 models that included it. The macro-level variables that show the most convincing association with adolescent mental health are all deprivation measures from the MPI family, with all associations being relatively small and positive. The most consistently associated macro-level variables were child mortality (in 25/64 models), intensity of poverty (in 17/64

Table 4.2: Standardized median estimates for outcomes (worry and suicidality) and macro-level variable predictors across all specifications.

Term	**Beta**	**St.error**
Outcome		
Suicidality	0.002	0.008
Worry	0.007	0.007
Indicator		
-GDP	0.001	0.007
GINI, Disposable	0.002	0.007
GINI, Market	0.006	0.007
GINI, WIID	0.003	0.007
MPI	0.007	0.008
MPI Education, Attendance	0.008	0.009
MPI Education, Years	-0.001	0.008
MPI Health, Child Mortality	0.012	0.008
MPI Health, Nutrition	-0.002	0.009
MPI LS, Assets	0.005	0.009
MPI LS, Cooking	0.004	0.008
MPI LS, Electricity	0.008	0.008
MPI LS, Housing	0.001	0.009
MPI LS, Sanitation	0.008	0.008
MPI LS, Water	0.005	0.008
MPI, Incidence of Poverty	0.007	0.009
MPI, Intensity of Poverty	0.003	0.009
Palma	0.001	0.007
Ratio 2020	0.002	0.007

models), nutrition and electricity (both in 16/64 models). In terms of inequality measures that had significant effects, we note the Ratio 20-20 (in 8/64 positive) and the Palma ratio (in 1/64 models).

Lastly we note the interesting negative relationship between GDP and mental health, with significant results in 8/64 models. We had reverse-coded GDP for interpretability and consistency with the other variables, so that higher values indicate higher deprivation or inequality. This suggests that higher levels of per capita income are associated with higher levels of mental ill health.

Table 4.3: Number of significant estimates from our multiverse and corresponding median beta and standard error.

Term	**Beta**	**St.error**	**N**
Outcome			
Worry	0.019	0.006	170
Suicidality	0.017	0.008	24
Indicator			
MPI Health, Child Mortality	0.017	0.007	25
MPI, Intensity of Poverty	0.022	0.007	17
MPI Health, Nutrition	0.024	0.007	16
MPI LS, Electricity	0.018	0.006	16
MPI Education, Years	0.021	0.006	15
MPI Education, Attendance	0.019	0.006	14
MPI LS, Cooking	0.023	0.006	14
MPI LS, Sanitation	0.022	0.006	14
MPI, Incidence of Poverty	0.022	0.006	14
MPI	0.022	0.006	13
-GDP	-0.017	0.007	8
MPI LS, Water	0.019	0.007	8
Ratio 2020	0.018	0.008	8
MPI LS, Assets	0.017	0.006	7
MPI LS, Housing	0.015	0.007	4
Palma	0.016	0.008	1

Control analysis

We supplement our main multiverse strategy by a further control analysis in order to contextualize our effects. In our control specification, we use the same data, variables, and multiverse branches, though we randomly shuffle the macro-level variables between country-years (such that for instance the Gini value for Afghanistan in 2014 may be assigned to Bolivia 2016). This permutation approach allows us to retain the underlying structure of our data (the clustering of individuals in country-years, the associations between outcomes and individual level characteristics such as age, gender and hunger), while permuting the predictor variables of interest. This permutation analysis thus allows us to generate a null distribution of coefficient estimates. That is, it allows us to estimate what distribution of coefficient estimates we may get by chance, since by definition, the association between the randomized macro-level indicators and outcomes should be 0.

4. The association between adolescent worrying, suicidal ideation and country-level inequality and deprivation: Evidence from a multiverse analysis.

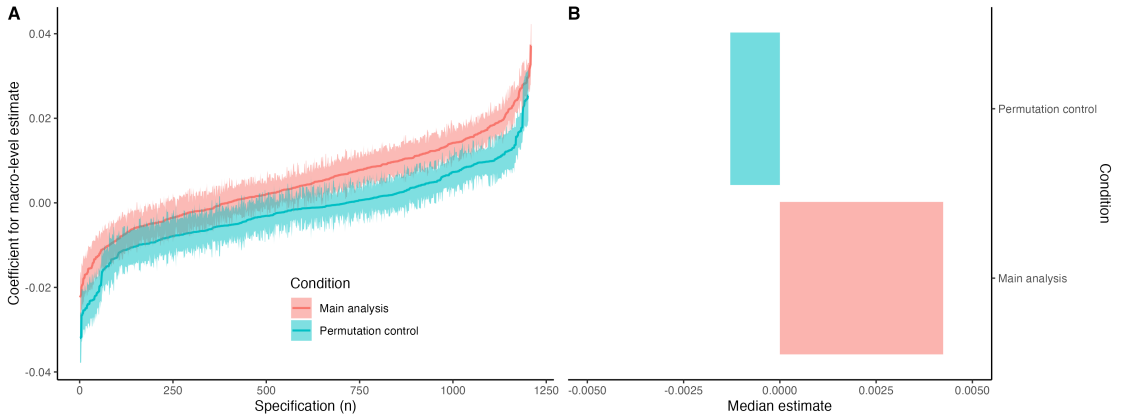

Figure 4.3: A. Comparison of specification curves for our main analysis (red) and our permutation control analysis (blue). B. Median estimates for the main analysis and control analysis.

We plot the specification curves of our main analysis and our comparison analysis in Figure 4.3. The left plot visualizes the estimates (and standard errors) across specifications; the right plot visualizes the median coefficient estimates. The curve formed by the main analysis is shifted upwards relative to the control curve. This suggests that the effect of the macro-level variables on mental ill health is consistently more positive than we would expect by chance alone (control curve). The comparison against the null distribution indicates that although the effect is small, it is reliable. Further, the median effect from our main analysis is over 3 times stronger than the null effect, which is not only smaller but of opposite sign.

4.3.3 The effect of micro-level (individual) variables

Hunger

The multiverse analysis, also allows us to assess the robustness of the effects of hunger on adolescent mental health across the different model specifications. In 608 models, hunger served as covariate and so we can probe the coefficient estimates for hunger from those. Figure 4.4 visualizes the coefficients estimated for hunger. Across all models, hunger had a significant and positive effect on adolescent mental ill health. The estimates appear in three clusters, tracking the different effect sizes for suicidality, worry (binary) and frequency of worry. This maps onto the results of Chapter 3 and further suggests that the effect of hunger cannot be subsumed by

4. The association between adolescent worrying, suicidal ideation and country-level inequality and deprivation: Evidence from a multiverse analysis.

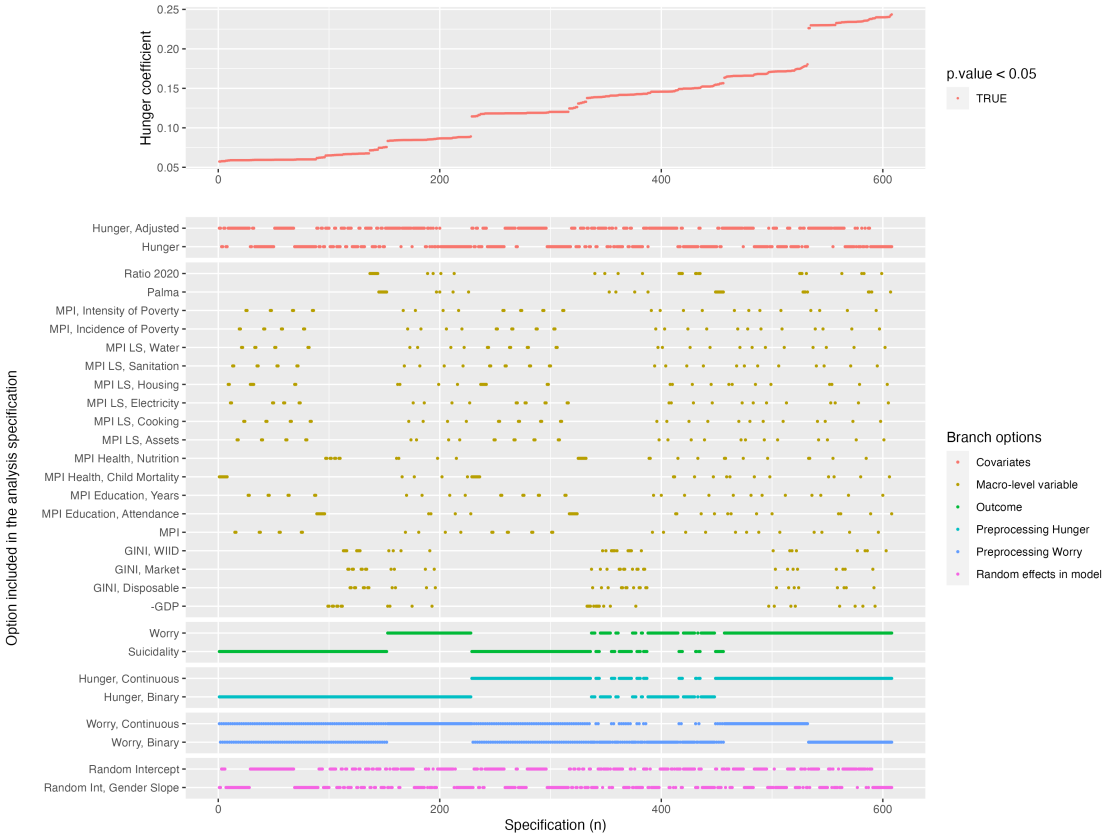

Figure 4.4: Coefficient estimates for hunger in our multiverse analysis. Notably, the coefficient estimate is positive and significant across all specifications.

macro-level measures of inequality and deprivation; it is not sensitive to various analytical choices for covariates and macro-level indicators.

Gender

In our multiverse, we are also able to assess the stability of the effects of gender on adolescents mental health across varied analytical choices. In 606 models, gender was used as a covariate and so we can use this population of models to evaluate the effects of gender. These effects are visualized in Figure 4.5. In all models, the coefficient estimate for boys was significant and positive, suggesting that boys are less likely to experience worry and suicidal ideation. This coheres with our earlier results (Chapter 3) supporting the idea that girls report more frequent worrying and suicidal ideation. The impacts of gender are robust across various analytical choices and cannot be subsumed by macro-level measures of inequality and deprivation.

4. The association between adolescent worrying, suicidal ideation and country-level inequality and deprivation: Evidence from a multiverse analysis.

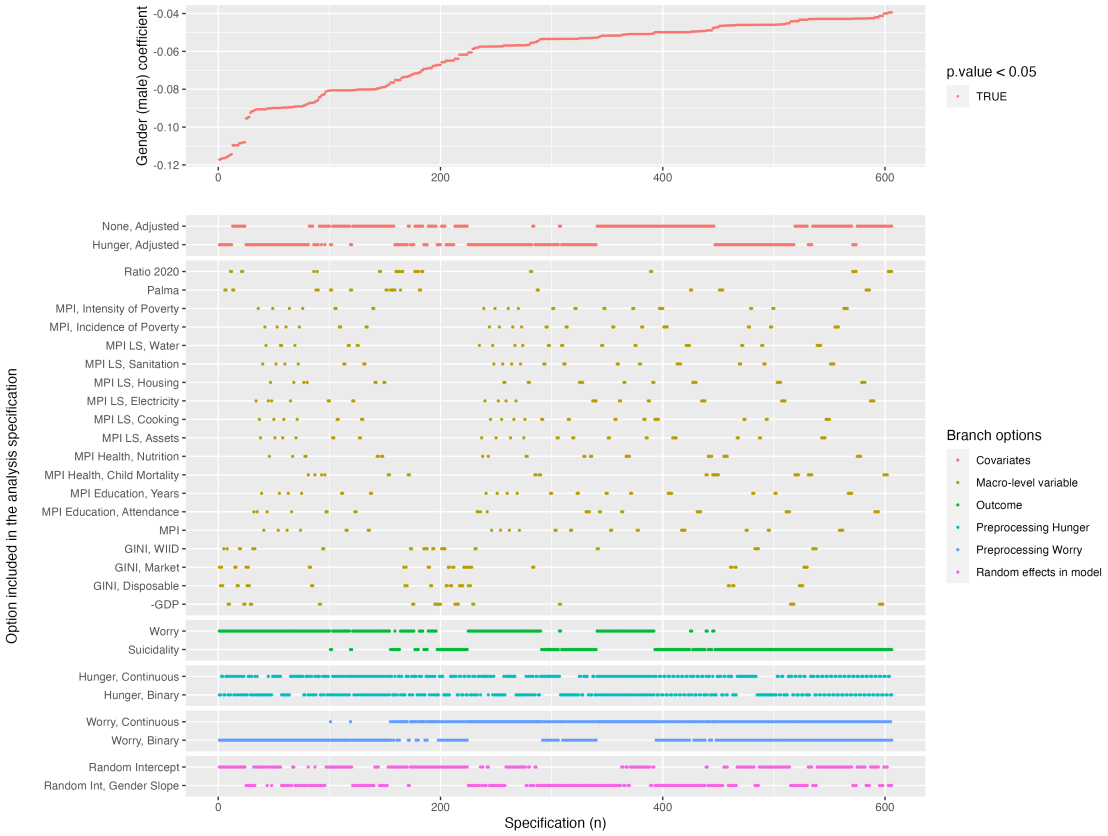

Figure 4.5: Coefficient estimates for gender in our multiverse. Notably, the coefficient estimate is positive and significant across all specifications. This means girls report more frequent worrying and suicidality than boys.

4.4 Discussion

4.4.1 Key takeaways

In our multiverse, we find that the estimate for the macro-level variable is positive in the majority of models (67%), indicating higher levels of country-level inequality and deprivation are associated with higher levels of mental health problems, in particular more worrying and suicidal ideation for adolescents. Notably, these effects are consistently small, but they correspond to population-level effects (Pearce 2000). Based on the models yielding statistically significant estimates for macro-level indexes, one standard deviation increase in a macro-level index increases the likelihood of reporting worrying by 1.9% and suicidality by 1.7%. We find more convincing evidence for the impacts of deprivation, through the MPI and

its sub-indicators, rather than for inequality measures (see Figure 4.1). Perhaps counterintuitively, the effects of GDP are in the opposite direction, suggesting that higher levels of country-level wealth are associated with an increased likelihood of mental health problems. Evidence is also more convincing for the impacts on worrying (based on significant models), rather than suicidality (see Table 4.3). In terms of individual-level impacts, both hunger and gender are consistently associated with mental health across all model specifications, suggesting more frequent experiences of hunger are linked with more mental health difficulties and that girls tend to report more mental health problems.

The majority of our model specifications suggest non-significant impacts of macro-level variables on mental health. Here, we caution that the presence of some non-significant estimates should not be interpreted as lack of effect, as we are likely underpowered. We have as few data points as we have country-years matched to corresponding macro-level variables, ranging from a maximum of 76 data points or a minimum of 45 data points depending on the indicator (see Table 4.1). The choice of a multiverse approach and the plotting of a specification curve allow us as a key advantage to ascertain that estimates in our models are predominantly positive, regardless of (non)significance. Further, comparison against our permutation control analysis indicates the coefficient estimates are consistently shifted away from the null distribution, hence suggesting a small but reliable effect.

4.4.2 Mechanisms

How do macro-level inequality and deprivation impact adolescent mental health? As discussed earlier (Chapter 3), the mechanisms are likely different. Our results suggest measures of deprivation (such as the MPI family of measures) are more strongly associated with mental health than measures of inequality (e.g. Gini). Our findings may support the idea that more proximal experiences are more salient to adolescents' lives and as such have a more direct bearing on their mental health. For instance, the experience of deprivation tracked here, such as access to water or electricity or sufficient nutrition, are likely much more acutely experienced and known in the

everyday lives of young people compared to unequal distributions in income across the population (Dierckens et al. 2020). Adolescents' disposable income is likely more closely related to their parental or caregiver income rather than country-level economic indicators. A potentially important avenue for future research could be to examine measures that more closely track adolescents' own purchasing power and their perception about macro-level indicators' relevance to their lives.

In the case of GDP, our findings replicate an effect that has previously been found in a large cross-national study (Campbell et al. 2021), similarly suggesting that increases in wealth are linked with decreases in mental health, although this was suggested to be driven by high-income countries in the Campbell et al.'s sample. We consider our work to be an extension of this finding in low- and middle- income countries, thus adding further evidence to the robustness of this effect. This effect has previously been contextualized via the so-called 'affluenza virus' mechanism where values in more affluent societies around acquiring money and possession also make individuals more vulnerable to emotional distress, increase the risk of depression, anxiety, and substance misuse (James 2007; Pickett and Wilkinson 2010). More granularly, this risk for poor mental health could occur because of social comparison as well valuing the accrual of material wealth over other facets of life that have positive implications for mental health (e.g. quality of social relationships, Umberson and Karas Montez 2010).

4.4.3 Limitations

Some of the limitations of this work pertain to the nature of the available data and as such have already been discussed in Chapter 3. In brief, as the GSHS is a cross-sectional dataset, we are not able to draw causal inferences through this work. The strength of our inferences is similarly limited by the nature of the mental health measures available which are single-item questions. In terms of capturing inequality and deprivation, we acknowledge the further availability of different country-level indexes (e.g. Theil index, Hoover index, 80/20 ratio). While it was not practically feasible for us to include a greater number of macro-level

variables due to practical constraints (e.g. paucity of data for our sample and lack of access to a supercomputer), we have attempted to capture the most widely used measures in this current project, while also being mindful to include a selection of indexes that have different sensitivities to the income distribution (e.g. Gini - more sensitive to changes in the middle, Palma - more sensitive to changes in the tails). As a related point, we also consider the consideration of more varied macro-level indicators as an important future research target. Here, we have examined the impacts of so-called 'objective' macro-level indicators of inequality, though there is now also a growing body of subjective country-level indicators such as for perceived wealth, justice, freedom (Scholten et al. 2017). A further limitation pertains to the sample of adolescents participating in the Global School-Based Health Survey. As discussed earlier (see Chapter 3), the mean age in our sample is 14.8 years (minimum 11 - maximum 18 years old), and this mean falls in what has typically been considered in the developmental literature as young adolescence (Blakemore 2019). Replication in different age cohorts remains important, especially given the rapid developmental changes occurring in adolescence, including development of richer perceptions of self and others, social and situational awareness (Blakemore and Mills 2014). It is important to replicate outside of this cohort, as we note that the sample of adolescents in the GSHS were all surveyed at school. While the GSHS places great effort on capturing as close as possible to nationally representative samples, particularly by surveying schools in urban (both large cities and smaller town) and rural settings, this sample may not be representative of the perceptions and experience of adolescents who do not currently attend school. Despite strong global commitments to ensure universal education, about 200 million adolescents are out of school (62 million of lower secondary school age and 138 million of upper secondary age) and they are most facing the highest burden of inequality and deprivation (UNESCO 2023).

4. The association between adolescent worrying, suicidal ideation and country-level inequality and deprivation: Evidence from a multiverse analysis.

4.4.4 Implications of the effects

On the whole, effects discussed here tend to be relatively modest – approximately 2% increase in likelihood of reporting worrying/suicidality with a standard deviation increase in a macro-level indicator. This is consistent with the broader literature examining macro-level impacts, such as for instance the impacts of country-level inequality on mortality (Kondo et al. 2009). As we see these macro-level effects on mental health operating on the population level ((Pearce 2000); see also Chapter 3), even small decreases in inequality and deprivation could translate to important and larger positive significance for mental health.

While we cannot be sure of the nature of the studied association, if our findings correspond to a causal relationship, then we might worryingly anticipate worsening of adolescent mental health worldwide given troubling current trends for poverty and inequality. According to the United Nations, income inequality within countries has been rising (United Nations 2023) and has likely been exacerbated even more with the recent Covid-19 pandemic (Ferreira 2021). Worse still, the effects of this post-pandemic inequality are likely to be particularly shouldered by young people entering the labour market in years to come, thus making them particularly vulnerable and likely to face disproportionate mental health burdens (Deaton 2021; Ferreira et al. 2021; Patel and Kleinman 2003). The pandemic has also also exacerbated poverty, plunging a further 100 million children worldwide into multidimensional poverty (representing a 10% increase since 2019) and with further projections for increases in the poverty rate for low-income countries (UNICEF 2023). On the basis of our results and their implications, we consider that intervention and policy work that target the macro-level context, such as decreasing country-level inequality and deprivation, are needed and cohere with global mental health goals.

4.5 Acknowledgments

I am grateful to Professor Lucy Bowes and Professor Aaron Reeves for their supervision of this work.

5

The impact of cash transfers and monetary interventions on children and adolescents' mental health: a systematic review and meta-analysis.

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Poverty alleviation programs, such as cash transfers and monetary grants, may not only lift people out of poverty but, some argue, may improve mental health as well. However, to date, the impact of such programs on children and adolescents' mental health is unclear. Methods: We carried out a systematic review and meta-analysis of poverty alleviation interventions providing monetary support and reporting mental health outcomes in 0-19 year olds in low-, middle-, and high-income countries.

5. The impact of cash transfers and monetary interventions on children and adolescents' mental health: a systematic review and meta-analysis.

We searched 11 databases for research published between 1 January 1990 - 1 June 2020 and included interventions offering unconditional and/or conditional monetary support and reporting mental health outcomes. Results: After screening 7733 unique articles, we included 14 papers (16750 children and adolescents at follow-up) in our narrative summary. We meta-analyzed data on internalizing symptoms from 8 papers (13538 children and adolescents analyzed). This indicated a small but significant reduction in adolescents' internalizing problems post-intervention compared to control ($OR = 0.72$, 95% CI 0.59-0.88, $p < 0.01$). Our narrative synthesis provides further support for the overall effectiveness of cash programs but also notes that monetary support alone may not be sufficient in extreme risk settings and that imposing conditions may be actively harmful for the mental health of adolescent girls. Conclusions: We provide causal evidence that monetary interventions reduce internalizing symptoms of adolescents experiencing poverty. We recommend that future programming thoughtfully considers whether to apply conditions as part of their interventions and highlight the importance of providing additional comprehensive support for children and adolescents living in extreme risk settings.

5.1 Introduction

Poverty has devastating consequences on mental health outcomes: it has been consistently associated with increased prevalence of depression and anxiety, as well as increased rates of suicidal behaviors and ideation (Lund, De Silva, et al. 2011; Ribeiro et al. 2017; Lund, Brooke-Sumner, et al. 2018). Worryingly, poor mental health can trap an individual in poverty by preventing them from improving their economic outcomes (Lund, De Silva, et al. 2011; Haushofer and Fehr 2014; Richmond-Rakerd et al. 2020). This vicious cycle of poverty and mental ill health is particularly harmful for young people as deprivation experienced early on in life is strongly predictive of later mental health problems throughout the lifespan (Gibson et al. 2017). Further, adolescence is an important developmental timepoint when many mental health problems emerge (Paus et al. 2008; Lee, Heimer, et al. 2014). Consequently,

childhood and adolescence are particularly important periods for potential early intervention that can break the cycle of deprivation and mental ill health.

Previous research in the field of poverty and mental health has largely focused on the adult population with a recent high-quality review (Ridley et al. 2020) suggesting that different anti-poverty interventions, including both multifaceted programs and cash transfers, can improve psychological well-being and certain indices of mental health. Past syntheses or systematic reviews for children and adolescents are outdated and have been able to provide largely non-causal, correlational evidence (Reiss 2013) or have been unable to produce conclusive findings due to aggregating very heterogeneous interventions (Lund, De Silva, et al. 2011) (e.g. targeting housing improvements, education, as well as providing cash transfers). A more recent meta-analysis found no effect of cash transfers on the depressive symptoms of young people (Zimmerman, Garman, et al. 2021). However, this paper only focused on low- and middle-income countries, did not consider other types of monetary support beyond cash transfers, and included a wider age range going beyond adolescence (0-24 year olds).

With this in mind, this review and meta-analysis aims to provide causal evidence regarding the effectiveness of poverty alleviation interventions for improving the mental health of children and adolescents in low-, middle-, and high-income countries. In order to elucidate specific intervention mechanisms, we focus exclusively on monetary interventions, such as cash transfers and grants, that report mental health outcomes (excluding broader non-clinical outcomes like wellbeing, happiness, or life satisfaction). We excluded non-monetary interventions such as those that, for instance, provide housing improvements, education interventions, health schemes, food provisions as these likely impact mental health outcomes through different mechanisms. This evidence is particularly pertinent given the United Nations' Sustainable Goals to end extreme poverty and halve multidimensional poverty by 2030, as well as the recent rise of poverty alleviation efforts across the globe (e.g. in Sub-Saharan Africa, World Bank 2015; Owusu-Addo et al. 2018). Further, there is a need to understand what works in terms of breaking the cycle of poverty and

poor mental health for young people not only because of the accelerated efforts to this end but also because the current context of the global Covid-19 pandemic will likely exacerbate existing socioeconomic inequalities, leaving more young people vulnerable to ill mental health (Li, Wang, et al. 2021).

5.2 Methods

5.2.1 Search strategy and selection criteria

This systematic review and meta-analysis adheres to PRISMA guidelines (Arya et al. 2021). We carried out our main search in 11 databases:1) Applied Social Sciences Index Abstracts, 2) the International Bibliography of the Social Sciences, 3) PsycINFO, 4) Global Health, 5) EMBASE, 6) Child Development and Adolescent Studies, 7) Family & Society Studies Worldwide, 8) CINAHL, 9) SCOPUS, 10) MEDLINE, 11) Web of Science. As a secondary search, we carried out backwards and forwards reference tracking, emailed relevant researchers and NGOs, and queried Google Scholar. The specific search terms used are available on our OSF page. We implemented a hybrid search strategy which incorporated both terms for specific program types (e.g. "unconditional cash transfer") and a combination of terms for general study design and program aims (e.g. "RCT" and "poverty"). We accepted work published in peer-reviewed journals, book chapters, reports from NGOs and charities, as well as unpublished literature such as dissertations, theses, pre-prints, and working papers. Studies had to be published from 1 January 1990 to 1 June 2020. Following existing recommendations (such as by Reiss et al. 2019) in assessing the relationship between socioeconomic inequalities and mental health outcomes, we consider there may be poor comparability in studies prior to 1990 due to the use of non-standardized mental health instruments.

Our inclusion criteria applied the World Health Organization's definition for children and adolescents, limiting our age group of interest to 0-19 year olds. We included all studies with samples whose average age fell within this range. If a study's average age fell outside of this range but otherwise met our inclusion

criteria, we queried the corresponding author if they could provide a sub-group analysis. We included monetary transfer interventions that aim to alleviate poverty or socioeconomic inequalities. As we are interested in the potential causal effects of monetary transfers on mental health, we excluded interventions that involved in-kind benefits such as vouchers for goods or services. Similarly, we excluded programs that provided skills training, educational opportunities or housing improvements in the absence of monetary transfers.

Included studies had to provide quantitative measures for mental health in children and adolescents following the intervention. We accepted outcome measures for different facets of mental health such as internalizing and externalizing symptoms, behavioral or emotional problems and functioning, as well as specific mental health conditions and diagnoses, such as depression and anxiety. However, we excluded measures of life satisfaction, general happiness, or wellbeing. Eligible designs included randomized and pseudo-randomized controlled trials, as well as interrupted time series without a control group but featuring pre- and post-intervention outcome measures. We carried out the search in English but did not use the language of publication as grounds for exclusion.

The search strategy, abstract and full text screening, data extraction, and quality assessment were carried out in full by the first author. The second author independently screened a random sample of 15% of all the abstracts and a random sample of 15% of all the full texts. We obtained very high agreement between the two raters for both stages (abstract: Cohen's kappa $\kappa = 0.881$, $p < 0.001$; full text: $\kappa = 0.842$, $p < 0.001$). The second author was later involved in full (100%) for data extraction and quality assessment. For all stages of the review, disagreements were resolved through consensus discussions and where required by further arbitration from the remaining authors.

5.2.2 Data analysis

We extracted and double-checked data via a customized spreadsheet recording the characteristics of interest for each study, including design, sample size and

profile, intervention and comparison type, and relevant mental health outcomes. When data was missing or unclear, we contacted the study authors for clarification. Findings from all included studies were narratively synthesized. The narrative synthesis aggregated findings from the included interventions. We mapped emerging patterns in the literature with regards to particular sub-populations (e.g. by gender or age), study setting (e.g. income levels, fragile or other settings), and intervention characteristics (e.g. conditionality, targeting). We planned to carry out an inverse variance method random effects meta-analysis on quantitative data for each outcome type for which we could extract an effect size estimate and 95% confidence interval from a minimum of 3 studies. This was only possible for internalizing symptoms. Our pre-registration originally specified that our preferred effect size would be Cohen's d but we found that the vast majority of papers reported odds ratios and so decided to opt for odds ratios in order to minimize the potential of error due to conversion between effect sizes. Study variability was assessed via the I^2 estimate of heterogeneity. Analyses were carried out in R, version 3.6.1 with the meta package (Schwarzer et al. 2007). We assessed the risk of bias of included studies via the Cochrane Collaboration's RoB2 tool (Higgins et al. 2019).

This study was pre-registered at OSF: `https://osf.io/fq9us/`. All associated materials are stored in the same OSF depository.

5.3 Results

After screening 7733 unique articles we identified 14 eligible studies for inclusion in the systematic review (see flowchart in Figure 5.1). Mental health measures were secondary outcomes in all interventions. Two interventions were pseudo-randomized controlled trials and the remaining 12 were RCTs (5 randomized on the individual and 7 on the cluster level). We found an evidence gap for high-income countries, externalizing symptoms, and young children. Specifically, only two of the 14 studies were conducted in a high-income country (USA) with all remaining studies carried out in low- and middle-income countries in Africa, Latin America, and Asia. All

papers included internalizing symptoms as outcomes (most commonly the CES-D measure) but only 4 included some measure of externalizing symptoms. Most often this was the Behavior Problems Inventory (BPI) (Yoshikawa, Magnuson, et al. 2003; Paxson and Schady 2010; Macours et al. 2012) with only one paper (Macours et al. 2012) assessing specific externalizing behaviors. Only three papers provided data for young children: 2-6 years olds in Nicaragua (Macours et al. 2012) and Ecuador (Paxson and Schady 2010) as well as 2-9 and 1-10 year olds in the USA (Yoshikawa, Magnuson, et al. 2003). The remaining studies reported outcomes for adolescents above 10 years of age. The majority of studies were cash transfer programs with cash typically dispensed to adult caregivers. These were either unconditional cash transfers (UCT) or conditional cash transfers (CCT). In CCT programming participants needed to comply with a certain condition such as school attendance or health care visits. Two programs (Ismayilova et al. 2018; Kang Dufour 2011) provided grants in the form of larger lump sums. Three programs were integrated with social care and also provided training or coaching components (Ismayilova et al. 2018; Kang Dufour 2011; Özler et al. 2020). We provide further study characteristics in Table 5.1.

Moreover, we assessed methodological quality via the Cochrane RoB2 tool which produces ratings for 5 methodological domains for RCT trials and 6 domains for cluster RCT trials. While quality varied, the most common rating for each domain was 'low risk'. The most common source of potential bias pertained to outcome measurement with 5 out of 14 publications receiving a rating of 'some concerns' or 'high risk'. Overall, there were not many baseline imbalances and randomization was generally successful, although 5 out of 14 publications were rated as having 'some concerns' regarding potential bias in randomization.

5.3.1 Meta-analysis

We were able to include 8 of the studies in a meta-analysis for which there was sufficient information to compute an effect size for similar outcomes. These 8 studies were all comparable in that they all assessed internalizing symptoms in adolescents

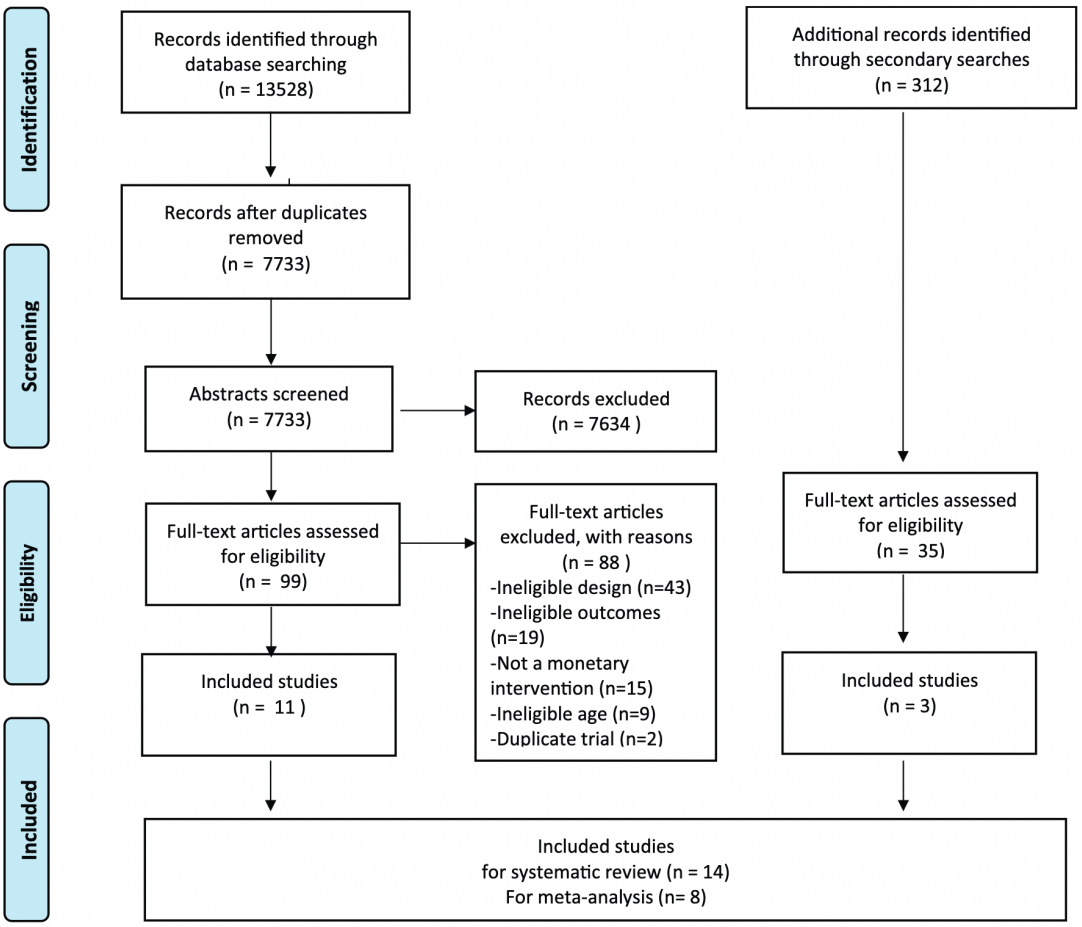

Figure 5.1: PRISMA flowchart.

(aged 10-19) in low- and middle-income countries. Across the included studies, there were still considerable differences in the way the interventions were designed and their purposes (i.e. primary outcomes), setting, duration, and outcomes measured. Due to the limited sample size, we were not able to evaluate different potential moderators in a meta-regression such as gender or intervention type (e.g. conditional or unconditional). Our random effects meta-analysis revealed that internalizing problems were significantly reduced post-intervention compared to control (OR = 0.72, 95% CI 0.59-0.88, p $<$ 0.01; I^2= 67%, τ^2 = 0.05, p $<$ 0.01; see Figure 5.2. Our funnel plot (Figure 5.3) and Egger's test (p = 0.13) do not indicate the presence of asymmetry, although we may lack sufficient power to detect bias in our sample of published studies (k = 6 studies). We note that at the time of conducting our review, we included two unpublished studies, both of which

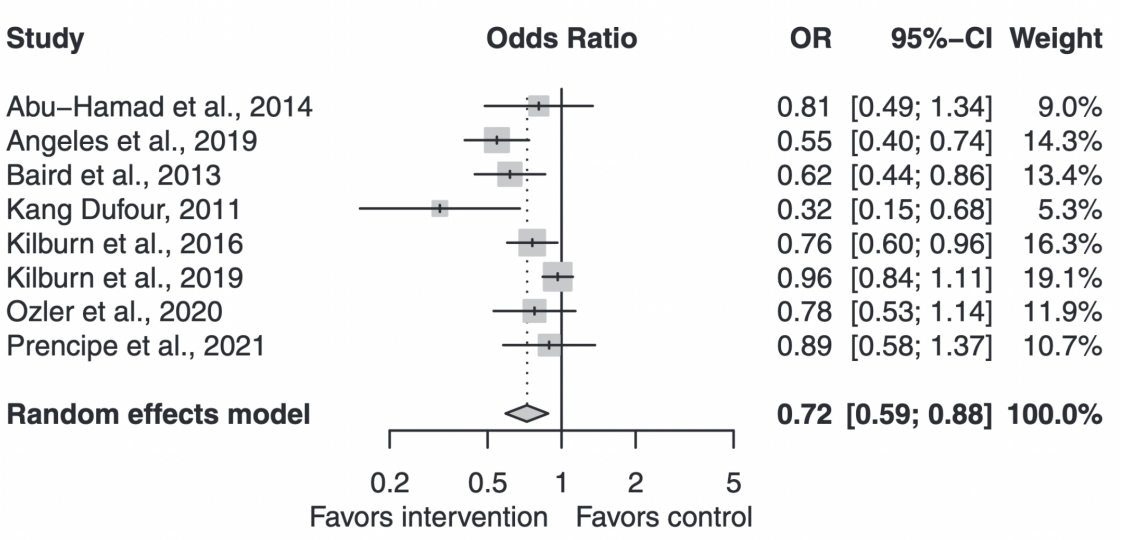

Figure 5.2: Forest plot of effect sizes in included papers.

(Kang Dufour 2011; Prencipe et al. 2021b) report positive effects. One of these has since been published (Prencipe et al. 2021a).

5.3.2 Narrative synthesis

While the meta-analysis suggests a small positive effect of the intervention on adolescent mental health on the aggregate, there was considerable variability in the strength and direction of the effect depending on the characteristics of the (sub-)sample.

Gender effects

Multiple cash intervention programs focus on girls specifically due to their increased vulnerabilities to, for instance, domestic and sexual violence, household and social pressures to stay outside of school, early pregnancy (e.g. interventions, Kang Dufour 2011; Özler et al. 2020; Kilburn, Hughes, et al. 2019; Baird et al. 2013). Two programs (Prencipe et al. 2021b; Kilburn, Thirumurthy, et al. 2016) that include both boys and girls find differential effects by gender such that the cash transfer programs generally produce greater benefits for boys. Importantly, on the basis of our narrative synthesis, we note a gender interaction effect with the conditionality of the intervention. In Tanzania, Prencipe and colleagues (Prencipe

et al. 2021b; Prencipe et al. 2021a) investigate the impact of an unconditional base transfer paired with an additional transfer, conditional on school attendance. When examining the interaction between gender and condition, they found that boys' mental health improved following the intervention as evidenced by a decrease in 8 percentage points on CES-D. For girls, there was no effect in a younger subsample (aged 14-18), but mental health worsened in an older subsample and a subsample of girls who had a child. Similarly, an RCT in Malawi (Baird et al. 2013) found stronger positive effects for a UCT compared to a CCT program which required girls (aged 13-22) to attend school. With each additional dollar given to the parents, conditional on school attendance, mental health worsened (likelihood of psychological distress increased by 3 percentage points). Some authors (Prencipe et al. 2021b; Angeles et al. 2019) have argued that CCTs exacerbate the existing additional demands placed on adolescent girls (e.g. household work, family support). Conditional programs that require school attendance (or comparable conditions such as health visits to distant hospitals) may serve as an added burden and source of stress. To address gender disparities in economic autonomy, poverty alleviation interventions such as the SHAZ! Program in Zimbabwe (Kang Dufour 2011), provide monetary as well as social support, mentoring, and opportunities for economic independence to adolescent girls (aged 16-19). Completion of the program resulted in a reduction of an anticipated 14% of participants who would have, otherwise, exhibited symptoms of mental ill health, indicating that economic empowerment can have significant positive impacts on adolescent girls' mental health.

The importance of context

Beyond the differential gender effects, we found heterogeneity in regards to study setting. Some contexts are characterized by extreme deprivations and disproportionate risks faced by children and adolescents including, for example, armed conflict areas, fragile settings, settings with ultra-poverty and chronic malnutrition, hazardous child labor, high levels of sexual and gender-based violence, and armed conflict. For instance, qualitative and quantitative evaluations of The

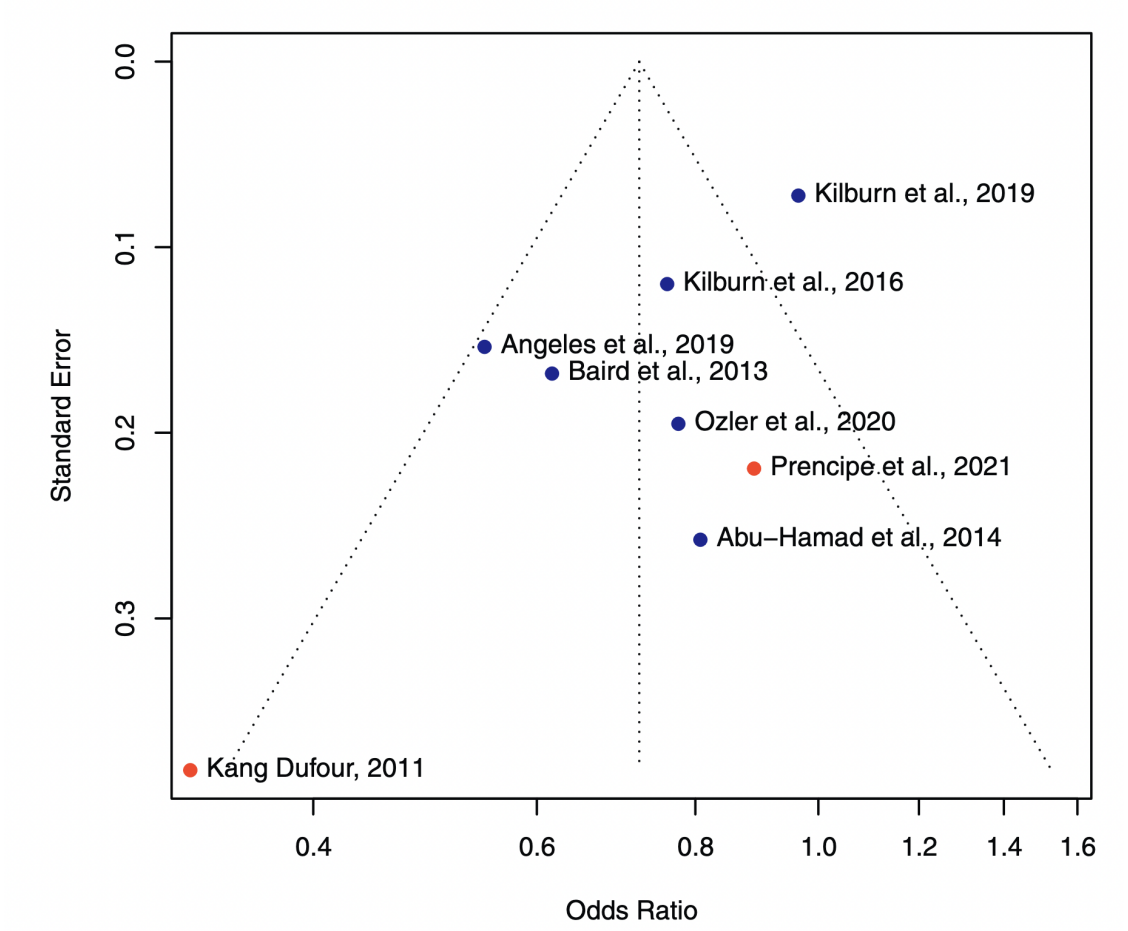

Figure 5.3: Funnel plot of effect sizes in included papers.

Palestinian National Cash Transfer program (Abu-Hamad et al. 2014) which provides unconditional cash transfers to eligible severely and extremely poor households revealed that children were exposed to various risks, including systemic intra-household and macro-level violence. While the cash transfers were essential for families to address their basic needs, they appear insufficient for child protection and safe-guarding purposes. Integrated interventions combining cash and social care components aim to address this issue. For instance, the Trickle-Up Intervention in Burkina Faso (Ismayilova et al. 2018), targeting ultra-poor households that experienced extreme deprivation both in terms of degree and duration including chronic hunger and illiteracy, combined grants with whole family coaching on treating children well and household decision making and communication. The combined intervention had a positive effect on adolescent mental health (aged

10-15) but the economic intervention alone did not, despite evidence that it allowed for more spending on children. However, combined cash and social programming interventions are limited in terms of the extent of risks for children and adolescents that they can address. A recent study in Liberia combining a girl empowerment (aged 13-14) program with cash transfers (Özler et al. 2020) showed no significant impacts on mental health outcomes. While the program engaged both girls and their caregivers regarding social norms pertaining to gender and violence, it was not successful in changing caregivers' perceptions. Further, it did not address the holistic community context in which adolescents were situated – at follow-up, 95% of girls across conditions had experienced violence and 1/3 had been raped.

Effects by baseline income

Moreover, there was indication of heterogenous effects per baseline income. While some programs specifically targeted the most deprived households, other programs (Macours et al. 2012; Kilburn, Hughes, et al. 2019) did not employ income metrics as an eligibility criterion or utilized lower thresholds. As a result, the samples in these latter programs exhibited higher heterogeneity in baseline income. The observed disparity in baseline income levels was reflected in differential intervention effects on child and adolescent mental health. In particular, Kilburn and colleagues (Kilburn, Hughes, et al. 2019) found that for the poorer half of the sample, for whom baseline consumption fell beneath the South African definition of the poverty line, the intervention effectively reduced the degree of depressive symptoms in adolescent girls (aged 13-20). However, no effect was observed for participants who had been relatively wealthier at baseline. This finding echoes findings by Macours and colleagues (Macours et al. 2012) from the Nicaraguan Attención a Crisis intervention, which effectively reduced behavior problems in younger children (aged 2-6) only in the poorest quintile.

Kilburn and colleagues (Kilburn, Hughes, et al. 2019) consider that their the cash transfers represented a larger proportion of the budgets of the neediest households in the sample compared to those better off. As such, the intervention not only decreased

the absolute deprivation experienced by those poorest at baseline, but also decreased their relative deprivation, which further contributed to the amelioration of child and adolescent mental health difficulties. Baird and colleagues (Baird et al. 2013) provide direct evidence for the impact of relative deprivation. Their multi-arm, multi-control cluster-RCT in Malawi was devised to measure the impact of a cash transfer on adolescent girls in intervention areas who did not receive the intervention. While cash transfer recipients enjoyed better mental health outcomes, non-recipient girls in intervention areas were worse off in terms of prevalence of psychological distress compared to non-recipients in control areas (9.9 percentage points). The program indirectly altered their relative income compared to their peers, who received the intervention, which resulted in significant impacts for their mental wellbeing.

5.4 Discussion

This systematic review and meta-analysis found evidence that poverty-alleviation interventions providing monetary transfers are generally effective in improving the mental health of adolescents. However, an important caveat is that some programs may actually be harmful for adolescent girls. In theory, conditional cash transfers aim to supplement the effects of the monetary component of the intervention with an intended positive impact stemming from completion of the condition. In practice, the conditions may have the intended positive effect on adolescent mental health in some cases, as for instance changes in how adolescents spend their time in the Opportunity RCT in New York have been linked with decreased externalizing problems (Morris, Aber, et al. 2017). However, program conditionality can also backfire. School attendance, health visits and other time-intensive conditions pose a differential burden for adolescent girls in low- and middle-income countries, and as such may constitute a source of stress and produce worse mental health outcomes (Prencipe et al. 2021b; Baird et al. 2013). Although this finding is tentative as it is based on a limited evidence base, it coheres with a much broader literature of qualitative studies in anthropology and ethnography, which have observed that women bear the

brunt of conditional requirements for cash transfer programs, including increased travel, logistics coordination, time loss, and stress (Cookson 2018).

Irrespective of conditionality, it is important to consider the differential gender effects of cash transfer interventions in general. One proposed mechanism for this may related to economic autonomy. While it is established in adults that women and men in low-income countries have different levels of economic agency and ability to make financial decisions, this is less clear in younger populations. It is possible that boys have more autonomy and are more likely to spend transferred money as they like, while girls may feel pressure to contribute to the family budget. Another potential confounder may be the fact that in some, but not all interventions, the parents or caregivers were given the money. These two modes of administration could lead to different causal mechanisms but unfortunately, as we are limited by a small sample, we are not able to quantitatively test for differences in outcome. This would be an important avenue for future research and more consideration should be given to providing the monetary support directly to the adolescent.

Another important consideration emerging from the present review is that, in the context of high-risk settings, such as armed conflict or extreme deprivation, monetary transfer programs are limited in their effectiveness on their own. Instead, integrated poverty alleviation interventions, combining cash and social care, appear more impactful for improving outcomes for adolescents (Ismayilova et al. 2018), and have been found effective elsewhere in reducing HIV risk behaviors (Cluver et al. 2016). The targeting focus of the intervention also emerges as an important factor: anti-poverty efforts produce the strongest effects for the worst off, both financially and mental health-wise (Kilburn, Hughes, et al. 2019; Ohrnberger et al. 2020) and may produce adverse mental health outcomes for those who are left off (Baird et al. 2013).

Limitations

We acknowledge as an overall limitation that the subgroup effects (e.g. gender, relative income, extreme risk settings) we report are based on a small number of papers and it was not possible to meta-analyze them. As such they should be

treated tentatively and considered targets for further study. More generally, the presently available evidence base is limited and this is perhaps in part due to the fact that mental health is a secondary outcome for monetary poverty alleviation programs. A further limitation is that the available research synthesized here focuses predominantly on the effects of poverty alleviation on the internalizing symptoms of adolescents in low- and middle-income countries. Evidence is severely lacking for high-income countries, externalizing symptoms, and young children. Given the limited number of included papers, we are also unable to quantitatively asses a number of other relevant factors, such as the potential of time decay of effects after program cessation, whether the absolute amount impacts the magnitude of the relationship with mental health, whether conditional or unconditional transfers confer different benefits overall.

State of the literature

The focus on adolescents' internalizing difficulties is in line with existing theoretical and empirical work on associations between poverty and mental health. Deprivation is primarily linked with internalizing disorders (e.g. depression, anxiety, suicidal ideation, Lund, De Silva, et al. 2011; Ribeiro et al. 2017; Lund, Brooke-Sumner, et al. 2018; Patel and Kleinman 2003) that typically emerge during adolescence (Paus et al. 2008), making this developmental period a particularly important subject of investigation and opportunity for intervention. The paucity of evidence for younger children may also be driven by a methodological difficulty in reliably measuring their mental health (e.g. see 'Min Ila', de Hoop et al. 2018), as poverty alleviation research often reports effects on anthropometric measures such as children's weight and height instead (Macours et al. 2012). Worryingly, the current evidence base lacks insight on what works in high income countries. Anti-poverty efforts in high-income settings typically constitute established government-led welfare programs. In most cases, studies examining the impact of welfare programs tend to use cross-sectional or longitudinal data but lack a robust experimental design. We found only two RCTs in a high-income setting which met our eligibility

criteria – both from the United States and both inconclusive about the effects on children and adolescents' internalizing outcomes (Yoshikawa, Magnuson, et al. 2003; Morris, Aber, et al. 2017).

Our findings are in contrast to those of a recent review (Zimmerman, Garman, et al. 2021) on the impact of cash transfers on the mental wellbeing of young people in low- and middle-income countries. There are two key differences in results. First, our meta-analysis indicates an overall positive effect of monetary interventions (including cash transfers as well as grants) for internalizing symptoms. In the current review, internalizing symptoms constitute a broad category encompassing depressive symptoms, symptoms of anxiety, trauma, and mental distress. In comparison, the meta-analysis by Zimmerman and colleagues only considers depressive symptoms and does not find an effect of cash transfer interventions for these. It is possible that the different types of meta-analyzed outcomes underpin the different results. Second, our narrative synthesis reports a negative (iatrogenic) effect of interventions on mental health in the context of conditional interventions for girls. By contrast, Zimmerman and colleagues state they do not find any negative effects. This is likely due to the fact that their narrative synthesis considers only overall effects, whereas we synthesize evidence on heterogeneous group effects. We note that both reviews contain 7 papers in common (Paxson and Schady 2010; Macours et al. 2012; Özler et al. 2020; Kilburn, Hughes, et al. 2019; Baird et al. 2013; Kilburn, Thirumurthy, et al. 2016; Angeles et al. 2019) but differ in the remaining papers that are included (5 different papers for Zimmerman et al., and 7 different papers in the current review). This can likely be explained by the differences in methodology between the two papers. More specifically, the two reviews used different participant age cut-offs (0-24 vs 0-19 in the current review), different contexts (low and middle income countries vs. low, middle, and high income countries), different program types (cash transfers vs. cash transfers and grants), and different outcomes considered for inclusion. We purposefully excluded non-clinical mental health measures, such as power in relationships (Zimmerman, Garman, et al. 2021), cognitive development scores, or intelligence tests (Lund, De Silva, et al. 2011), to specifically elucidate effects

on well-defined mental health categories. Examining validated clinical measures has direct implications for public health diagnosis and treatment. The discrepant findings between our two reviews bear very important policy implications.

Evidence updates since this review

This work underlying this Chapter was published in an academic journal in 2022 (Zaneva et al. 2022). Since then, colleagues have published two new and relevant systematic reviews on the impacts of cash transfers on mental health (McGuire et al. 2022; Wollburg et al. 2023). Although both reviews primarily capture adult populations, their findings cohere with the results described in the present Chapter, particularly for the overall positive but small and significant effect of cash transfers on mental health. McGuire and colleagues (McGuire et al. 2022) also find small and significant improvements associated with receipt of cash transfers, particularly on subjective well-being (overall measure including life satisfaction, happiness, and subjective wellbeing indices) and mental health (also treated as a broad construct, including measures for depression, anxiety, worry). This review finds that cash transfer value, not solely in absolute terms but also in relative regards to previous income, strongly predicts the magnitude of impact. This coheres with our qualitative finding about stronger impacts when transfers are larger compared to recipients' baseline income. Wollburg and colleagues (Wollburg et al. 2023) review cash transfer programs in low- and middle-income and find that these programs significantly reduced depression and anxiety. Importantly, their findings suggest improvements may not be sustained after time, typically 2-9 years after the end of an intervention. Time decay of effects is a crucial future research and intervention consideration, given the increasingly more convincing evidence base positive mental health benefits from cash transfer and monetary programs.

Conclusion

Our study improves on previous existing work on the impact of anti-poverty interventions on the mental health of children and adolescents in two important ways.

First, we reviewed only programs which provided monetary transfers, and as such homed in on one specific type of poverty alleviation and excluded education or home improvement interventions. Further, we imposed a high cutoff for the methodological rigor of the included research which excluded some cash transfer programs which have been previously featured in literature syntheses (e.g. Oportunidades, Fernald and Gunnar 2009). On the basis of our quality assessment, we find that baseline imbalances were few and randomization was generally successful. Hence, we are able to provide causal evidence regarding the impact of poverty alleviation on children and adolescents' mental health (Rubin 1974). Our results paint a rich and nuanced picture of how anti-poverty interventions affect child and adolescent mental health. Importantly, some aspects of monetary transfer programs may prove harmful. Intervention design should consider carefully 1) the conditionality of the intervention which may produce differential harms for adolescent girls, 2) the integration of social care components to address systemic risk factors to mental health, and 3) the targeting of the population of interest to maximize impact and avoid worsening mental health outcomes in left out eligible individuals. While our meta-analysis indicates that cash transfer programs have a significant positive but small effect on the internalizing outcomes of children and adolescents, it is important to recognize this is a population-level effect and that small effects from public health interventions would produce greater net benefit than large changes in small segments of the population (Rose 1985). On the whole, monetary poverty alleviation programs improve the mental health of children and adolescents living in poverty and can provide essential support to help break the vicious cycle between poverty and mental ill health.

Table 5.1: Summary table of included studies. A star in the citation of the paper in the 'Study' column signifies this paper was included in the meta-analysis. In the 'n analyzed' column, the symbol denotes an approximation of the percentage of girls. In these cases, we have reported the percentage girls for the full sample rather than the analyzed sample. The outcomes are reported as in the original texts. In the outcome columns, stars ($*$) denote statistical significance, as reported in original publications, where *** $p < 0.001$, ** $p < 0.05$, * $p < 0.1$. The mental health scales reported in the table are: General Health Questionnaire 12 (GHQ-12), Center for Epidemiological Studies Depression Scale (CES-D), Strength and Difficulties Questionnaire (SQD), Short Mood and Feelings Questionnaire (SMFQ), Children Revised Impact of Events Scale (CRIES-8), Behavioral and Emotional Screening System (BASC), Behavioral Problem Index (BPI), Shona Symptom Questionnaire (SSQ). In Kang Dufour (2012) the control group received Life Skills and Red Cross training; in Yoshikawa et al., (2003) the control group received welfare as usual. In all other publications, the control groups did not receive any intervention.

Study	**Design**	**Intervention**	**N**	**Money**	**Sample**	**Follow up**	**Outcome**
Abu-Hamad et al., 2014* Palestine Palestinian National Cash Transfer Programme	pseudo-RCT	UCT to caregiver	204 (51% girls)	Caregiver: $195-$468 per quarter	11-17 years old	Variable (maximum 3 years)	Calculated odds ratio of abnormal score, SDQ Overall: -0.252
Angeles et al., 2019* Malawi Malawi Social Cash Transfer Program	cRCT	UCT	1366 (47% girls)	Caregiver: 17% of median income	13-19 years old	2 years	Reported OLS coefficient for depressive symptoms, CES-D (probability of change) Overall: -0.149*** Girls: -0.152** Boys: -0.145***
Baird et al., 2013 * Malawi	RCT	UCT for schoolgirls; CCT for schoolgirls; CCT for drop-outs Conditional arms: conditional on school attendance All arms provide payments to both girls & caregivers	2827 (100% girls)	Caregiver: $4,6,8 or 10 per month (randomized at cluster level) Child: $1,2,3,4 or 5 per month (randomized at individual level)	Schoolgirls & drop-outs (girls only); 13-22 years old	1 year 2 years (after program end)	Reported OLS regression coefficient estimate of psychological distress, GHQ-12 (probability of change) UCT: -0.143*** (1y), -0.043(2y) CCT schoolgirls: -0.063** (1y), -0.040 (2y) CCT drop-outs: 0.004 (1y), 0.021 (2y) Spillover effects on controls in same area: 0.064**(1y), 0.007 (2y)

de Hoop et al., 2018 Lebanon Min Ila	cRCT	UCT+CCT (base payment + additional payment conditional on school attendance & health care visits)	724 (46% girls)	Caregiver: $65 per month	10-14 years old	1 year	Reported OLS coefficient for depressive symptoms, CES-D (probability of change) Overall: -0.10
Ismayilova et al., 2018 Burkina Faso Economic Strengthening and Family Coaching (Trickle Up +)	cRCT	Trickle Up: grant and financial training to female caregiver Trickle Up+: grant and financial training to female caregiver + family coaching	344 (12mo follow-up, 46% girls) 314 (24mo follow-up)	Caregiver: $100 lump sum seed grant	10-15 years old	1 year 2 years	Reported Cohen's d for depression symptoms, CES-D Incidence-rate ratios for trauma symptoms, CRIES-8 Trickle Up: Depression: -0.14 (12 mo), -0.10 (24 mo) Trauma: 0.64 (12 mo), 0.97 (24 mo) Trickle Up+: Depression: -0.41*** (12 mo), -0.39** (24 mo) Trauma: 0.62** (12 mo), 0.69 (24 mo)
Kang Dufour, 2011* Zimbabwe Shaping the Health of Adolescents in Zimbabwe (SHAZ!)	RCT	Grant + life skills and vocational training to girl	315 (100% girls)	Girl: $51-$87 lump sum grant	16-19 years old	3 months after receipt of grant (2 years after SHAZ! program start)	Reported odds ratio for mental ill health, SSQ Overall: 0.32***
Kilburn et al., 2016* Kenya Kenya's CT-OVC Cash Transfer Program for Orphans and Vulnerable Children	pseudo-cRCT	UCT	1960 (40% girls)	Caregiver: $20 per month	Orphans and vulnerable children; 11-20 years old	4 years	Reported adjusted odds ratio of depressive symptoms, CES-D Overall: 0.76** Girls: 1.07 Boys: 0.60***
Kilburn et al., 2019* South Africa HPTN 068	RCT	CCT conditional on school attendance	2438 (100% girls)	Caregiver: 200 Rand per month Child: 100 Rand per month	Schoolgirls; 13-20 years old	3 years	Reported OLS regression coefficient for CES-D z-score Overall: -0.02 Baseline poverty x intervention: -0.14**
Macours, Schady & Vakis, 2012 Nicaragua Atención a Crisis	cRCT	CCT conditional on non-enforced health visits	1620 (9mo, 49% girls) 2863 (33mo)	Caregiver: 15-26% of income every 2 months	2-6 years old	9 months 33 months (2 years after program end)	Reported OLS regression coefficient for problem behaviors, BPI score Overall: 0.048 (9 mo) -0.021 (33 mo)

Morris et al., 2017 USA Opportunity NYC-Family Rewards	RCT	CCT conditional on school attendance, health care visits and other items	511 (54% girls)	Caregiver: $240 per month	14-15 years old	18 months	Reported OLS coefficients for depression, anxiety (BASC), any delinquent behavior, any aggressive behavior, any substance use Depression: 0.13 Anxiety: -0.38 Delinquent behavior: 6.62 Aggressive behavior: -9.40*** Substance use: -15.16***
Özler et al., 2020* Liberia Girl Empower	cRCT	Girl Empower (GE): UCT and training program to girl Girl Empower+ (GE+): UCT and training to girl and CCT to parents (conditional on girl's program attendance)	1159 (100% girls)	Girl Empower: $2 per month to girl Girl Empower+: $2 per month to girl, $5 per month to caregiver	Girls; 13-14 years old	1 year	Reported OLS regression coefficient for SMFQ scale & CRIES-8 scale Girl Empower: 0.645 (SMFQ), 1.020* (CRIES-8) Girl Empower+: 0.530 (SMFQ), 0.244 (CRIES-8)
Paxson & Schady, 2010 Ecuador Bono de Desarrollo Humano	cRCT	UCT to caregiver	2029 (48% girls)	Caregiver: $15 per month	2-6 years old	2 years	Reported OLS regression coefficient for problem behaviors, BPI score Overall: -0.069 Bottom income quartile x intervention: -0.265*
Prencipe et al., 2021* Tanzania Productive Social Safety Net	cRCT	UCT+CCT (base payment + conditional payment on school attendance & health care visits)	385 (44% girls)	Caregiver: $6 per month	14-18 years old	18 months	Reported OLS coefficient for depressive symptoms, CES-D (probability of change) Overall: -0.20 Girls(<18): 0.10 Girls with child/ pregnant: 1.32* Boys(<18): -1.21*

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Yoshikawa et al., 2003 USA Minnesota Family Investment Program (MFIP) New Hope Project (NHP)	RCT	MFIP: Earnings disregard to working welfare recipients NHP: Cash supplement to parent conditional on working 30+ hours a week	MFIP: 401 (49% girls) NHP: 467 (49% girls)	MFIP: Dependent on earnings NHP: Increase income to reach poverty threshold	MFIP: 2-9 year old NHP: 1-10 years old	MFIP: 3 years NHP: 2 years	Reported Cohen's d for all outcomes divided per quartile of risk of unemployment of parent (Q1: lowest risk) MFIP: Externalizing behaviors; Internalizing behaviors Q1: 0.07; 0.11 Q2: -0.27; -0.23 Q3: -0.41**; -0.25 Q4: -0.03; -0.13 NHP: Aggressive behaviors, Hyperactive behaviors, Internalizing behaviors Q1: 0.14; 0.25; -0.20 Q2: -0.47*; -0.53*; -0.34 Q3: -0.67***; -0.69***; -0.33 Q4: 0.25; 0.49**; 0.14

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Khaw who helped me better appreciate the lived experiences of adolescent and young adult cash transfer recipients.

6 Discussion

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6.1 Main contributions

There is increasing awareness of the risks poverty and inequality pose on mental health. My doctoral work studies these effects for children and adolescents, and aims to address key challenges in our field, including: 1) lack of diverse data and lack of data for young people, 2) theoretical difficulties in defining and clarifying the differences between poverty and inequality, 3) measurement problems relating to precision, heterogeneity, 4) appropriate choice of level, and 5) need for subgroup disaggregation.

First, my work contributes four studies based on data from a range of different countries in the world, capturing high-, middle-, and low-income contexts. Taken together, my results illustrate the need for diverse data, the benefits of it use, and the challenges when researchers try to (mis)generalize across contexts. For instance, in Chapter 2, I find evidence of such misgeneralization, illustrated through the use of measures in different historical, cultural, geographical contexts where they no longer carry the same significance (e.g. applying the same income thresholds, querying possession of the same material goods). Diverse cross-contextual data carries the further benefit of being able to discern gaps in our global knowledge, which would not be possible with more limited data. Specifically, in Chapter 5, I am able to point to gaps in our knowledge in high-income contexts, where I was able to find a very limited and dated body of work on randomized controlled trials of monetary poverty alleviation efforts. This is somewhat surprising at face value, given the abundance of welfare programs in high-income countries, though perhaps less so when such programs are understood in the context of wide-scale government policies, where longitudinal follow-ups of recipients are more common (and where people in need are not placed in control arms). Previous reviews of such poverty alleviation efforts have largely focused on low- and middle-income countries, but the further inclusion of high-income settings allowed for this gap to be noted. A further benefit of using more varied data is found in the ability to determine whether effects have stable, global patterns or whether these are more heterogeneous. In Chapter 3 and Chapter 4, I use a large cross-national dataset, capturing a range of low- and middle-income countries. In this dataset, I find evidence for a universal association between experiencing hunger and greater reporting of worrying and suicidality in adolescents, signifying the global health and policy importance of this relationship.

Second, my work advances our field by providing further evidence in a still understudied population, that of children and adolescents. Broadly, many of the effects of different measures for poverty and inequality that are known risk factors for adult mental health, have not been rigorously or definitely clarified in children and adolescents. As discussed, much of what we know in the already

constrained fields studying hunger and mental health (Chapter 3) or cash transfers and their mental health implications (Chapter 5), are primarily from work in adults. Across my work, mental health risk tracks with age. Both Chapter 3 and Chapter 4 evidence this quantitatively in regards to the effects of hunger. Further, Chapter 5 offers some additional nuance of the relationship between adversity and age, illustrating how adolescent girls in particular may experience harm from interventions, potentially due to increased time demands associated with both their age and gendered expectations. On one hand, this may mean adolescents face particular adversities that children do not, and so warrant further social protection. At the same time, caution should be applied as I was unable to carefully examine the experience of young children, who were missing from the examined data in my thesis and remain, still, an understudied group.

Third, my work addresses some of the theoretical difficulties in defining and clarifying the differences between poverty and inequality. As discussed in Chapter 1, measures for poverty and inequality can vary widely and it is not always possible to precisely 'break down' the contributions of potentially separable factors, such as income, education, employment, and food security. Indeed, I evidence this challenge in Chapter 2, where I find an abundance of unclearly defined heterogenous variables in the literature on socioeconomic status, including composite measures, which may pose a challenge for understanding which factors are comparably more important than others. Broadly, my work does not advocate for the exclusion or inclusion of any particular measures but for the more transparent and theoretically positioned measurement choices. This is further illustrated when I consider the theoretical problem of arbitration between poverty and inequality. These risk factors more often tend to be studied in isolation rather than compared in the same work, as I do in Chapter 4 (and they are most often compared in high-income adults, Belle and Doucet 2003). The multiverse analysis illustrates both the need for clear scientific reporting in the face of many researcher degrees of freedom, and the useful information that can be obtained from direct comparisons of these risk factors. More concretely, this direct comparison provides stronger

evidence for the impacts of poverty rather than of inequality on adolescents' mental health, at least on the macro-level.

Fourth, my work contributes to efforts of recognizing and considering poverty and inequality in a multilevel fashion, accounting for the context in which individuals are embedded. I do so quantitatively through my multilevel analysis in Chapter 3 and multiverse analysis in Chapter 4, and more theoretically in my critical review in Chapter 2, as well as my general literature overview in Chapter 1. The quantitative components of my thesis illustrate the additional explanatory power offered by multilevel models, and so the need for it if we want to obtain a fuller understanding of how adversity can impact individuals and societies. More theoretically, although I discuss multiple plausible measures for poverty at a variety of levels (e.g. individual, household, neighborhood), my work generally advocates for the consideration of inequality as a relational concept best understood at meso- or macro-levels.

Fifth, my work advocates for the consideration of sub-group effects where possible. In the past, calls for such disaggregation in the context of poverty and inequality's effects have largely been focused on stratification by income (Lund 2014). Here, I recommend a broader consideration of social and individual factors, which has been missing from previous work in global mental health (**lund2011**; e.g. McGuire et al. 2022). Across the four studies presented here, I have been able to disaggregate data by age and gender, showcasing how effects differ between individual characteristics. These more careful considerations have allowed to me find evidence for the differing impacts of hunger on boys' and girls' mental health. In Chapter 5, I provide qualitative evidence regarding how the impact of cash transfers may vary by gender, baseline income, and existing additional risk. I discuss this in broader context further below.

6.1.1 Strengths and limitations

One of the key strengths of this body of works is the use of mixed methods, including both qualitative approaches such as a critical literature review (Chapter 2) and a systematic review (Chapter 5) and quantitative approaches including

a series of linear, logistic and multinomial regressions (Chapter 3), a multiverse analysis (Chapter 4), and a meta-analysis (Chapter 5). Some of the common themes that emerge from this body of work - the need for transparency in measurement, the changes in relationship depending on specification of analytical choices, the importance of examining potential sub-group effects - are corroborated by different methods and different sources of data, and so could be interpreted with greater confidence. A further strength of this thesis is the consideration of poverty and inequality from a global perspective in all chapters, thus hopefully contributing to what is a growing body of work that focuses on or, at least, includes low- and middle-income countries. The consideration of poverty and inequality across individual and macro-levels in this thesis further contributes to work acknowledging different ways through which these risks factors may operate, particularly in the case of how they may affect young people.

On the other hand, one of the key limitations of this thesis is the use of cross-sectional data. With the exception of Chapter 5 which includes randomized controlled trials and finds causal evidence for the relationship between money and mental health, other projects in this thesis are unable to advance our causal inference. Cross-sectional designs are also limited in that they do not allow for capturing any changes over time and thus are unable to adequately represent potentially dynamic processes such as many of those occurring in child or adolescent development. Two further limitations here relate to the lack of evidence for externalizing problems and young children (<10 years). Externalizing problems are very narrowly captured in two papers included in my systematic review (Chapter 5); the same chapter includes data from only 3 papers with children aged 2-6. To some extent, the lack of inclusion for externalizing problems may speak to broader problems in the global mental health literature pertaining to the difficulties of appropriately assessing behavioral problems. Others have previously argued that some of the difficulties in externalizing assessment relate to the need for contextualized understanding of behavioral problems (Beauchaine and McNulty 2013). Similarly, as already discussed earlier in Chapter 1 there are noted precision problems in assessing child

mental health. Both of these issues nevertheless remain an important gap for understanding childhood and adolescent mental health and potentially offering early protection. In regards to externalizing problems, we have evidence that there are appropriate, long-term effective interventions that prevent crime and violence in older cohorts in low- and middle-income countries such as cash transfers and cognitive behavior therapy (Blattman et al. 2022). A further limitation is the lack of available individual characteristics. Although the current work actively advocates for considering sub-group effects and does so most consistently for age and gender (Chapter 3, Chapter 4, Chapter 5), others have argued for the importance of factors I was not able to examine here. For instance, some have suggested that geographical features may further exacerbate the effects of poverty and inequality, particularly for those living rurally, where travel is required to access basic services and social protections (Cookson 2018). Similarly, here I was not been able to examine whether effects may differ for children and adolescents from different ethnic minority groups, who have physical disabilities or are neurodiverse, who are refugees or asylum seekers, who are trans or genderqueer, despite existing evidence that such groups of young people may be impacted by poverty to greater extents and that they may face particular challenges when accessing institutional support (Klineberg et al. 2006).

6.2 Findings in context

6.2.1 The importance of considering different groups

Work in this thesis points to the importance of examining sub-group effects such as by disaggregating data by gender or including gender as a consideration in model selection. For instance, in Chapter 3 I find that girls are more likely to report worrying and suicidality compared to boys. Moreover, while girls and boys report similar experiences of hunger I find that hunger has different implications for their mental health. I find that experiencing hunger increases the probability of reporting worry slightly more for boys than for girls. However, I caution that overall girls still report worrying more at any level of hunger. Similarly, our finding

from the systematic review presented in Chapter 5 that girls may experience harm from conditional cash transfers has gone unexamined in previous systematic reviews and meta-analyses due to lack of disaggregation of available data for intervention effects by gender (e.g. Lund, De Silva, et al. 2011; Zimmerman, Garman, et al. 2021). Considering such potential sub-group effects is important in order to identify potential inequities that may otherwise be hidden when looking at averaged total effects. In the case of hunger, sex-related physiological differences may signify differential effects of hunger on mental health by gender; social and cultural mechanisms may underpin gender effects as well. For instance, for cash transfers, girls may face greater constraints on their time due to gendered expectations. In the case of conditional cash transfers, it is possible that averaged total effects, found to be null in previous meta-analyses, (Lund, De Silva, et al. 2011; Zimmerman, Garman, et al. 2021) could be underpinned by positive effects for certain groups of individuals (for instance, boys) and negative effects for others (such as adolescent girls or girls at higher risk). Variations in outcomes could occur across different population characteristics beyond gender, such as age, ethnicity, health, socioeconomic status, geographic location. A richer consideration of sub-group effects could enable a more accurate understanding of social and health inequalities, such as for instance, the well-established gender gap in adolescent mental health (Campbell et al. 2021). This would also allow for consideration of intersectionality and better understanding of how different dimensions of identity intersect, such as better clarifying the risks that girls overall face versus the risks adolescent girls living rurally do. Moreover, the consideration of sub-group effects has further benefits in the context of targeted interventions. Where specific populations face disproportionate risk or may benefit differently from interventions, careful consideration of appropriate support and resources is warranted (such as the provision of cash in addition to social protection for those in fragile settings, or such as preferring unconditional transfers over conditional ones as appropriate).

6.2.2 Measurement and transparency

Measurement practices are a key theme in this dissertation. Broadly, this dissertation sits in an academic context of advocating for further use of mental health measures in the context of economic interventions and policy, where they are still underutilized - for instance, in Chapter 5 I found that all cash transfers interventions had considered mental health outcomes as secondary outcomes. I look more closely at measurement practices in Chapter 2, which evidences the wide heterogeneity underpinning the concept of socioeconomic status and in Chapter 4, which maps a multitude of plausible analytical decisions and models. Rather than being prescriptive and advocating for the use of certain measures over others, or certain analytical choices over others, the key recommendation from this body of work is for further transparency in reporting choices related to definition of key concepts and variables, measurement, and analysis. Although here I do not focus on the measurement of mental health, similar issues pertaining to high levels of variation and difference in constructs have been observed in the clinical literature and similar recommendations for increased transparency have been made (Fried 2017; Fried et al. 2022). Indeed, as some have recently argued in the context of mental health measures (Patalay and Fried 2021), here (with most depth in Chapter 2) I do not advocate for the use of certain narrow and specific sets of measures. Instead, based on a critical review, I recommend a wider consideration of measures that can better reflect people's different experiences with deprivation or inequality, so long as this is coupled with discussion on appropriateness (such as for the cultural, social context or given population as the same measures will not always be appropriate across context) and consideration of limitations (e.g. validity). Indeed, replication of or use of a variety of different measures for the same umbrella concept, such as in Chapter 4, can provide further certainty on the stability of relationships of interest.

6.2.3 The need for further inclusion of young people in research and interventions

Since the 1990s, there has been growing recognition in clinical psychology about the necessity and benefits from co-production of knowledge and participatory research work, particularly when working alongside people facing particular risks, marginalization, stigma or discrimination (Cornwall and Jewkes 1995; Gourdon-Kanhukamwe et al. 2022). Nevertheless, there are still apparent gaps and missed opportunities for the further inclusion of children and adolescents and their lived experiences in social policy and global mental health work (Bemme et al. 2023; Speed and Reeves 2023). This thesis points to two specific targets in this regard.

First, in Chapter 2, I find very few papers (5 papers or 2% of our included sample of papers) that incorporate SES measures based on adolescents' own perceptions. Such adolescent reported subjective measures are strongly associated with health behaviors and outcomes (Piera Pi-Sunyer et al. 2023; Fernandez et al. 2023, see also Chapter 3). Some work has also suggested that inequalities in adolescent health outcomes were stronger when measured through variables capturing adolescents own education and perceived relative family SES rather than objective measures such as parents' education or family affluence or (Moor et al. 2019). In the same context, findings from a twin study indicate that twins' differential perceptions of their family's social standing underpins differential mental health outcomes (Rivenbark et al. 2020). Bearing all this in mind, I advocate for a greater consideration of young peoples' voices, such as through the inclusion of more self-reported measures on their experiences. This family of measures may allow for better understanding of salient risk factors and their relationship to (mental) health outcomes.

Subjective measures are traditionally criticized for potentially introducing reporting biases, although such concerns have not limited the frequent utilization of adult-reported (e.g. teacher or caregiver) subjective measures, even when these measures tap into the adults' perception of adolescents lives. That young people and the adults in their lives may have different perceptions is perhaps an obvious observation, though it is one with important implications. Past work has evidenced

adolescents often report problems in their own lives that adult family members are unaware of; for instance, both boys and girls report more externalizing problems than their parents do, and girls tend to report more internalizing problems than their parents do (Verhulst and Van der Ende 1992). In other words, excluding adolescent reports may mean losing out on valuable information. Nevertheless, a case can be made for a related and perhaps stronger objection to the use of subjective measures in younger populations, namely that response errors (both in general and in regards to state dependence, such as being hungry or stressed) may happen less often with age (Mathiowetz and Dipko 2000; Kerkhofs and Lindeboom 1995). Pragmatic decisions can be made in this regard, such as treating reports by children and young adolescents more tentatively than older adolescents. These can be paired with statistical approaches too, such as direct contrasts between adult and adolescents measures, or more cautious inclusion of adolescent measures in analyses such as through robustness checks, or, if authors consider it theoretically appropriate, bias correction methods (Gupta, Adam, et al. 2010). With all of this in mind, more holistic evaluations in future work can acknowledge the limitations of subjective measures such as reporting biases, while balancing the inclusion of different viewpoints that can capture a useful and broader range of information.

A further opportunity for the further inclusion of adolescents comes from the results reported in Chapter 5. I find that cash transfers are most often given to caregivers rather than to adolescents (even if the interventions primarily aim to target young people). Given the fact that there is still considerable academic debate and uncertainty about the specific mechanisms through which cash transfer may benefit mental health (Evans-Lacko et al. 2023), further involvement of adolescents, including direct provision of benefits to them and co-production practices, such as, as a minimum, focus interviews, seem surprisingly underutilized: why not ask (young) individuals about their own experiences?

6.2.4 Which effect sizes matter?

Across this thesis, I find evidence from a variety of different data and through mixed methods about the association between poverty and inequality and childhood and adolescent mental health. A common feature of these relationships is the direction of the association (greater experience of inequality and poverty is associated with more mental health problems) but the magnitude of this relationship varies (particularly across levels). There is ongoing debate in different scientific disciplines when it comes to arbitration between effect sizes that have meaningful implications for practice or policy.

In this thesis, I have generally relied on the traditional approach of categorical cut-offs advocated by statisticians such as Cohen since the 1990s (Cohen 1992) and I have complemented this with direct model comparisons in our specification curve (Chapter 4) as well as visual contextualization through estimation plots (Ho et al. 2019). It is nevertheless important to acknowledge the limits of these approaches and the need to contextualize effect sizes in a broader public health setting. Like many epidemiologists, here I advocate for the position that when there is evidence for population-level effects (as I argue in particular in Chapter 3, Chapter 4, Chapter 5), even very small effect sizes are of clinical and policy concern (Rose 2001; Carey et al. 2023). This is because changes to such population-level effects can effectively shift the entire distribution of a given factor (such as for instance poverty) and so also shift the overall burden of disease, likely to extents greater than targeting subsets of individuals within the population.

On the flip side, however, global and government led policy efforts or interventions are costly and associated with further logistical and time burdens and so others have reasonably argued that prioritizing more substantial effects is prudent (Ferguson 2016). In this line of thinking, cost-effectiveness calculation metrics, such as dollar amounts per disability-adjusted life-year (DALY) saved or the marginal value of public funds (MVPF, tracking the quotient of the willingness to pay by the net cost of a policy to the government, Hendren and Sprung-Keyser 2020), are popular

ways to contextualize and compare effects sizes, and are increasingly more widely used in policy and global intervention efforts (Croke et al. 2016).

These two somewhat contrasting views of the practical significance of effects sizes illustrate the overall need to contextualize any effects. Importantly, a further approach to considering the importance of effect sizes is by aiming to understand the smallest difference that would be associated with a noticeable impact in people's lives (Bauer-Staeb, Wiles, et al. 2019). There is ongoing discussion regarding different statistical approaches to simulating minimal clinically important differences (Bauer-Staeb, Kounali, et al. 2021), though in line with our earlier discussion, I believe such approaches can be complemented by active involvement of children and adolescents to help better understand their lived experiences.

6.3 Conclusion

Much of what we know regarding the impacts of poverty and inequality on mental health comes from adults in high-income settings. My thesis contributes to our understanding of this relationship in children and adolescents around the world. Through a mixed-methods body of work, relying on diverse qualitative and quantitative approaches, I attest to how various specific measures for both poverty and inequality track with worse mental health, particularly internalizing problems. Without advocating for the use of any concrete measures over others, I discuss the need for theoretical grounding of empirical work and precision in measurement and analysis reporting, in order to obtain reliable effect estimates and maintain an ability to assess mechanisms and candidate interventions. Across my studies, I advocate for the consideration of sub-group effects and provide evidence for differing effects by age (where older age is associated with more mental ill health), by gender (such as a gap in mental health between boys and girls, different impacts of hunger, and, potentially, of cash transfers). Further, as I found adolescents' own perspectives and experiences critically missing, I encourage young people's further inclusion, such as through surveying their own perspectives via self-reported measures, participatory

and co-production of knowledge engagement, and through the direct provision of interventional benefits to young people. Taking all of the work presented here, I evidence that poverty and inequality are neither immeasurable, nor unmodifiable. There are promising interventions, such as cash transfers, which can both improve the material circumstances and the mental health of young people. And so, in these ways, I hope my thesis advances our understanding of the question how poverty and inequality impact child and adolescent mental health. But beyond this question is a bigger and arguably more important one: why do we still live in a world with child and adolescent poverty?

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