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Early-life income inequality and adolescent health and well-being

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ABSTRACT

A prevailing hypothesis about the association between income inequality and poor health is that inequality intensifies social hierarchies, increases stress, erodes social and material resources that support health, and subsequently harms health. However, the evidence in support of this hypothesis is limited by cross-sectional, ecological studies and a scarcity of developmental studies. To address this limitation, we used pooled, multilevel data from the Health Behaviour in School-aged Children study to examine lagged, cumulative, and trajectory associations between early-life income inequality and adolescent health and well-being. Psychosomatic symptoms and life satisfaction were assessed in surveys of 11- to 15-year-olds in 40 countries between 1994 and 2014. We linked these data to national Gini indices of income inequality for every life year from 1979 to 2014. The results showed that exposure to income inequality from 0 to 4 years predicted psychosomatic symptoms and lower life satisfaction in females after controlling lifetime mean income inequality, national per capita income, family affluence, age, and cohort and period effects. The cumulative income inequality exposure in infancy and childhood (i.e., average Gini index from birth to age 10) related to lower life satisfaction in female adolescents but not to symptoms. Finally, individual trajectories in early-life inequality (i.e., linear slopes in Gini indices from birth to 10 years) related to fewer symptoms and higher life satisfaction in females, indicating that earlier exposures mattered more to predicting health and wellbeing. No such associations with early-life income inequality were found in males. These results help to establish the antecedent-consequence conditions in the association between income inequality and health and suggest that both the magnitude and timing of income inequality in early life have developmental consequences that manifest in reduced health and well-being in adolescent girls.

1. Introduction

Socioeconomic contexts shape and constrain adolescent health and well-being (Chen and Paterson, 2006). Recent evidence suggests that socioeconomic differences in adolescent health have widened due to rising income inequality (Elgar et al., 2015; Viner et al., 2012). Income inequality also correlates with poor health and social outcomes (Kondo et al., 2009; Wilkinson and Pickett, 2010). An analysis of adolescent health in 34 mostly high-income countries found that national income inequality related to higher body mass indices, less physical activity, and more self-rated mental and physical health symptoms (Elgar et al., 2015). Other research on children and youth found that national or regional income inequality relates to poor self-rated health (Rözer and Volker, 2016), alcohol misuse (Elgar et al., 2005), school bullying (Elgar et al., 2009), physical assaults (Pabayo et al., 2014), teenage pregnancy (Pickett et al., 2005), and child maltreatment (Eckenrode et al., 2014). Pickett and Wilkinson (2007, 2015a) reported that international differences in UNICEF indices of child well-being relate more closely to national income inequality than to country wealth. Based on these and similar data on income inequality, the authors suggested that future improvements in child well-being in rich countries may depend more on reductions in income inequality than on further economic growth (Pickett and Wilkinson, 2015a).

An association between income inequality and health has been replicated by numerous independent studies. One explanation for this link suggests that inequality affects the quality of public services and infrastructure that support health, including social

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benefits and cash transfers to low-income families (Evans, 2002; Lynch et al., 2000). Another is that inequality is socially corrosive in that it intensifies socioeconomic hierarchies, erodes social capital that supports health, and consequently contributes to stress-related health and social problems (Chiavegatto Filho et al., 2013; Pickett and Wilkinson, 2015b; Wilkinson and Pickett, 2010). Support for this pathway was recently reported by Rözer and Volker (2016). Using data collected in 30 countries, they found that social trust partially mediated a negative association between national income inequality and poor self-rated health in adolescents and young adults (16–25 years). A psychosocial explanation is consistent with developmental models of how early-life exposure to inequality shapes moral development. Arsenio and Gold (2006) theorised that children's exposure to unfairness in society biases social cognitive schemas such that instrumental goals become valued more than relational goals and that violence and intimidation are learned to be effective ways to succeed. This developmental perspective helps to explain an association between income inequality and school bullying (Elgar et al., 2009).

Each of these explanations implies a temporal precedence of income inequality to poor health. This temporality – a criterion of any causal inference (Gordis, 2013; Kraemer et al., 1997) – has not been firmly established as most analyses of income inequality are cross-sectional. Other limitations of previous studies are their reliance on aggregated health indicators (e.g., mortality, life expectancy) and limited number of country observations. Ecological studies of country differences often lack the statistical power needed to detect contextual effects on health with important statistical controls for country wealth, individual socioeconomic position (SEP), and other individual characteristics.

This study addressed this question of temporality by testing the hypothesis that income inequality during infancy and childhood predicts adolescent health and wellbeing. This hypothesis was based on prior research on the developmental consequences of early childhood stress. Developmental and epigenetic studies have traced the origins of SEP differences in mental and physical health to early life experiences, specifically to neuroendocrine stress pathways (Gillman, 2005), neuroregulatory centres of the brain that govern attention, social interaction, and emotion (Kim et al., 2013), and cumulative impacts of psychological stress on health (Shonkoff et al., 2009). Longitudinal studies by Evans and colleagues have found that low SEP at age 9 prospectively predicts physiological stress dysregulation, emotion dysregulation, and emotional and behavioural problems in adolescence (ages 13 and 17), after differences in concurrent SEP were controlled (Doan et al., 2012; Evans and Kim, 2012). This biological embedding of childhood poverty and the durability of socioeconomic differences in health across the life course suggest that early life stressors – like income inequality – relate to health and well-being through similar stress pathways and sensitive periods of development (Bradley and Corwyn, 2002).

Further support for our hypothesis comes from studies of income inequality and adult health. Karlsson and colleagues studied national income inequality and adult health in 19 rich countries in 1990 and 2006 and found evidence of lagged, negative associations between income inequality and activities of daily living and life expectancy (Karlsson et al., 2010). Another study of physical health in old age in 16 countries found a negative association between national income inequality (averaged over a 46-year period) and later health (De Vries, Blane and Netuveli, 2004). Blakely and colleagues used US state-level data on income inequality and self-reported adult health and similarly found that in older adults (45 + years), income inequality experienced up to 15 years previously was more closely related to poor health than inequality measured contemporaneously (Blakely et al., 2000). Zheng (2012) also found that the lagged effects of income inequality on adult mortality in the US National Interview Study were more robust than its contemporaneous association, with the effect of inequality persisting from five to 12 years and peaking at seven years after the exposure. Lillard and colleagues reported small but statistically significant associations between early life (0–4 years) national income inequality in the US and health later in life (Lillard et al., 2015). However, this study confounded cohort and period effects because it tracked a single cohort in one country, so income inequality varied synchronously with developmental stages and not between settings or individuals. Other studies have found no significant lagged associations between income inequality and later health. Leigh and Jencks (2007) examined life expectancy, infant mortality, homicide, and suicide in 12 countries and found no association (concurrently or with a 5-year lag) with national income inequality. Similarly, Mellor and Milyo (2003) found no significant lagged association between US state-level income inequality and adult self-rated health after controlling for state fixed effects.

We are not aware of previous research on lagged associations between income inequality during infancy and childhood and health during adolescence. The few studies that have examined lagged associations with adult health involved different sample characteristics, analytic approaches, statistical controls, and measures of income inequality and health, which complicate efforts to synthesise the evidence. No study has yet used data that provided sufficient heterogeneity in income inequality between populations, time periods, and cohorts. We addressed this knowledge gap using data from a series of repeated, cross-national surveys of adolescent health in the World Health Organisation's Health Behaviour in School-aged Children (HBSC) study. Our approach involved linking individual records on health and well-being in 11, 13 and 15-year-olds to country-level data on income inequality for each survey year and for earlier developmental periods, from 0 to 4 years and from 5 to 9 years. These age groups were chosen to distinguish infancy and early childhood stages of development when social influences begin to extend from the family environment to school and community settings (Lillard et al., 2015).

Examining income inequality and health across age groups and across historical time introduces the well-known challenge of separating age, period and cohort effects and the need to control unmeasured third variables. One approach is fixed effects models (FE) which remove endogeneity in the data by differencing the stable country characteristics from dependent and the independent variables (i.e., at *both* sides of the regression equation). Therefore, FE models are based on the analysis of differences in differences from country means, and test only within-country changes across time. Another approach to analysing data from repeated cross-sectional surveys is to specify random effects (RE) models. The RE model allows for estimation of both within and between country-level effects while accounting for the correlation structure at the country level.

An alternative, hybrid model combines this RE structure with a FE model of the measured independent variable (Fairbrother, 2014). By subtracting country-level means from the independent variables, within-country and between-country effects can be modelled separately. Unlike the FE model, the hybrid model allows for the inclusion of both country-level characteristics and within-country changing characteristics. We applied this hybrid model to data on adolescent health and well-being that were collected in repeated cross-sectional surveys. We accounted for population autocorrelation and isolated within- and between-group effects by separating 'country/year' and 'country' levels of variation (Fairbrother, 2014). This hybrid model enabled us to pool data from repeated cross-sectional surveys while retaining their multilevel structure.