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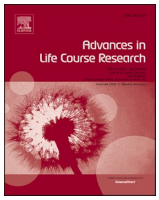

A longitudinal analysis of health inequalities from adolescence to young adulthood and their underlying causes

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ABSTRACT

Research suggests that children of low-educated parents face greater health burdens during the passage from adolescence to young adulthood, as they are more likely to become low-educated themselves, establish behavioural and psychosocial disadvantages, or being exposed to unhealthy working conditions. However, studies examining the development and drivers of health inequalities during this particular life stage are limited in number and have produced varied results. This study investigates trajectories of self-rated health and overweight from 14 to 25 years of age, stratified by parental education, and explores the role of potential mediators (educational achievement, health behaviours, psychosocial factors, working conditions). We rely on prospective cohort data from the National Educational Panel Study (NEPS), a representative sample of 14,981 German ninth graders interviewed yearly from 2011 to 2021 (n = 90,096 person-years). First, we estimated random-effects growth curves for self-rated health and overweight over participants' age and calculated the average marginal effect of high versus low parental education. Second, a series of simulation-based mediation analyses were performed to test how much of health inequalities were explained by children's educational attainment (years of school education, years in university), health behaviours (smoking, alcohol, physical inactivity), psychosocial factors (number of grade repetitions, years in unemployment, chronic stress, self-esteem) and working conditions (physical and psychosocial job demands). We accounted for potential confounding by controlling for age, sex, migration background, residential area, household composition, and interview mode. Results show that higher parental education was related to higher self-rated health and lower probabilities of being overweight. Interaction between parental education and age indicated that, after some equalisation in late adolescence, health inequalities increased in young adulthood. Furthermore, educational attainment, health behaviours, psychosocial factors, and early-career working conditions played a significant role in mediating health inequalities. Of the variables examined, the level of school education and years spent in university were particular strong mediating factors. School education accounted for around one-third of the inequalities in self-rated health and one-fifth of the differences in overweight among individuals. Results support the idea that the transition to adulthood is a sensitive period in life and that early socio-economic adversity increases the likelihood to accumulate health disadvantages in multiple dimensions. In Germany, a country with comparatively low educational mobility, intergenerational continuities in class location seem to play a key role in the explanation of health inequalities in youth.

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1. Introduction

The transition from late adolescence to young adulthood is a critical period characterised by major changes in both biological and social aspects (Arnett, 2000). This phase involves ongoing processes of physical growth and cognitive development, as well as – in the social sphere – transitions in the domain of family life, partnership, education, and work (Buchmann, 2011). Consequently, the passage into adulthood has long-lasting effects on subsequent stages of life. The level of education achieved during this time greatly influences future career prospects, working conditions, and unemployment risks (Buchmann & Kriesi, 2011; Müller & Gangl, 2003; Shavit & Müller, 1998). Furthermore, health disadvantages established during adolescence are likely to be carried into adulthood. For example, this concerns the rise in unhealthy behaviours (e.g. binge drinking, drug use, and physical inactivity) and their link to obesity and addiction (Crosnoe et al., 2017; Frech, 2012), or chronic stress experiences that can trigger mental health problems such as depression or anxiety disorders (Pascoe et al., 2020).

Past research has theorised that children from socio-economic disadvantaged families are likely to face greater burdens during their transition to adulthood (Due et al., 2011). One key mechanism is the intergenerational transmission of adversity from parents to children (Crosnoe et al., 2002). Children from low-educated parents are more likely to become low-educated themselves (Bukodi & Goldthorpe, 2013; Erikson & Goldthorpe, 1992) and to accumulate multiple health risks in the area of health behaviours, psychosocial factors, and early-career working conditions (Reuter et al., 2023; Viner et al., 2012). Thus, the time from adolescence to young adulthood might have a key role in structuring health opportunities for the whole population. However, the development of health inequalities in young adulthood and the underlying causes are not well understood and the most limiting factor is the rareness of longitudinal studies located in this life period (Bambra & Thomson, 2019; Matos Fialho et al., 2022). Thus, the following study addresses this limitation by drawing on data from a large German cohort study that followed around 15,000 ninth graders during their transition into adulthood. We examine trajectories of self-rated health and overweight between the ages of 14 to 25 years and investigate differences by levels of parental education. Second, we aim to disentangle mechanisms explaining health inequalities by studying mediation via children's educational attainment, health behaviours, psychosocial burdens and resources, and early career-working conditions.

2. Background

2.1. The transition to young adulthood and its impact on subsequent life stages

In recent decades, life course research has established a new perspective to understand the importance of early life experiences for the development of health and health inequalities (Ben-Shlomo & Kuh, 2002). Life course models postulate the existence of critical and sensitive periods, in which exposures or life events cause health effects that would not have been possible at other times (or would have been less severe in their consequences). Yet most life course research has focussed on very early life stages such as gestation and childhood (Ben-Shlomo et al., 2016). More recent works recognise that subsequent stages as late adolescence (15–19 years) and young adulthood (20–24 years) are also of importance because they involve pivotal biological and social processes of change that make individuals increasingly vulnerable (Due et al., 2011).

Biological processes encompass the completion of physical and cognitive development affecting body growth, learning abilities, decision-making, and intellectual maturity (Sawyer et al., 2012). At the same time, young adults become more independent from their parents and are more likely to engage in unhealthy behaviours such as cigarette smoking, alcohol consumption, poor diet, or even drug use (Frech, 2012). Research demonstrates that unhealthy behaviours established early in life do not only pose major risks to physical and cognitive development (Dahl et al., 2018; Patton et al., 2018) but are also likely to be carried into adulthood (Umberson et al., 2010).

Furthermore, the transition to adulthood involves important processes of social change in the domains of family, education, and work. During the school-to-work transition, young people complete secondary school education, start vocational training or academic study, and finally enter the labour market (Müller & Gangl, 2003). In Europe, as in most countries around the world, education has become the most important investment for occupational careers and income opportunities, as well as for preventing poor working conditions and unemployment (Buchmann & Kriesi, 2011; Manzoni et al., 2014; Müller & Gangl, 2003; Shavit & Müller, 1998; Siegrist & Marmot, 2004; Stawarz, 2013; Taylor & Seeman, 1999). As a general pattern, individuals who accumulate more schooling and more years of academic education reach higher wages and more favourable career paths. According to human capital theory, education can be conceptualised as a private 'investment' for monetary or non-monetary outcomes (Becker, 1993). This also holds for health. In every country of the world, a higher level of schooling is associated with longer and healthier life (Mackenbach et al., 2008; Marmot, 2015). The (causal) relationship between education and health is considered to be driven by systematic differences in individual exposures and resources, most importantly material, behavioural, and psychosocial factors (Kawachi, 2002; Krieger, 2001). For instance, higher education enables access to better jobs and higher incomes, which can be used to promote health through better housing and living conditions. Higher education also provides knowledge relevant to health behaviours. Thus, better-educated individuals were found to be less likely to engage in cigarette smoking and risky alcohol consumption, while being more likely to a healthy diet and regular physical exercise (Pampel et al., 2010).

As educational attainment has such a great influence on general life chances, it is not surprising that young adults were found to experience a great amount of stress resulting from academic pressure and increased uncertainty for the future (Pascoe et al., 2020). For instance, many transitions on the way to adult life can be associated with failure, including the inability to find an apprenticeship or a place at university, or the possibility of becoming unemployed. Early disruptions in labour market careers are particularly problematic, as they have been found to produce so-called "scarring effects" by increasing the risk of future labour market disadvantage (Schmillen & Umkehrer, 2017) but also for subsequent health problems (Dietrich et al., 2021; Reuter et al., 2022).

2.2. The role of socio-economic background

Adolescents from families with a lower socio-economic position (SEP) often face more challenges when transitioning to adulthood. One key factor contributing to this is the transmission of educational attainment from parents to their children across generations. Extensive empirical evidence supports the notion that individuals whose parents have higher levels of education are more likely to achieve higher schooling and enrol in tertiary education (Bradley & Nguyen, 2003; Fleury & Gilles, 2018). In Germany, intergenerational social mobility is particularly low due to the early onset of school tracking, which involves assigning pupils to different school types based on their abilities (Van de Werfhorst & Mijs, 2010). While in most countries of the Organisation for Economic Co-operation and Development (OECD), individuals are typically selected for high or low-achieving educational tracks at around the age of 15 or 16 years, in Germany this process begins as early as age 10 (Ozer & Perc, 2020). Research has discovered that children from socio-economically disadvantaged families often require more time to develop similar competencies compared to their peers from higher socioeconomic backgrounds. Consequently, a high degree of school tracking has been observed to hinder social mobility between generations and accentuate disparities in educational opportunities.

According to Bourdieu's capital theory, several mechanisms underlie the intergenerational transmission of education from parents to children (Bourdieu, 1986). As parental education is fundamentally linked to different assets in the sphere of cultural, economic, and social capital, these forms of capital can be used by parents to maximise the educational attainment of their children. For instance, highly educated parents are provided with intellectual abilities that are beneficial in supporting their children's academic success both during school and when they pursue higher education. Moreover, highly educated parents often have access to networks that can provide valuable opportunities for their children's education and career advancement. Economic resources can be used to invest in further education and to compensate for the lack of income associated with studying.

Parental background is expected to produce inequalities in health chances as individuals transition to adulthood. As parents provide varying levels of economic, social and cultural resources to their children, we anticipate differences in own educational attainment, health-related behaviours, psychosocial stressors, psychological resources, as well as variations in work environments. This assumption is supported by research on socio-economic disparities in the health outcomes of young people. First, children of parents with a low SEP start earlier and more frequently with unhealthy behaviours such as smoking, alcohol consumption, poor diet, and physical inactivity (Hanson & Chen, 2007; Pearce et al., 2019). These habits are major risk factors of overweight and preventable diseases (Cawley & Ruhm, 2011). Second, studies suggest that children from low-SEP families are more often exposed to psychosocial burdens during adolescence, including lower levels of self-esteem (Houtte et al., 2012), more frequent experiences of chronic stress (Goodman et al., 2005), and greater risks for class repetition (Rathmann et al., 2020) and youth unemployment (Wiesner et al., 2003). Third, low parental SEP causes selection into manual and low-status work (Blau & Duncan, 1967; Erikson & Goldthorpe, 1992; Stawarz, 2013), which often exposes to higher physical and psychosocial job demands (Bartley, 2016; Hoven & Siegrist, 2013; Marmot, 2004). Yet, studies testing how much of the relationship between education and health is mediated via material, behavioural, and psychosocial factors are scarce (Moor et al., 2017) and only single studies exist for the age span from adolescence to young adulthood (Carroll et al., 2017).

2.3. Research gaps and theoretical considerations

The studies presented thus far suggest that children of parents with lower education experience more unfavourable health conditions on their way to adulthood. Thus, we hypothesise that the passage from late adolescence to young adulthood represents a critical period where health disparities become increasingly pronounced. However, this particular life stage is understudied. Research has mainly focussed on adulthood (Mackenbach et al., 2008; Marmot, 2015) or childhood (Due et al., 2009; Elgar et al., 2015; Moor et al., 2015; Reiss, 2013; Torsheim et al., 2004) and studies provide evidence for pronounced socio-economic health differences at both stages of life. However, research that specifically addresses the period in between is limited and has produced inconsistent findings (Bambra & Thomson, 2019; Matos Fialho et al., 2022).

On the one hand, several studies have found significant health inequalities during adolescence or young adulthood. Analyses based on the cross-sectional US National Health Interview Survey demonstrated that high parental SEP was associated with better general health at each age between 0–18 years (Chen et al., 2006). Two studies based on the German Health Interview and Examination Survey for Children and Adolescents (KiGGS study) showed that high parental SEP was negatively associated with overweight from 3 to 17 years of age (Krause & Lampert, 2013) and positively associated with self-rated health from 14 to 24 years (Waldhauer et al., 2019). Analyses of the US National Longitudinal Study of Adolescent to Adult Health (Add Health) demonstrated that low parental education was related to lower self-rated health and higher BMI between 13 and 33 years (Bauldry et al., 2012; Bradshaw et al., 2017; Sokol et al., 2017). A recent analysis based on Add Health also revealed that low educational attainment was linked to cardio-metabolic health risks when transitioning to adulthood (high blood pressure, diabetes, hyperlipidaemia, inflammation, and high waist circumference) (Noppert et al., 2021). In Finland, low parental SEP was linked to lower self-rated health between 12 and 16 years (Koivusilta et al., 2006) and from 18 to 29 years (Kestilä et al., 2009).

In contrast, other studies found no or no clear association between socio-economic origin and health in the same age period. Two studies based on the Scottish Young People's Survey Cohort series (SYPS) showed no association between parental SEP and physical and mental health from age 13 to 15 years (West & Sweeting, 2004), nor from age 15 up to 36 years (Sweeting et al., 2015). Notably, health inequalities were only found for own SEP at 24 years. A Finnish cohort study found no association between parental occupational class and children's self-rated health and overweight at ages 16, 22, and 32 in the case of males, while significant associations in overweight were found for females (Huurre et al., 2003). A cross-sectional British household study found no clear association between parental SEP and self-rated health in children aged 15–18 years (Spencer, 2006). A similar finding was obtained in an Australian youth study, showing no association between parental education and self-rated health at age 16 years (Siahpush & Singh, 2000).

While some of this variation is likely to be driven by country differences or inconsistent operationalisations of health or SEP, there are also two competitive hypotheses regarding the development of health inequalities in youth. Studies observing no health inequalities from adolescence to young adulthood support the so-called 'equalisation in youth' hypothesis (West, 1997). Accordingly, growing independence from family is considered to cause youth-specific health determinants (characteristics of schools, peer groups, or youth culture) to outbalance the relevance of the socio-economic origin (characteristics of the family, home, or neighbourhood). In contrast, studies observing existent health inequalities support assumptions of risk accumulation formulated by life course research (Ben-Shlomo et al., 2016; Ben-Shlomo & Kuh, 2002). Accordingly, early (childhood) disadvantage is assumed to make individuals more likely for further disadvantage. For instance, according to the 'chain of risk' model, low parental education causes low educational achievement in children which is followed by health problems when transitioning to adulthood. Paralleling this view, risk accumulation might also occur through 'risk clustering', where a disadvantage in one dimension (e.g. low educational achievement) is accompanied by a disadvantage in another dimension (e.g. unhealthy behaviours). Processes of risk accumulation are supposed to make individuals increasingly stratified over the life course. This assumption has been formulated within the theory of cumulative disadvantage, where initial disadvantage is supposed to produce further disadvantages leading to patterns of widening health inequalities over the life course (Dannefer, 2003; Ferraro, Shippee & Schafer, 2009).

Considering the inconsistent findings observed in previous research, several factors may contribute to the mixed results obtained when studying health inequalities during this age range. Some studies available have taken a cross-sectional approach, comparing their findings between samples from different age groups. This methodology does not allow to study longitudinal development and is prone to bias resulting from health selection ('survival' of healthy individuals in higher age groups) and reversed causality (health influencing educational achievement). Additionally, many of the past studies did analyse comparatively short periods, primarily focussing on the time of early adolescence, with few studies covering the whole transition into young adulthood. Furthermore, the available longitudinal studies that focus on adolescents transitioning into adulthood are limited to a small number of countries, primarily the Add Health study conducted in the United States and the SYPS study carried out in Scotland. However, it is important to consider that various country-specific factors such as

education system characteristics or labour market conditions may impact how health and health inequalities evolve during this specific life stage. Therefore, studies from other countries would be beneficial to gain a broader understanding of these dynamics. Finally, a limitation of past studies is that they do not account for potential mechanisms that explain health inequalities during this life stage (Adler & Stewart, 2010; Due et al., 2011).

2.4. Research objectives

Related to the state of research, we aim to extend knowledge about health inequalities in young adulthood while evaluating the role of potential mediators. More specifically, there are two primary aims of this study:

(1) To investigate the impact of parental education on children's trajectories of general health and overweight during the transition to adulthood
(2) To ascertain how much of the health inequalities are mediated by children's educational attainment, health behaviours, psychosocial factors, and early-career working conditions

We rely on longitudinal data from Germany to model trajectories of health throughout the age span between 14–25 years. This allows us to focus on the individual development of health and to test if health disparities between children of low and highly-educated parents change by age. We examine the trajectories of self-rated health and overweight. Self-rated health is a global health measure that reflects general health functioning, prevalent diseases, current pain and mental health. Overweight is a highly prevalent health problem among young people worldwide. Both outcomes are linked to behavioural and psychosocial exposures (Abarca-Gómez et al., 2017; Bauldry et al., 2012). Furthermore, we apply a state-of-the-art approach towards mediation analysis to disentangle how much of the relationship between parental education and health is due to specific disadvantages established in this life stage. Germany presents a noteworthy example in terms of its unique educational system, which has been observed to exacerbate social disparities in access to education and hinder inter-generational social mobility. Building upon the concept of risk accumulation, whereby early disadvantages are likely to perpetuate further disadvantages, we can hypothesise that there is a strong link between socio-economic background and health prospects during the transition into young adulthood in Germany.

3. Methods

3.1. Data

We used data from Starting Cohort 4 (SC4, SUF 13.0.0) of the National Education Panel Study (NEPS) (Blossfeld et al., 2011; NEPS Network, 2023). NEPS SC4 is a representative sample of German 9th graders first interviewed in 2010 or 2011 and then followed yearly. A stratified multi-stage sampling technique was used where secondary schools were selected within the six most common school forms in Germany, subsequently classes were sampled within schools, and finally all students within those classes (Aßmann et al., 2019). Pupils were interviewed in school classes using paper-and-pencil interviews (PAPI) and school leavers were surveyed using computer-assisted telephone interviews (CATI). More detailed information on the study design and sampling procedure can be found in the study report (NEPS, 2020). We included all available survey waves up to the year 2021. We could not include the first survey wave of 2010, because self-rated health was not measured. In sum, nine survey waves between 2011 and 2021 were used, with each wave covering one calendar year (except for 2018, where no survey took place).

3.2. Study sample

To form the study sample, we took several steps. First, we excluded 1178 individuals who attended special needs schools because self-rated health was not assessed in this group. The resulting sample included 92,091 person-years of 15,046 individuals. Observations were not considered when individuals were younger than 14 years or older than 25 years (358 person-years), when information on self-rated health or body mass index was missing (663 person-years), or when information on parental education, sex, migration background, household composition, or region was missing (974 person-years). Eventually, 90,096 person-years of 14,981 individuals were used for the following analyses. A detailed overview of the eligibility criteria and their effect on the sample size can be found in the Appendix (e-Table 1).

3.3. Variables

Fig. 1 presents a visual representation of the assessment of time-dependent variables in NEPS by survey wave. The subsequent section provides a comprehensive explanation of how each variable is constructed.

3.3.1. Outcomes

We used two indicators to assess participants' health. First, we used self-rated health as a global health measure reflecting overall health functioning, prevalent diseases, current pain, and mental health (Burström & Fredlund, 2001; Idler & Benyamini, 1997; Lazarevič & Brandt, 2020). Self-rated health was ascertained in each survey wave by the question "How would you describe your health overall?" followed by a five-point Likert scale with possible responses ranging from "very poor" to "very good". We treated self-rated health as a quasi-metric, where higher values indicate better health.

As a second outcome, we considered overweight, which is a highly prevalent health problem among young people worldwide (Abarca-Gómez et al., 2017). Overweight was assessed by self-reported anthropometric data on body height and weight collected at waves 2011, 2015, 2020, and 2021 which was used to calculate the body mass index (BMI = kg/m2). Overweight was defined based on age and sex-specific cut-offs. For ages below 18 years, overweight was defined by a BMI exceeding the age- and sex-specific reference value for German adolescents, corresponding to the 90th percentile (Kromeyer-Hauschild et al., 2001). For participants 18 years and older, we defined overweight by the World Health Organization criteria of a BMI $\geq$ 25 kg/m2 (World Health Organization, 2005). Different reference systems were used to consider higher variability of body weight trajectories in younger ages.

3.3.2. Predictor

Parental education was the main exposure variable and was used as an indicator of children's socio-economic position (SEP) (Galobardes et al., 2006). Parent's formal education is usually completed before children's adolescence, allowing us to establish a temporal order between the exposure, mediator and outcome variable. In contrast, other SEP indicators such as household income or parents' occupation may change over time and produce reversed causality or misclassification bias. Information on the mother's and father's highest school-leaving certificate and vocational training certificate was extracted from parental interviews conducted in a baseline survey in 2010. In rare cases, parental information was not available and instead information provided by the child was used. Parental education at the baseline survey was then carried forward into later survey waves, yielding a time-constant predictor variable. Parental education was classified by the Comparative Analysis of Social Mobility in Industrial Nations (CASMIN) classification (König et al., 1988) and then transformed into a continuous variable (years of completed education). The mean of maternal and paternal education years was calculated (range 9–18), to consider that both contribute material and intellectual resources

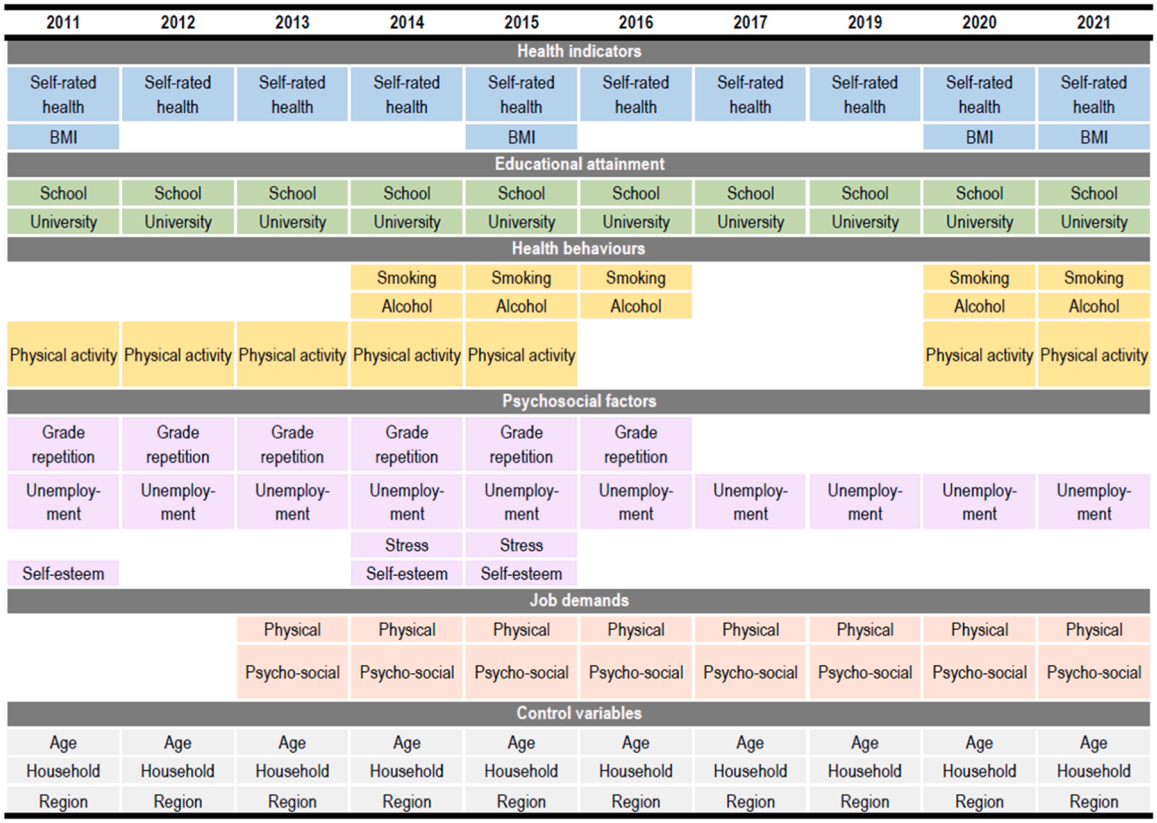

Fig. 1. Assessment of time-dependent variables in NEPS Starting Cohort 4 by survey year.

relevant for children's health and own educational attainment (Galobardes et al., 2006). For the main analyses, parental education was dichotomised into low (≤ 13 years) and high (> 13 years).

3.3.3. Mediators

We constructed eleven variables that considered factors mediating the relationship between parental education and health. We used two indicators of children's educational attainment (years of school education, years in university), three indicators of health behaviours (smoking status, alcohol consumption, and physical inactivity), three indicators of psychosocial factors (number of grade repetitions, years in unemployment, chronic stress, and self-esteem), and two indicators of working conditions (physical and psychosocial job demands).

3.3.4. Mediators: children's educational attainment

We calculated two count variables that are influenced by the amount of time a person spends in education. The first variable represents the number of years spent on school education and increases as each grade is completed. Conversely, the second variable reflects the number of years spent pursuing higher education at a university level and increases with each year enrolled. We examined these variables independently as they represent distinct interpretations of education. As compulsory full-time schooling in Germany ends after the completion of grade nine, there is even a large variation in the school education variable in the early waves of the survey. An overview of the distribution of both education variables is to find in the Appendix (e-Table 2).

3.3.5. Mediators: health behaviours

Smoking status was assessed at waves 2014, 2015, 2016, 2020, and 2021. A distinction was made between individuals who did not smoke at all and those who reported occasional or regular smoking. Similarly, we generated a variable to examine the patterns of alcohol consumption among individuals. We made a distinction between those who indicated consuming alcohol once per week or less and those who reported drinking multiple times per week. Physical activity levels were evaluated from 2011 to 2015 and from 2020 to 2021. The criterion for determining physical inactivity was based on individuals who reported engaging in sports once a month or less compared to those who participated in physical activities multiple times per month.

3.3.6. Mediators: Psychosocial factors

To ascertain the cumulative number of school grade repetitions, data collected from parents in 2010 and from pupils in subsequent survey years were utilised. Similarly, information regarding participants' labour status during each survey wave was employed to calculate a variable that accounts for the cumulative number of years spent unemployed. Chronic stress was assessed in waves 2014 and 2015 by the Standard Stress Scale (SSS) (Gross & Seebaß, 2014). The SSS was developed to assess stress in different life stages such as school, university, unemployment or employment, and orientates on established work stress models, predicting stress in situations of high demands or efforts and low control or reward. Participants could rate seven items about how they feel on an average day each on a five-point Likert scale (e.g. performance is appreciated, looking forward to the future, doing meaningful tasks). An overview of the items is to find in the Appendix (e-Table 3). Positive items have been reversed and then the sum of all items was divided by the maximum and multiplied by hundred, leading to a continuous variable ranging from 0 (no stress) to 100 (highest level of stress). Self-esteem was measured in waves 2011, 2014 and 2015 by a German adaption of the Rosenberg self-esteem scale consisting of 10 items asking participants about different aspects of self-worth (e.g. being satisfied with oneself, thinking to be not good at all, feeling to be a failure) (Rosenberg, 1965). More details about the items are to find in the Appendix (e-Table 2). Negative items have been reversed and a sum score of all items was calculated, divided by the maximum and finally multiplied by hundred, leading to a scale ranging from 0 (lowest level of

self-esteem) to 100 (highest level of self-esteem). Self-esteem is an important psychological resource that is associated with greater resilience to stress, more health-promoting behaviours and better mental health in youth (Arsandaux et al., 2020).

3.3.7. Mediators: Job demands

From 2013 onwards, we assessed physical and psychosocial job demands of individuals who were at least 16 years old, engaged in vocational training or employed in full- or part-time work (including side and student jobs). As the assessment of working conditions was not part of the NEPS, information concerning job demands was determined indirectly via a Job Exposure Matrix (JEM) based on the International Standard Classification of Occupations 2008 (ISCO 08). JEMs use occupation as a proxy for job demands, which were measured individually in previous studies and then assigned to occupation. In occupational epidemiological research, the use of JEMs is well-established as they give good predictions of future work ability (Brünger et al., 2020), as well as for general health, health symptoms, and sickness-related absence days (Kroll, 2011, 2015). We here relied on the JEM recently developed based on 22 indicators and five subscales of job demands assessed in the BIBB/BAuA Employment Survey 2018 which is representative of the German workforce (Meyer & Siefer, 2021). The following five subscales were included:

(1) Physical work hazards (e.g. lifting and carrying heavy loads)
(2) Environmental work hazards (e.g. working in smoke, dust, under gases, vapours or noise)
(3) Work intensity (e.g. time pressure, managing multiple tasks simultaneously)
(4) (Low) decision latitude (e.g. no influence on amount or organisation of work tasks)
(5) Working time demands (e.g. working on weekend or working nightshifts)

Each indicator is a continuous variable ranging from 1 (lowest decile = lowest job demands) to 10 (highest decile = highest job demands). We constructed an indicator of physical job demands as a mean of physical and environmental work hazards, as well an indicator of psychosocial job demands as a mean score of work intensity, (low) decision latitude and working time demands. To consider that impact of job demands is likely to interact with working hours and to increase comparability between full-time and student or side jobs, we multiplied each JEM indicator with a weighting factor (working hours divided by the sample median of working hours). For instance, the weighting factor was "1" in case the individual working hours were "38″, (reflecting the sample median) or was "0.5″ in case working hours were 19. The upper limit of the weighting factor was "1" (in case individual working hours were higher than the median). We validated the usefulness of JEM indicators with the self-assessed impact of working conditions on health assessed in wave 2020 (see Appendix, e-Table 4). High physical and psychosocial demands were associated with higher odds of reporting that work affects health, indicating good content validity of JEMs.

3.3.8. Control variables

We included control variables that were considered as possible confounders in the relationship between exposure and mediator, mediator and outcome, and exposure and outcome (further details are to find in the section about statistical analyses). Sociodemographic controls were age in years (one-life year dummies to consider non-linearity), sex, migration background, household composition and residential area. A person had a migration background if he or she (1st generation) or at least one parent (2nd generation) was born without German citizenship, according to the definition of the German Federal Statistical Office (Will, 2019). While sex and migration background were time-constant factors measured at baseline, age, household composition and residential area were repeatedly assessed and allowed to vary over time.

3.3.9. Missing values

Missing values in variables of interest were analysed in the baseline survey (2010) and the survey year 2011 and described in the Appendix (e-Table 5). We found higher proportions of missing values for variables derived from parental interviews, which were the mother's education (10.7%) and the father's education (14.8%). We imputed missing values using chained equations with a predictive mean matching procedure (Enders, 2010). The imputation models included both health outcomes, mediator variables, control variables as well as additional auxiliary variables (stratum of the school sample, current labour market state, and personal well-being). A comparison of the original versus the imputed data set is to find in the Appendix (e-Table 6).

3.4. Statistical analysis

Several analytical steps were performed to analyse the relationship between parental education and health, as well as to investigate the contribution of mediating factors in this relationship. First, we described the distribution of the predictor, mediator, control and outcome variables in Table 1, stratified by parental education dichotomised into low ($\leq$ 13 years) and high ($>$ 13 years). We show means along with standard deviations (SD) for continuous variables, and absolute frequencies along with column percentages for binary variables. We tested for significant differences in parental education using Pearson's chi-square (for categorical variables) or Student's t-test (for continuous variables).

Second, we analyse the development of self-rated health and overweight over time by parental education using group-specific random-effects growth curve models (Rabe-Hesketh & Skrondal, 2005). Growth curve modelling is a panel regression technique to model intra-individual change over time and to analyse differences in the rate of change between individuals. The linear growth curve model is described as follows:

$$y_{it} = \alpha + \vartheta G_i + \beta A_{it} + \delta(G_i * A_{it}) + a_i + \varepsilon_{it}$$

Equation 1 Group − specific growth curve model

Here y_{it} is the health of individual (i) at time (t), as a function of the interaction between age (A_{it}) with a time-constant group variable (G_i). The group variable is binary indicator (G:{0,1}) for low or high parental education. Furthermore, ϑ is the group difference at A= 0 and δ indicates the change in group difference with every year. We chose a random-effect instead of a fixed-effect approach because parental education is a time-constant variable and its effect cannot be estimated within the fixed-effect approach. Time was specified by age dummies (in one-life-year increment). By using dummy variables instead of linear, quadratic, or cubic function of time, we adopt the most flexible approach to model the relationship between age and health, without imposing any specific assumptions about its mathematical representation. Growth curves were adjusted for two time-constant variables (sex, migration background) and the following time-dependent covariates: household composition, residential area, and survey mode (PAPI or CATI). We specified linear ordinary last squares (OLS) regression models for self-rated health and Poisson regression models for overweight as a binary outcome (Zou, 2004). In all regression analyses, we calculate cluster-robust standard errors to account for autocorrelation and heteroscedasticity of panel data (Brüderl & Ludwig, 2015). Regression estimates were converted using Stata's "margins" post-estimation command into average predictions at the mean (APMs) and into average marginal effects (AMEs) (Williams, 2012). APMs show adjusted means of self-rated health and proportions of overweight (profile plot). AMEs show the impact of high parental education on health as individuals age (conditional effect plot). Results are plotted in Fig. 3.

Third, we investigate associations between education/mediators and both health outcomes in Table 2. Again, we choose a random-effect approach that allows for combing between- and within-effects of time-dependent variables, thus considering the impact of changes in mediator variables (e.g. starting to smoke) on individual health. For

Table 1
Descriptive statistics by parental education (90,096 person-years of 14,981 individuals).

	Parental education				
	Low (≤ 13 years)		High (> 13 years)		
	n	% / Mean (SD)	n	% / Mean (SD)	p-value
Self-rated health					
(1-5)	51,317	4.1 (0.8)	38,779	4.2 (0.8)	< 0.001
Overweight					
No	14,759	80.0	11,878	84.5	< 0.001
Yes	3701	20.0	2177	15.5	
Total	18,460	100.0	14,055	100.0	
School education (years)					
(9-13)	51,317	10.2 (1.2)	38,779	11.0 (1.3)	< 0.001
University education (years)					
(0-7)	51,317	0.2 (0.8)	38,779	0.7 (1.3)	< 0.001
Smoking status					
No smoking	7783	74.2	9331	77.5	< 0.001
Occasionally or regularly	2711	25.8	2716	22.5	
Total	10,494	100.0	12,047	100.0	
Alcohol consumption					
Once a week or less	9287	90.5	10,386	87.1	< 0.001
Several times a week	979	9.5	1540	12.9	
Total	10,266	100.0	11,926	100.0	
Physical activity					
≥ Several times a month	26,637	80.0	20,783	86.9	< 0.001
Once a month or less	6659	20.0	3126	13.1	
Total	33,296	100.0	23,909	100.0	
Grade repetitions (years)					
(0-3)	50,570	0.3 (0.5)	38,705	0.2 (0.4)	< 0.001
Unemployment (years)					
(0-7)	51,317	0.1 (0.3)	38,779	0.0 (0.2)	< 0.001
Chronic stress					
(0-100)	7711	29.0 (9.5)	7082	28.8 (9.2)	0.126
Self-esteem					
(0-100)	12,182	78.0 (12.9)	9079	79.3 (13.1)	< 0.001
Physical job demands[1]					
(1-10)	15,734	6.7 (2.8)	7812	5.7 (3.0)	< 0.001
Psychosocial job demands[1]					
(1-10)	15,734	5.5 (2.1)	7812	4.9 (2.2)	< 0.001
Age in years					
(14-25)	51,317	18.2 (2.8)	38,779	18.6 (3.0)	< 0.001
Gender					
Male	25,462	49.6	19,221	49.6	0.878
Female	25,855	50.4	19,558	50.4	
Total	51,317	100.0	38,779	100.0	
Migration background					
No migrant background	37,072	72.2	32,127	82.8	< 0.001
1st generation	3302	6.4	1317	3.4	
2nd generation	10,943	21.3	5335	13.8	
Total	51,317	100.0	38,779	100.0	
Household composition					
Living with parents	43,029	83.8	29,421	75.9	< 0.001
Single-person household	2737	5.3	4075	10.5	
Couples without children	2450	4.8	2072	5.3	
Couples with children	395	0.8	147	0.4	
Single parents	134	0.3	24	0.1	
Other	2572	5.0	3040	7.8	
Total	51,317	100.0	38,779	100.0	
Region of education or work					
West Germany	44,793	87.3	33,685	86.9	< 0.001
East Germany	6365	12.4	4660	12.0	
Abroad	159	0.3	434	1.1	
Total	51,317	100.0	38,779	100.0	

Data set: NEPS SC4, SUF 13.0.0. [1] If currently employed (full-time job, apprenticeship or student job). Significance of group differences by two-sided t-test (for continuous variables) or chi-2 test (for categorical variables).

overweight, prevalence ratios (PR) were calculated, indicating the average change of overweight prevalence combined over all survey waves when increasing a continuous variable by a one-scale point or when comparing two categories of a binary variable.

Fourth, we performed a series of mediation analyses to evaluate to contribution of each mediator for health inequalities. In a mediation model, we aim to disentangle the total effect of education into a direct effect not going through a mediator and an indirect effect that goes through a mediator (Baron & Kenny, 1986). We follow the simulation-based, counterfactual approach proposed by Imai et al. (2011) to calculate the total, direct and indirect effect as well as respective 95% confidence intervals for significance testing. Uncertainty estimates are based on a quasi-Bayesian Monte Carlo approximation, a procedure relying on repeated random sampling (Imai et al., 2010). We use Stata's "mediate"-package (Hicks & Tingley, 2011) which has implemented the algorithms proposed by Imai et al. (2011). The package allows for high flexibility in specifying regression models as linear OLS models for continuous and logit models for binary mediator or

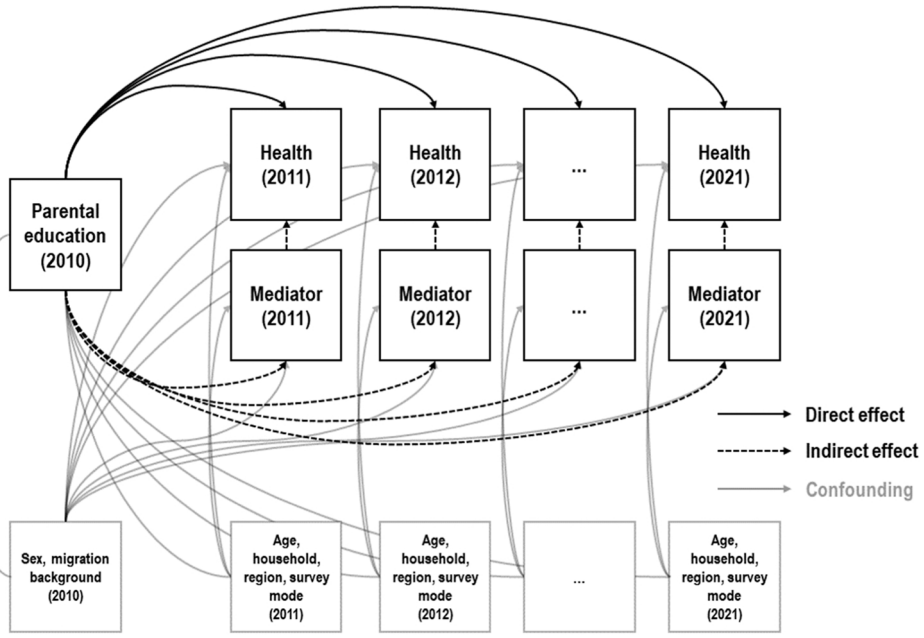

Fig. 2. Mediation model illustrating the relationship between parental education, a mediating factor and health under control of possible confounding factors (time of measurement in parenthesis).

outcome variables. Furthermore, it allows to test if a mediation effect is statistically significant, defined by an indirect effect confidence interval that does not contain zero. Furthermore, the proportion of the total effect mediated (PM) in percent was expressed by dividing the indirect by the total effect estimate. Despite utilising panel data with multiple measurements over time, we conceptualise the mediation model as a series of cross-sectional analyses merged from various survey years. Rather than employing a longitudinal cross-lagged mediation model that provides benefits like improved control for temporal sequencing and time-constant confounding factors, we opted for a pooled cross-sectional method to simplify our model's complexity, reduce computational time, and most importantly, align with our research objective of examining absolute disparities in health outcomes among children based on their parents' levels of education instead to explain variability in the rate of change within individuals (MacKinnon, 2012). Fig. 2 provides a visual representation of the mediation model. In this analysis, we aim to determine the extent to which parental education, assessed at baseline and prior to the study period, influences various health measures during the course of the study by acting through a specific mediator. Thus, we here obtain estimates for indirect, direct and total effects pooled over all survey waves. Moreover, we included all survey years available to the mediation analysis, despite age-specific variation in the statistical impact of parental education. This was done because selectivity would likely result in the inflation of the statistical impact of parental education on our outcomes of interest, while including all survey years accounts for any variability in the association between education and health across different age groups.

For each mediator and each of both outcomes, the mediation analysis contains three consecutive steps. The first step is to fit a mediator model in which the mediator (M) is a function of the exposure (E) and possible confounding factors (C):

$$f(M_i \mid E_i, C_i)$$

Equation 2 Mediator model

The second step is to fit an outcome model in which the outcome (O) is a function of the mediator (M), the exposure (E), and possible confounding factors (C):

$$f(O_i \mid E_i, M_i, C_i)$$

Equation 3 Outcome model

In the third step, the outputs of both models are used as input to estimate the total, direct, and indirect effect. The total effect if defined as the sum of the direct and the indirect effect of parental education.

Furthermore, as all regression models include important socio-demographic covariates, we aim to reduce heterogeneity between children from low and highly-educated parents that might confound effect estimates (VanderWeele, 2015). Fig. 2 gives a graphical visualisation of the assumed relationship between parental education, mediator variables, health and the control variables.

We make control for confounding in the relationship between exposure and outcome, between the mediator and the outcome, as well as between the exposure and mediator. For instance, migration background is a well-established correlate of parental education while also predicting health (exposure-outcome confounding). Furthermore, sex is a predictor of educational achievement and working conditions while also being associated with health (mediator-outcome confounding). In addition, the occurrence of specific health behaviours such as smoking or job demands is dependent on age, which is simultaneously associated with health (mediator-outcome confounding). We also control all models for household composition and residential area to further reduce unobserved heterogeneity between individuals from advantaged and disadvantaged families. This concerns, for instance, differences resulting from east-west status that might determine different job opportunities and unemployment risks. Furthermore, the household composition is reflecting aspects as moving out from parents or early parenthood being associated with own education pathway and health. Finally, NEPS switched the survey mode from PAPI to CATI or computer-assisted web interviews (CAWI) after individuals left school. Since non-anonymous interview settings as PAPI can affect answering behaviours through social desirability (Reisinger, 2021), we control for interview mode in all multivariable regression models. We present the results of the mediation analyses in Table 3 and in Fig. 4.

As an alternative strategy, mediator variables could be specified as a lagged effect in the regression models, considering that behavioural or psychosocial disadvantages may take some time to express a negative effect on health. However, due to the retrospective nature of the

Table 2
Association between parental education or mediator variables and health.

	Self-rated health		Overweight	
	Unadjusted (b)	**M1 (b)**	**Unadjusted (PR)**	**M1 (PR)**
Parental education				
Est. [95% CI]	0.04 * ** [0.02,0.06]	0.05 * ** [0.03,0.07]	0.78 * ** [0.73,0.83]	0.69 * ** [0.65,0.74]
Observations (n)	90,096	90,096	32,515	32,515
Individuals (n)	14,981	14,981	14,679	14,679
School education				
Est. [95% CI]	0.02 * ** [0.01,0.02]	0.02 * ** [0.01,0.03]	1.19 * ** [1.16,1.21]	0.81 * ** [0.78,0.84]
Observations (n)	90,096	90,096	32,515	32,515
Individuals (n)	14,981	14,981	14,679	14,679
University education				
Est. [95% CI]	0.02 * ** [0.01,0.02]	0.01 * ** [0.01,0.02]	1.14 * ** [1.12,1.16]	0.90 * ** [0.88,0.92]
Observations (n)	90,096	90,096	32,515	32,515
Individuals (n)	14,981	14,981	14,679	14,679
Smoking status				
Est. [95% CI]	-0.14 * ** [− 0.17,− 0.11]	-0.14 * ** [− 0.17,− 0.12]	1.31 * ** [1.22,1.42]	1.19 * ** [1.10,1.28]
Observations (n)	22,541	22,541	10,778	10,778
Individuals (n)	9348	9348	6070	6070
Alcohol consumption				
Est. [95% CI]	-0.01 [− 0.04,0.02]	-0.03 [− 0.06,0.00]	1.09 [0.98,1.20]	0.98 [0.88,1.08]
Observations (n)	22,192	22,192	10,793	10,793
Individuals (n)	9250	9250	6075	6075
Physical inactivity				
Est. [95% CI]	-0.11 * ** [− 0.13,− 0.09]	-0.11 * ** [− 0.13,− 0.09]	1.38 * ** [1.30,1.48]	1.23 * ** [1.15,1.31]
Observations (n)	57,205	57,205	23,584	23,584
Individuals (n)	14,945	14,945	14,406	14,406
Grade repetitions				
Est. [95% CI]	-0.03 * ** [− 0.04,− 0.02]	-0.05 * ** [− 0.06,− 0.04]	1.16 * ** [1.13,1.19]	1.09 * ** [1.06,1.12]
Observations (n)	89,275	89,275	32,483	32,483
Individuals (n)	14,943	14,943	14,679	14,679
Unemployment				
Est. [95% CI]	-0.02 * ** [− 0.03,− 0.02]	-0.03 * ** [− 0.04,− 0.02]	1.11 * ** [1.10,1.13]	1.02 * * [1.01,1.04]
Observations (n)	90,096	90,096	32,515	32,515
Individuals (n)	14,981	14,981	14,679	14,679
Chronic stress				
Est. [95% CI]	-0.23 * ** [− 0.25,− 0.22]	-0.23 * ** [− 0.25,− 0.22]	1.10 * ** [1.05,1.15]	1.09 * ** [1.04,1.15]
Observations (n)	14,793	14,793	9487	9487
Individuals (n)	10,635	10,635	9487	9487
Self-esteem				
Est. [95% CI]	0.19 * ** [0.17,0.20]	0.18 * ** [0.17,0.19]	0.93 * * [0.89,0.97]	0.87 * ** [0.83,0.91]
Observations (n)	21,261	21,261	16,050	16,050
Individuals (n)	14,357	14,357	14,189	14,189
Physical job demands[1]				
Est. [95% CI]	-0.01 [− 0.02,0.01]	-0.03 * ** [− 0.04,− 0.02]	1.13 * ** [1.08,1.18]	1.15 * ** [1.10,1.20]
Observations (n)	23,546	23,546	7979	7979
Individuals (n)	7810	7810	5327	5327
Psychosocial job demands[1]				
Est. [95% CI]	-0.02 * ** [− 0.03,− 0.01]	-0.02 * ** [− 0.03,− 0.01]	1.04 * [1.00,1.09]	1.10 * ** [1.06,1.14]
Observations (n)	23,546	23,546	7979	7979
Individuals (n)	7810	7810	5327	5327

Data set: NEPS SC4, SUF 13.0.0. Estimates (Est.) based on panel regression analysis with random effects and cluster-robust standard errors. Linear models estimate unstandardised regression coefficients (b) for self-rated health. Poisson models estimate prevalence ratios (PR) for overweight. A standard model without random effects was used to regress stress on overweight. Model 1 (M1) adjusted for age dummies (one life-year increment), sex, migration background, household composition, residential area and survey mode. Separate regression analyses were conducted for each independent variable. Continuous variables were standardised to compare effect size across variables with different metrics. [1] If currently employed (full-time job, apprenticeship or student job). * $p < 0.05$, * * $p < 0.01$, * ** $p < 0.001$.

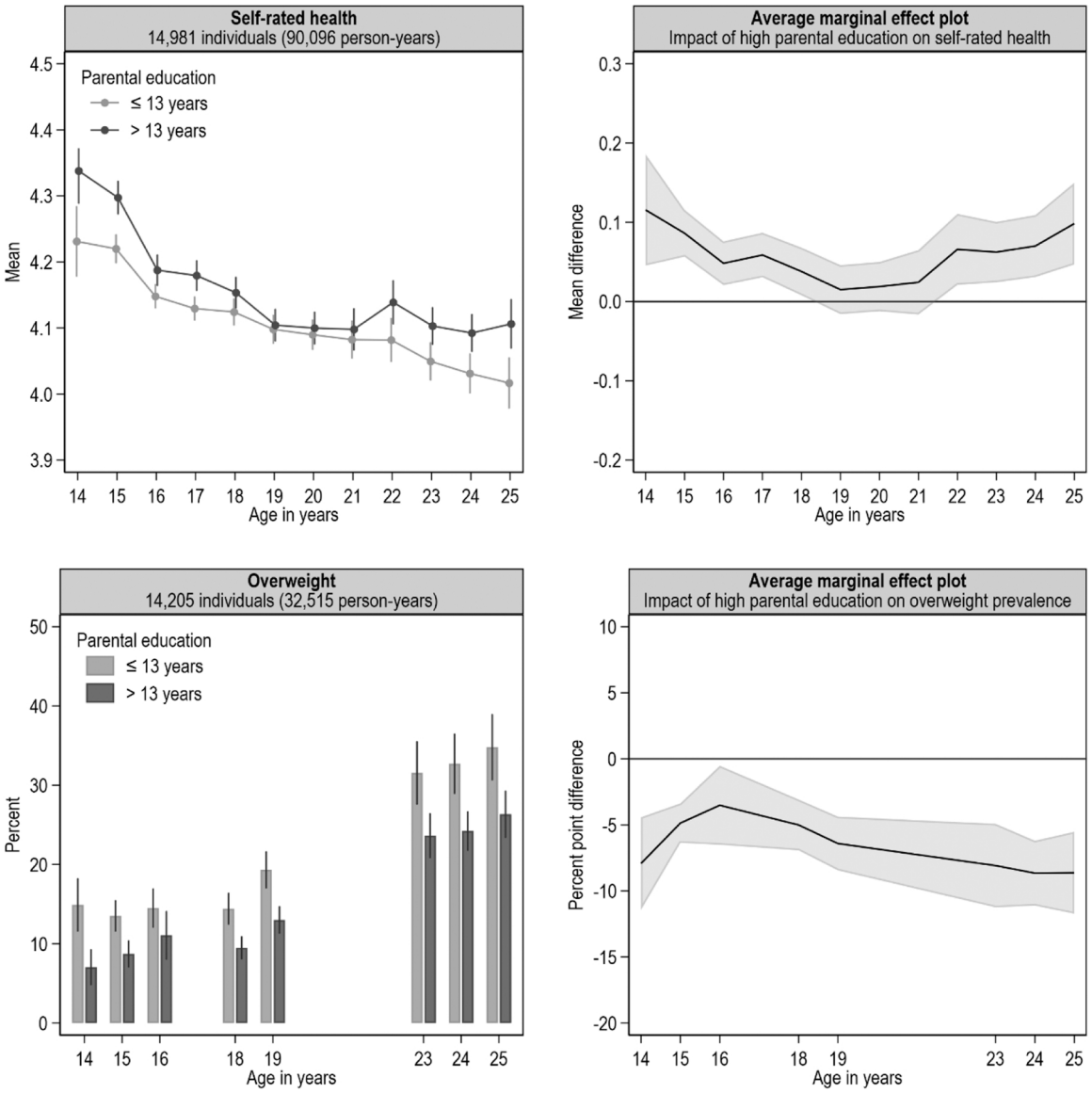

Fig. 3. Profile plots for health trajectories by parental education (left side of panel) and conditional effect plots for health inequalities by parental education over age (right side of the panel), Data set: NEPS SC4, SUF 13.0.0. Profile plots and average marginal effect plots with point estimates and 95% confidence intervals based on group-specific random effects growth curves with cluster-robust standard errors. Growth curves were adjusted for sex, migration background and survey mode. For overweight, no estimates were shown for ages 17, 20, 21 and 22 years, as low case numbers in these years yielded high statistical uncertainty.

questionnaire, which asks about changes since the last survey period (e.g. grade repetition, unemployment, school completion or university study), we refrained from using this method as the main analytical strategy. Instead, we tested the robustness of our findings using lagged effects as an alternative and report the results as part of the sensitivity analysis.

All analyses were performed using Stata 16.1 MP (64-bit, StataCorp LLC, College Station, TX, USA).

4. Results

4.1. Sample description

Table 1 shows that a low level of parental education was associated with lower self-rated health and a higher likelihood for overweight. Children with low-educated parents had less years of school education, and less years of university education, and were more likely to smoke, be physically inactive, have school grade repeating, be unemployed, low self-esteem, while showing higher means of stress (not significant), as well as higher physical and psychosocial job demands. In contrast, alcohol consumption was more frequent among children of parental with higher levels of education.

4.2. Age-trajectories of self-rated health and overweight by parental education

Fig. 3 illustrates trajectories of self-rated health and overweight by parental education over participants' age. Overall, the left-handed side of the graph shows that self-rated health declined over time while the prevalence of overweight increased. Furthermore, inequalities in both health outcomes were observable with higher means of self-rated health and lower proportions of overweight among children from parents with higher levels of education. In addition, the right-handed side of the graph indicates that the extent of health inequalities was not constant over time. For both outcomes, relative inequalities decreased over time but increased again in young adulthood.

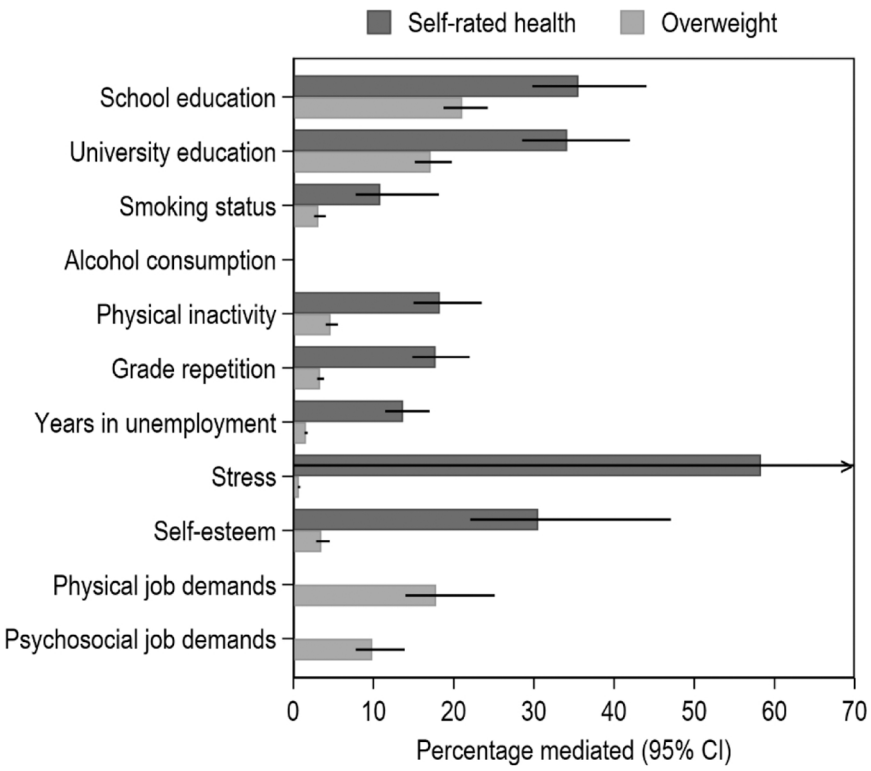

Figure 4. Mediation analysis for the association between parental education and children's health via different indicators of disadvantage Data set: NEPS SC4, SUF 13.0.0. Graphical illustration of the mediation analysis presented in Table 3. The greater statistical uncertainty for the stress variable is due to the smaller sample size and the smaller overall effect of parental education at the time of measurement.

4.3. Multivariable analyses on the relationship between parental education or mediators and health

The association between parental education, mediator variables and health under the control of socio-demographic variables was examined in Table 2. Higher parental education was associated with better self-rated health and a lower likelihood for overweight. When adjusting for covariates in Model 1, we observed stronger effect sizes, suggesting that some part of the association between education and health is suppressed by socio-demographic differences between children from high and low-educated parents. After full adjustment, high versus low parental education was statistically associated with an increase in self-rated health by + 0.05 scale points and a 0.69-fold lower likelihood for overweight.

The next section of the table is concerned with the association between mediator variables and health outcomes. Overall, unhealthy behaviours, psychosocial burdens and poor working conditions were associated with worse health outcomes, while educational attainment and psychosocial resources were linked to better health. More precisely, harmful health behaviours (despite alcohol consumption), class repetitions, unemployment, chronic stress and physical and psychosocial job demands were related to lower self-rated health and higher probabilities for overweight, while higher school education, studying at university and higher self-esteem were positively linked to self-rated health and negatively related to overweight.

4.4. Mediation analysis

The results of the mediation analyses are presented in Table 3. The total effect of high versus low parental education was 0.054 (95% CI 0.044; 0.065) for self-rated health and − 0.062 (95% CI −0.070; −0.054) for overweight. For each potential mediator, we calculated the percentage mediated by dividing the indirect effect by the total effect. However, in case of a negative indirect effect, no meaningful percentage mediated could be calculated. The strongest mediation was observed for indicators of children's educational attainment. Years of schooling mediated 35.5% of the relationship between parental education and self-rated health and 22.5% of inequalities in overweight. Furthermore, years in university accounted for 34.2% (self-rated health) and 17.8% (overweight) of health inequalities. Significant mediation effects were also observed for health behaviour variables that were smoking behaviour (self-rated health: 10.8%, overweight: 3.2%) and low physical activity (self-rated health: 18.3%, overweight: 4.7%). Alcohol consumption was neither a mediator for inequalities in overweight nor in self-rated health. Furthermore, psychosocial factors contributed to health inequalities. More specifically, grade repetition (self-rated health: 17.7%, overweight: 3.3%), years in unemployment (self-rated health: 13.7%, overweight: 1.6%) and self-esteem (self-rated health: 30.5%, overweight: 3.5%) accounted significantly for health inequalities. Chronic stress showed mediation effects for self-rated health (58.3% with high statistical uncertainty) and overweight (1.0%). In a smaller subsample of workers (including only person-years in apprenticeship or employment), we found significant mediation effects of physical and psychosocial job demands.

A graphical representation of the mediation effects is to find in Fig. 3. For both health outcomes, the most important mediators were found in indicators of educational success (years of schooling, years in university). Strong mediation was also found for grade repetitions, self-esteem, physical inactivity and physical job demands.

4.5. Sensitivity analysis

We utilised a lagged effect modelling technique to account for a potential time delay needed for certain mediators to have an impact on health. As a result, we re-analysed models presented in Table 2 and Table 3 but incorporated mediator variables as lagged effects, where

Table 3
Mediation analysis for the impact of high parental education on self-rated health and overweight via different indicators of disadvantage.

		Self-rated health			Overweight		
		Coef.	95% CI		Coef.	95% CI	
School education	Indirect Effect	**0.019**	**0.016**	**0.022**	**-0.014**	**-0.016**	**-0.012**
	Direct Effect	0.035	0.024	0.046	-0.048	-0.056	-0.039
	Total Effect	0.054	0.044	0.065	-0.062	-0.070	-0.054
	% mediated	35.5%	29.8%	44.0%	22.5%	19.9%	25.9%
	Observations (n)	90,096			32,515		
University education	Indirect Effect	**0.018**	**0.016**	**0.021**	**-0.011**	**-0.013**	**-0.009**
	Direct Effect	0.036	0.025	0.046	-0.050	-0.058	-0.042
	Total Effect	0.054	0.044	0.065	-0.061	-0.069	-0.053
	% mediated	34.2%	28.5%	42.0%	17.8%	15.7%	20.5%
	Observations (n)	90,096			32,515		
Smoking status	Indirect Effect	**0.005**	**0.003**	**0.008**	**-0.002**	**-0.004**	**-0.001**
	Direct Effect	0.045	0.025	0.065	-0.073	-0.089	-0.057
	Total Effect	0.050	0.030	0.070	-0.075	-0.091	-0.059
	% mediated	10.8%	7.8%	18.2%	3.2%	2.6%	4.1%
	Observations (n)	22,541			10,778		
Alcohol consumption	Indirect Effect	-0.000	-0.001	0.000	-0.000	-0.001	0.001
	Direct Effect	0.055	0.035	0.076	-0.075	-0.091	-0.058
	Total Effect	0.054	0.035	0.075	-0.075	-0.091	-0.059
	% mediated	N/A			N/A		
	Observations (n)	22,192			10,793		
Physical inactivity	Indirect Effect	**0.011**	**0.010**	**0.013**	**-0.003**	**-0.004**	**-0.002**
	Direct Effect	0.050	0.037	0.064	-0.056	-0.066	-0.047
	Total Effect	0.061	0.048	0.075	-0.059	-0.068	-0.050
	% mediated	18.3%	15.0%	23.5%	4.7%	4.0%	5.6%
	Observations (n)	57,205			23,584		
Grade repetition	Indirect Effect	**0.010**	**0.009**	**0.011**	**-0.002**	**-0.003**	**-0.001**
	Direct Effect	0.045	0.034	0.055	-0.063	-0.071	-0.054
	Total Effect	0.054	0.044	0.065	-0.065	-0.073	-0.057
	% mediated	17.7%	14.8%	22.0%	3.3%	2.9%	3.8%
	Observations (n)	89,275			32,483		
Years in unemployment	Indirect Effect	**0.007**	**0.006**	**0.008**	**-0.001**	**-0.001**	**-0.001**
	Direct Effect	0.047	0.036	0.057	-0.063	-0.071	-0.055
	Total Effect	0.054	0.044	0.065	-0.064	-0.072	-0.056
	% mediated	13.7%	11.5%	17.0%	1.6%	1.4%	1.8%
	Observations (n)	90,096			32,515		
Stress	Indirect Effect	**0.016**	**0.008**	**0.024**	**-0.001**	**-0.001**	**-0.000**
	Direct Effect	0.010	-0.014	0.035	-0.069	-0.084	-0.054
	Total Effect	0.026	-0.000	0.051	-0.070	-0.085	-0.055
	% mediated	58.3%	-156.7%	332.7%	1.0%	0.8%	1.3%
	Observations (n)	14,793			9487		
Self-esteem	Indirect Effect	**0.019**	**0.014**	**0.025**	**-0.001**	**-0.002**	**-0.001**
	Direct Effect	0.043	0.022	0.066	-0.041	-0.050	-0.031
	Total Effect	0.063	0.041	0.087	-0.042	-0.051	-0.032
	% mediated	30.5%	22.1%	47.1%	3.5%	2.9%	4.6%
	Observations (n)	21,261			16,050		
Physical job demands[1]	Indirect Effect	**0.009**	**0.006**	**0.012**	**-0.012**	**-0.016**	**-0.009**
	Direct Effect	-0.003	-0.023	0.018	-0.056	-0.075	-0.036
	Total Effect	0.006	-0.014	0.026	-0.068	-0.087	-0.048
	% mediated	N/A			17.8%	14.0%	25.1%
	Observations (n)	23,546			7979		
Psychosocial job demands[1]	Indirect Effect	**0.006**	**0.004**	**0.009**	**-0.007**	**-0.010**	**-0.004**
	Direct Effect	-0.000	-0.020	0.021	-0.062	-0.081	-0.042
	Total Effect	0.006	-0.014	0.026	-0.068	-0.087	-0.049
	% mediated	N/A			9.9%	7.8%	13.9%
	Observations (n)	23,546			7979		

Data set: NEPS SC4, SUF 13.0.0. Percentage mediated calculated by dividing the indirect effect by the total effect. N/A = When the indirect effect is not statistically significant or when the estimates of both the direct and indirect effects have different signs, percentage mediated was not computed. Control variables: Age, sex, migration background, household composition, residential area and survey mode. Indirect effect estimates in boldface mark the statistical significance of the mediation effect (indicated by a confidence interval that does not include 0). [1] If currently employed (full-time job, apprenticeship or student job).

information from the previous survey wave was utilised. This alternative analytical approach yielded similar results with no significant differences compared to our initial findings. However, it is worth noting that by including only lagged effects in our analysis, we had to exclude a substantial portion of the data which resulted in a reduction of sample size and consequently diminished statistical power.

5. Discussion

5.1. Summary of the main findings

This study aimed to investigate the development of health inequalities during the transition from adolescence to young adulthood in Germany and to analyse underlying causes. The first research objective was to study the impact of parental education on children's trajectories of general health and body weight. Our findings show that children of highly-educated parents reported better health and were less likely for overweight compared with children of low-educated parents. The total effect of high parental education on self-rated health was 0.054 (95% CI 0.044; 0.065) and − 0.062 (95% CI −0.070; −0.054) for overweight. According to Cohen's (1988) classification standards, the magnitude of these effects is relatively small (Cohen, 1988). Given that young people generally have good health and are rarely affected by serious illnesses at the beginning of their lives, it was expected that differences in health would be minimal. Other studies conducted on this topic, such as the Add Health Study in the United States, have reported similar effect sizes (Bauldry et al., 2012; Bradshaw et al., 2017). Although the disparities in health were not substantial, they still represent unequal starting points that should not be considered meaningless. Furthermore, it is worth noting that these inequalities in health were not constant over time and there was a notable increase in relative differences during the transition into adulthood.

The second aim was to study the underlying factors contributing to these disparities in health. Mediation analyses indicate that children of parents whose parents had lower levels of education were more likely to experience disadvantages across multiple domains during their transition to adulthood, many of which were negatively associated with their health status. Of the mediators examined, two variables stood out as particular strong factors: level of school education and years spent in university. School education accounted for approximately one-third of the observed disparities in self-rated health and one-fifth of the differences in overweight prevalence among individuals. Additionally, other mediating factors such as self-esteem, grade repetitions, stress, unemployment, smoking behaviour, physical inactivity, and job tasks requiring high physical or psychosocial demands also contributed significantly towards explaining socio-economic differences in individuals' health during this time. In contrast, no significant mediation was found for alcohol consumption. In the following, we want to discuss our results in more detail.

5.2. Health inequalities from adolescence to young adulthood

In relation to the primary research objective, our findings reveal that lower levels of parental education were associated with more unfavourable patterns of general health and body weight. Health inequalities have not often been analysed covering the whole transition from adolescence to adulthood. In general, our findings confirm those reported by previous studies conducted in the United States, Germany, and Finland (Bauldry et al., 2012; Bradshaw et al., 2017; Chen et al., 2006; Kestilä et al., 2009; Koivusilta et al., 2006; Krause & Lampert, 2013; Noppert et al., 2021; Sokol et al., 2017; Waldhauer et al., 2019). These studies utilised similar measures of health and encompassed equivalent age ranges. However, other studies from Scotland, Finland, Australia, and Britain did not observe significant health inequalities within the same age period (Huurre et al., 2003; Siahpush & Singh, 2000; Spencer, 2006; Sweeting et al., 2015; West & Sweeting, 2004).

There are several reasons that may account for this inconsistency. First, the limited extent of health inequalities in younger ages necessitates larger sample sizes in order to detect smaller effect sizes. When comparing the available youth studies, it is notable that those reporting null findings often lacked statistical power due to small sample sizes, whereas larger studies such as the Add Health Study or NEPS were able to draw on around 15,000 individuals. Another explanation might be given about the covered age span. An advantage of our study was that we used a longitudinal design that not only precludes bias resulting from health selection but also allows us to test changes in the extent of health inequalities by age. We observed that inequalities in health attenuated during late secondary education (around ages 15–18 years) and re-emerged later during the post-school phase. Many studies reporting null findings were based on samples around these ages, which may support the hypothesis of 'equalisation in youth' (West, 1997). According to this theory, socio-economic background becomes less influential on children's health during time of late secondary education, because other factors become more relevant (e.g., peer group behaviour, youth culture and school characteristics). When shifting to the post-school phase, socio-economic background again plays an important role in health, as it shapes further career paths, working conditions, and unemployment risks. Since we found these factors explain a significant part of the health inequalities, the findings of our study generally support this view. Nevertheless, it should be noted that subsequent to the period of equalisation, our findings revealed a notable rise in health disparities. This observation can be interpreted as suggestive evidence of risk accumulation and the compounding effects of cumulative disadvantage on individuals' health (Dannefer, 2003; Ferraro, Shippee & Schafer, 2009).

It would be of interest to conduct future research in different countries. Germany stands out as a country with lower levels of education and income-related disparities in overall health compared to other European nations (Mackenbach et al., 2008). Additionally, the child poverty rate in Germany falls below the OECD average, placing it within the lower third percentile (WHO, 2014). As such, it can be postulated that relative inequalities in health during the transition into adulthood may be more pronounced in economically deprived countries when compared to our sample from Germany.

5.3. Explanation of youth health inequalities

This study presents findings that support the idea that health disparities between children of parents with low education and highly-educated parents can be attributed to multiple disadvantages. Particularly, it was observed that children's educational achievement played a crucial role as a mediator in this relationship. These results imply that the transmission of class location from parents to children is a core mechanism contributing to explanations regarding unequal distribution of health. This is likely due to the impact of education on various factors such as knowledge, psychosocial burdens, and economic resources relevant for health. For instance, studies have shown that smoking rates among young adults vary by educational attainment (Hanson & Chen, 2007). Similarly, a recent study documents pronounced health inequalities by level of formal qualifications, even among young workers, due to socio-economic stratification of job demands (Reuter et al., 2023). In a broader context, this supports the assumptions made by life-course epidemiology known as the chain-of-risk model or theory of cumulative disadvantage (Ben-Shlomo et al., 2016; Dannefer, 2003). Accordingly, initial disadvantage (family background) leads to further disadvantage (educational attainment), which then influences material, psychosocial, and behavioural exposures. This pattern suggests that other mediators examined here are also partially influenced by one's

own education, but we were unable to account for this pathway in our analyses due to inconsistent measures of behavioural and psychosocial mediators.

Yet, life course research has mainly focussed on intra-individual processes explaining health inequalities. While the intra-individual perspective is significant, our study draws attention to the importance of inter-individual mechanisms. Traditionally within sociological research, there has been a focus on explaining class mobility through intergenerational associations between education, occupation and earnings (Blau & Duncan, 1967; Bukodi & Goldthorpe, 2013; Erikson & Goldthorpe, 1992). However, little attention has been given to how these associations relate to health disparities. As one of the scarce exceptions, a recent study based on data from the German Socio-economic Panel (SOEP) analyses health trajectories in dependence on both parental and children's education (Arránz Becker & Loter, 2021). Congruent with our findings, they observed that the impact of parental education on health attenuated when controlling for individuals' education. As a consequence, life course epidemiology should pay more attention to intergenerational processes that account for health inequalities in adolescence and young adulthood. In a more practical sense, our findings suggest that health inequalities could be reduced by increasing intergenerational social mobility. As mentioned above, Germany has an education system in which children are selected into different educational tracks at the age of 10, and in which those from lower socio-economic backgrounds in particular tend to be selected into lower performing tracks. Therefore, it is possible that the results may differ in countries with less emphasis on educational tracking. Additionally, it should be noted that Germany's vocational education and training system (VET) contributes to high employability rates even among individuals with lower levels of education (Bol & van de Werfhorst, 2013). As a result, youth unemployment rates in Germany remain low compared to other countries without a VET system (WHO, 2014). Consequently, the significance of mediator variables such as unemployment may vary depending on the labour market characteristics in different countries.

Furthermore, we observed other disadvantages explaining health inequalities in young adulthood, including health behaviours, psychosocial exposures, self-esteem and early-career working conditions. Studies testing mediation of youth health inequalities in comparable age spans are scarce and vary by potential mediators studied. In Germany, baseline data of the KiGGS study showed that around 70% of the total effect of parental SEP on self-rated health was explained by family characteristics, including family cohesion, parental well-being health behaviours (Rattay et al., 2022). In the United States, the Add Health study showed that health behaviours and stress experiences partially mediated youth health inequalities. Bradshaw et al. (2017) found that higher subjective social status in 14,780 individuals followed from adolescence to young adulthood was associated with lower BMI and that health behaviours and perceived stress explained this relationship to some degree (Bradshaw et al., 2017). Bauldry et al. (2012) found that low parental education predicted poor self-rated health during the transition to adulthood and that unhealthy behaviours (smoking, drinking) were significant mediators (Bauldry et al., 2012). Analyses of the Finnish Health 2000 Survey showed that unhealthy behaviours explained 63% of the association between parental education and self-rated health in early adulthood (Kestilä et al., 2009). As with previous research, our study also revealed a connection between unhealthy behaviours and disparities in youth health. Nevertheless, we took a broader approach by examining various additional factors that could potentially contribute to these inequalities. Our findings suggest that self-esteem, experiences of grade repetitions during school years, periods of unemployment after completing education, and early-career working conditions are all significant contributors as well. In contrast, no mediation was found for alcohol consumption, which is in line with other studies, reporting no clear association between SEP and alcohol consumption in adolescence (Due et al., 2011; Hanson & Chen, 2007). We also observed no clear support for mediation by stress experiences, which might be explained by the fact that chronic stress is also high due to academic pressure in university and therefore does not follow a classical social gradient (Pascoe et al., 2020). Nonetheless, the measurement of stress was only conducted at two specific moments in time, leading to increased statistical uncertainty when attempting to estimate the mediation effect.

We relied on parental education as an indicator of SEP in youth. In contrast to studies focussing on children's educational attainment, this allowed us to test for a causal benefit of higher socio-economic origin in terms of health, net from other processes as health selection. In general, the social gradient in health is explained by two competing theses, which are the assumption of processes of social causation (low SEP causes poor health) and health selection (poor health causes low education) (Lynch & von Hippel, 2016). A literature review based on 34 studies found evidence for both mechanisms (Kröger et al., 2015). Past studies focussing on the relationship between educational attainment and health in youth also found strong evidence for health selection (Haas & Fosse, 2008). Accordingly, individuals with poor health are less likely to achieve higher levels of education. However, parental education is generally completed at the time of children's late adolescence, thus, we could preclude that youth health inequalities are biased by health selection effects. In contrast, we showed that children's educational achievement is a mediator in the relation between socio-economic background and health.

5.4. Limitations and strengths

This study has several strengths and limitations. First of all, one of the outcomes, self-rated health, is a subjective health measure that is not able to identify certain diseases. However, especially in longitudinal youth studies, where clinical endpoints are rare, it is a valid measure for intra-individual change in overall health state (Bollen & Gutin, 2021). In addition, we relied on self-reported anthropometric data that might be affected by reporting bias. However, the prevalence of overweight in NEPS is generally comparable to other youth cohorts (Krause & Lampert, 2013). A second limitation is that, although accounting for multiple mediators, some potential mediators were not available in the NEPS, including social support, family cohesion, bullying in school, or parental divorce. Nonetheless, using secondary data from the NEPS allowed a longitudinal analysis of health inequalities covering a wide age range and several transitions that add to the current state of knowledge. Third, we acknowledge that due to methodological constraints, this study was unable to explicitly incorporate certain additional aspects of interest. This includes the potential interrelation between mediator variables and their impact on health outcomes (such as how unemployment can lead to unhealthy behaviours). Furthermore, we recognise that some mediators may interact differently with age about health, such as stress or smoking being more detrimental during late adolescence compared to young adulthood. Unfortunately, since many of these mediators were not consistently measured in the NEPS, we could not adequately account for age dependency. Moving forward, future studies should aim to address this limitation by including a more comprehensive assessment of mediator variables and considering how they may vary across different stages of life.

This study has several strengths. This is one of the sparse studies investigating the causes of youth health inequalities based on longitudinal data. By relying on the NEPS, we were able to use data that is representative for all ninth graders in Germany. The exceptionally high number of repeated measures allowed us to model changes over time and also to account for changes in the mediator variables. This was especially important to incorporate the assumption about risk

accumulation (e.g. by calculating the cumulative number of years spent in certain states as school, university, unemployment or the number of grades repeated). The longitudinal design of the NEPS allowed us to establish a causal order between parental education, mediators and health outcomes. A further strength is the use of a modern simulation-based approach towards mediation analysis, which allowed to model non-linear outcome and mediator variables, to preclude confounding between exposure, mediator and the outcome variable.

5.5. Conclusion

Our study provides evidence that the time of the transition into adulthood carries important implications for current and subsequent health chances. For the context of Germany, we found that socio-economic background is a predictor of health chances during the transition to adulthood. We were able to show that early socio-economic disadvantage is likely to cause adversity in multiple areas, including health behaviours, working conditions and psychosocial burdens and resources. Our study, thus, confirms the few previous studies from the United States and Finland. The most important factor explaining health inequalities in adolescence and young adulthood, however, was the intergenerational transmission of education from parents to their children. In Germany, a country where children are divided into different school types based on their performance, the intergenerational reproduction of class seems to be a major reason for the emergence of social inequalities in adolescents' health.

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CRediT authorship contribution statement

Hövener Claudia: Writing – review & editing. **Sundmacher Leonie:** Funding acquisition, Writing – review & editing. **Dragano Nico:** Funding acquisition, Project administration, Writing – review & editing. **Spallek Jacob:** Funding acquisition, Writing – review & editing. **Diehl Katharina:** Writing – review & editing. **Reuter Marvin:** Conceptualization, Formal analysis, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Richter Matthias:** Funding acquisition, Writing – review & editing.

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Authors' Disclosure Statement

Declarations of interest: none.

Appendix

e-Table 1
Assessment for eligibility for the study sample.

	Included				Excluded	
	Individuals		Person-years		Ind.	Prys
	n	%	n	%	n	n
Original sample	15,046	100.0	92,091	100.0	-	-
Drop if age < 14 years or > 25 years	15,046	100.0	91,733	99.6	0	358
Drop if missing information on self-rated health or BMI	15,045	100.0	91,070	98.9	1	663
Drop if missing information on parental education, sex, migration background, household, or region	14,981	99.6	90,096	97.8	64	974

Ind.=Individuals, Pyrs=Person-years.

e-Table 2
Distribution of the education variables by wave of the survey.

	2011	2012	2013	2014	2015	2016	2017	2019	2020	2021	Total
Years of school education											
9	14,191	2068	1792	1691	1372	1071	886	610	429	316	24,426
10	0	10,857	3771	2981	2474	2021	1693	1237	907	721	26,662
11	0	27	5999	1232	635	597	529	394	281	236	9930
12	0	0	79	4992	3729	3582	3311	2749	2295	2128	22,865
13	0	0	1	70	1277	1219	1168	954	803	721	6213
Years in university											
0	14,191	12,951	11,639	10,958	8187	5619	4328	2666	1816	1416	73,771
1	0	1	2	5	1292	1815	901	693	329	215	5253
2	0	0	1	3	5	1049	1485	868	617	383	4411
3	0	0	0	0	3	6	868	1156	756	600	3389
4	0	0	0	0	0	1	4	559	801	618	1983
5	0	0	0	0	0	0	1	1	394	647	1043
6	0	0	0	0	0	0	0	1	1	242	244
7	0	0	0	0	0	0	0	0	1	1	2
Total	**14,191**	**12,952**	**11,642**	**10,966**	**9487**	**8490**	**7587**	**5944**	**4715**	**4122**	**90,096**

e-Table 3
Construction of the stress scale and the self-esteem scale.

Construct	Items	Scale	Reference
Stress by the Standard Stress Scale (SSS)	(1) If I do not enjoy doing something, I usually do not have to do it (positive) (2) If I do not take care of things by myself, nobody handles it (positive) (3) I am doing meaningful tasks (4) I often feel lonely (5) My performance is appreciated adequately (positive) (6) There are people I can count on (positive) (7) Usually I have a restorative sleep (positive) (8) I often think about problems (9) After a normal day I am exhausted (10) I am afraid about what my life will be like in three years (11) I am looking forward to my future (positive)	Positive items have been reversed and then the sum of all items was divided by the maximum and multiplied by 100, leading to a continuous variable ranging from 0 (no stress) to 100 (highest level of stress)	(Gross & Seebaß, 2014)
Rosenberg self-esteem scale	(1) On the whole, I am satisfied with myself. (2) At times, I think I am no good at all. (negative) (3) I feel that I have a number of good qualities. (4) I am able to do things as well as most other people. (5) I feel I do not have much to be proud of. (negative) (6) I certainly feel useless at times. (negative) (7) I feel that I'm a person of worth, at least on an equal plane with others. (8) I wish I could have more respect for myself. (negative) (9) All in all, I am inclined to feel that I am a failure. (negative) (10) I take a positive attitude toward myself.	Negative items have been reversed and a sum score of all items was calculated, divided by the maximum and multiplied by 100, leading to a scale ranging from 1 (low self-esteem) to 100 (high self-esteem).	(Rosenberg, 1965)

e-Table 4
Odds ratios and 95% confidence interval for the association of job demands assessed by Job-Exposure-Matrix (JEM) with the self-assessed impact of work on health survey wave 2020.

	Does your work affect your health?
Physical job demands (1-10)	1.22 * ** [1.17,1.26]
Psychosocial job demands (1-10)	1.22 * ** [1.16,1.28]
N	**1727**

* $p < 0.05$, * * $p < 0.01$, * ** $p < 0.001$. Estimates are based on separate logit models.

e-Table 5
Patterns of missing values (variables of the imputation model).

Wave 2010						
		Missing (n)	**Complete (n)**	**Total (n)**	**Min**	**Max**
Independent variables						
casminmother	Education mother	1607	13,410	15,017	9	18
casminfather	Education father	2199	12,818	15,017	9	18
migr	Migration background	59	14,958	15,017	0	1
hhold	Household composition	83	14,934	15,017	1	6
esteem	Self-esteem	1524	13,493	15,017	20	100
classrep	Number of grade repetitions	712	14,305	15,017	0	3
agey	Age in years	0	15,017	15,017	12	19
gender	Sex	0	15,017	15,017	1	2
area	Residential area	0	15,017	15,017	1	2
Auxiliary variables			15,017	15,017		
wellbeing	Personal well-being index	613	14,404	15,017	0	10
stratum	Stratum of the school sample (Hauptschule, Realschule, Gesamtschule, Gymnasium)	0	15,017	15,017	1	5
state	Current state (school, vocational training, university, work, unemployment, other)	0	15,017	15,017	1	7

(*continued on next page*)

e-Table 5 (*continued*)

Wave 2011					
		Missing (n)	Complete (n)	Total (n)	Min	Max
Outcome variables						
srhlth	Self-rated health	539	13,678	14,217	1	5
height	Body height	1028	13,189	14,217	1.2	2.1
weight	Body weight	2022	12,195	14,217	35	200
Independent variables						
casminmother	Education mother	29	14,188	14,217	9	18
casminfather	Education father	35	14,182	14,217	9	18
migr	Migration background	59	14,158	14,217	0	1
hhold	Household composition	108	14,109	14,217	1	6
classrep	Number of grade repetitions	650	13,567	14,217	0	3
sports	Physical inactivity	382	13,835	14,217	20	100
agey	Age in years	0	14,217	14,217	0	1
gender	Sex	0	14,217	14,217	1	2
area	Residential area	0	14,217	14,217	1	2
Auxiliary variables			14,217	14,217		
wellbeing	Personal well-being index	594	13,623	14,217	0	10
stratum	Stratum of the school sample (Hauptschule, Realschule, Gesamtschule, Gymnasium)	0	14,217	14,217	1	5
state	Current state (school, vocational training, university, work, unemployment, other)	0	14,217	14,217	1	7

e-Table 6
Descriptive statistics for variables of interest before and after imputation.

Wave 2010										
Variable	**Before imputation**					**After imputation**				
	Complete (n)	**Mean**	**SD**	**Min**	**Max**	**Complete (n)**	**Mean**	**SD**	**Min**	**Max**
casminmother	13,410	13.13	2.40	9	18	15,017	13.04	2.39	9	18
casminfather	12,818	13.25	2.55	9	18	15,017	13.12	2.53	9	18
migr	14,958	1.46	0.80	1	3	15,017	1.46	0.80	1	3
hhold	14,934	1.28	1.14	1	6	15,017	1.28	1.14	1	6
esteem	13,493	78.51	12.67	20	100	15,017	78.50	12.68	20	100
classrep	14,305	0.20	0.43	0	3	15,017	0.22	0.45	0	3
Wave 2011										
Variable	**Before imputation**					**After imputation**				
	Complete (n)	**Mean**	**SD**	**Min**	**Max**	**Complete (n)**	**Mean**	**SD**	**Min**	**Max**
srhlth	13,678	4.13	0.85	1	5	14,217	4.13	0.85	1	5
height	13,189	1.72	0.09	1.2	2.1	14,217	1.72	0.09	1.2	2.1
weight	12,195	62.17	13.06	35	200	14,217	62.09	12.96	35	200
casminmother	14,188	13.06	2.40	9	18	14,217	13.06	2.40	9	18
casminfather	14,182	13.15	2.53	9	18	14,217	13.15	2.53	9	18
migr	14,158	1.45	0.80	1	3	14,217	1.45	0.80	1	3
hhold	14,109	1.27	1.13	1	6	14,217	1.27	1.13	1	6
classrep	13,567	0.19	0.43	0	3	14,217	0.21	0.45	0	3
sports	13,835	0.15	0.36	0	1	14,217	0.15	0.36	0	1

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