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The impact of parental educational trajectories on their adult offspring's overweight/obesity status: A study of three generations of Swedish men and women

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ABSTRACT

The objective of this study was to investigate the impact of grandparental and parental education and parental educational trajectory on their adult offspring's overweight/obesity. We used register data from the Uppsala Birth Cohort Multigenerational Study, based on a representative cohort born in Sweden 1915–1929 (G1). Our sample included 5122 women and 11,204 men who were grandchildren of G1 (G3), their parents (G2), and grandparents. G3's overweight/obesity (BMI ≥25 kg/m^2) was based on pre-pregnancy weight/height for women before their first birth (average age = 26 years), and measured weight/height at conscription for men (average age = 18 years). G1's, G2's, and G3's highest educational attainment was obtained from routine registers and classified as low, intermediate, or high based on respective sample distributions. Parental (G2) educational trajectory was defined as change in education between their own and their highest educated parent (G1), classified into 5 categories: always advantaged (AA), upward trajectory (UT), stable–intermediate (SI), downward trajectory (DT), and always disadvantaged (AD). We used hierarchical gender-stratified logistic regression models adjusted for G3's age, education, year of BMI collection, lineage and G2's year of birth and income. Grandparental and parental education were negatively associated with men's odds of overweight/obesity and parental education affected women's overweight/obesity risk. Furthermore, men and women whose parents belonged to the UT, SI, DT, and AD groups had greater odds of overweight/obesity compared to men and women whose parents belonged to the AA group (adjusted for G3's age, year of BMI collection, lineage, and G2's year of birth). These associations were attenuated when further adjusting for parental income and G3's own education. Socioeconomic inequalities can have long-term consequences and impact the health of future generations. For overweight/obesity in concurrent young cohorts, this inequality is not fully offset by upward educational trajectory in their parent's generation.

1. Introduction

Rates of overweight and obesity have been increasing over time and Sweden is no exception (Kark and Rasmussen, 2005; Lissner et al., 2000; Neovius et al., 2006). Although the prevalence of obesity in Sweden is low (~12%) compared to other high-income countries, still 55% of men and 40% of women 16–84 years of age are either overweight or obese (Statistics Sweden, 2012).

Many studies have shown an inverse association between socioeconomic position (SEP) and obesity in high-income countries, particularly among women (Al-Emrani et al., 2013; Devaux and Sassi, 2013; Mackenbach et al., 2008; McLaren, 2007). Moreover, childhood circumstances have also been linked to adult obesity, with lower parental SEP being an important determinant of their offspring's higher obesity risk in adulthood (Brisbois et al., 2012; Lahmann et al., 2000; Senese et al., 2009). Parental and familial characteristics are presumed to have an impact on offspring's obesity status not only through shared genes, but also through shared environments that determine nutrition and physical activity patterns early in life, as well as through the interaction of both (Martin, 2008).

If a low SEP is associated with a higher risk of obesity, upward social mobility may decrease one's obesity risk as individuals have access to more resources and adapt to the norms, values and behaviors of the newly joined social group. On the other hand, joining a new social group may be detrimental to one's mental health as

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the individual may lose their original social networks and struggle with acceptance in the newly joined group (Lundberg, 1991), and psychological stress is positively associated with obesity (Moore and Cunningham, 2012). Previous research has shown that social mobility is associated with overweight and obesity, although results vary based on the measure of mobility used (occupation or education), gender, and lineage (whether mobility is assessed in relation to one's father or one's mother) (Ball and Mishra, 2006; Heraclides and Brunner, 2010; James et al., 2006; Krzyżanowska and Mascie-Taylor, 2011). These studies have focused on mobility within one's life (intragenerational mobility) or in comparison to parental characteristics (intergenerational mobility across two generations). Overall, their findings support the notion that upward mobility is beneficial in terms of a decreased obesity risk when compared to those who remain in the lowest social educational/occupational group, who usually have the highest obesity prevalence (Ball and Mishra, 2006; Krzyżanowska and Mascie-Taylor, 2011). However, the upwardly socially mobile tend to have increased obesity risk when compared to those who were always in the highest educational/occupational group (Heraclides and Brunner, 2010; James et al., 2006).

In addition to own and parental SEP, some grandparental characteristics have been linked to their grandchildren's overweight/obesity (OWOB) risk. Previous studies have found a positive association between grandparents' and their grandchildren's Body Mass Index (BMI) and OWOB status (Davis et al., 2008; Murrin et al., 2012). In addition, a recent U.S.-based study found lower grandparental educational attainment to be associated with increased obesity among their 25–55 year-old grandchildren (Le-Scherban et al., 2014) and a Swedish study found a negative association between grandfather's earnings and their grandson's BMI (Modin and Fritzell, 2009). To our knowledge, there are no published studies to date investigating the impact of intergenerational educational trajectories on overweight/obesity (OWOB) risk including the grandparents' generation.

The main goal of this study was to investigate the impact of grandparental and parental educational attainment, as well as parents' educational trajectory (with respect to their highest educated parent) on their adult offspring's OWOB. We also investigated to what extent such effects are likely to be mediated through parental income and/or offspring's own education. Understanding the combined effect of grandparental and parental education, with a focus on a hypothesized protective effect of upward educational trajectories in the parental generation in particular, is important for further elucidating the etiology of OWOB. Most importantly, such knowledge can also help to inform social and educational policies for reducing health inequalities in future generations.

2. Methods

2.1. Study population

We used data from the Uppsala Birth Cohort Multigenerational Study (UBCoS Multigen; http://www.chess.su.se/ubcosmg). The aim of UBCoS Multigen is to investigate life course and intergenerational determinants of social inequalities in health. UBCoS Multigen is based on data from a cohort of 14,192 males and females born in the Uppsala University Hospital (Uppsala, Sweden) between 1915 and 1929 (generation 1; G1). Data on G1 and their descendants were obtained from hospital and school archives, church parish records and routine registries (Swedish Multigenerational register, Education register, Census 1960–1990, Longitudinal integration database for health insurance and labor market studies (LISA), Conscript register, Medical Birth Register), with available data up to 2008–2010, including information on children, grandchildren and great-grandchildren of G1 (Koupil, 2007; Koupil and Goodman, 2011). Our sample is composed of 5122 women and 11,204 men belonging to G3 (grandchildren of G1) for whom valid anthropometric data (i.e. weight and height) was available (Fig. 1).

2.2. Data management

Our outcome variable was G3's OWOB, which was defined as having a BMI $\geq$25 kg/m^2. Women's pre-pregnancy weight and height data recorded during visits to antenatal care were obtained from the Medical Birth Register, which includes all women who have given birth in Sweden since 1973, with weight and height data available for births from 1982 onwards. We only included women's pre-pregnancy weight from their first pregnancy resulting into a live birth. Men's measured weight and height were obtained from the Conscript register. BMI values <15 or >50 were considered implausible and were eliminated.

Our independent variables of interest were grandparental (G1) educational attainment, parental (G2) educational attainment, and G2's educational trajectory with respect to their highest educated parent (G1). Parental educational attainment (G2) was available for both fathers and mothers of G3. However, given our prospective study design, grandparental (G1) educational attainment was available for only one set of G3's grandparents (i.e. for *either* G3's paternal grandfather and grandmother *or* G3's maternal grandfather and grandmother) in ~96% of the cases. Therefore, only one lineage was considered per G3 individual (G3's father's education and educational trajectory with respect to his highest educated parent *or* G3's mother's education and educational trajectory with respect to her highest educated parent). In the remaining cases were information was available for the 4 grandparents ($N = 951$), educational trajectory was assessed only through the father. Sensitivity analysis showed that choosing the maternal line instead would provide similar results. G1's, G2's, and G3's highest educational attainment ever recorded from 1960 to 2008 at age 19 or above was classified into low, intermediate, or high based on sample distributions (Table 1). Education data was available from the Census register in 1960, 1970, and then yearly from 1985 to 2008 from the Education register. G2's educational trajectories were then classified into 5 groups, as follows:

1) *always advantaged* – if both G1 and G2 had a "high" education
2) *upward trajectory* – if education for G1 = "low" and G2 = "intermediate", OR G1 = "low" and G2 = "high", OR G1 = "intermediate" and G2 = "high"
3) *stable – intermediate* – if both G1 and G2 had a "intermediate" education
4) *downward trajectory* – if education for G1 = "intermediate" and G2 = "low", OR G1 = "high" and G2 = "low", OR G1 = "high" and G2 = "intermediate"; and
5) *always disadvantaged* – if both G1 and G2 had a "low" education

We further analyzed two educational trajectory subgroups to closely examine those with upward trajectories, comparing: 1) the *always advantaged* versus those who transitioned from "low" to "high" or from "intermediate" to "high" (three groups end in "high"); and 2) the *always disadvantaged* versus those who transitioned from "low" to "intermediate" or from "low" to "high" (three groups start in "low").

Men and women included in our sample accounted for 58% of all men and 28% of all women in G3 (Fig. 1). Men from our cohort who attended conscription and were therefore included in this study were more educated than those who did not attend conscription and were not included in this study. On the other hand, women in