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Article

Decomposition of income-related inequality in upper secondary school completion in Sweden by mental health, family conditions and contextual characteristics

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ABSTRACT

Background: While previous research has evidently and extensively acknowledged socioeconomic gradients in children's education, we know very little about the determinants of socioeconomic-related inequality in children's education at the population level in Sweden. Therefore, we aimed: (i) to assess the extent of income inequality in upper secondary school completion in Sweden; (ii) to examine the contribution of mental health and other determinants to income inequality; and (iii) to explore gender differences in the magnitude and determinants of the inequalities.

Method: We utilised data from a population-based cohort available in Umeå SIMSAM Lab, linked with several national registries in Sweden. The dataset includes all children who were born in Sweden in 1991 and completed or not completed their upper secondary education in 2010, n = 116,812 (56,612 girls and 60,200 boys). We analysed the data using a Wagstaff-type decomposition method.

Results: The results first show substantial income-related inequality in upper secondary school incompletion concentrated among the poor in the Swedish setting. Second, these inequalities were in turn to a large degree explained jointly by parental, family and child factors; primarily parents' income and education, number of siblings and child's poor mental health. Third, these inferences remained when boys and girls were considered separately, although the determinants explained a greater share of the inequalities in boys than in girls.

Conclusion: Our results highlighted substantial income-related inequality in upper secondary school incompletion concentrated among the poor in the Swedish setting. Apart from family level characteristics, which explained a large portion of the inequalities, mental health problems appeared to be of particular importance as they represent a central target for both increasing the population average in upper secondary school completion and for reducing the gap in income-related inequalities in Sweden.

Introduction

Equality in education has been a major goal for Swedish education policy during the last century, but children's education is still markedly patterned by socioeconomic status (Swedish National Agency for Education, 2018). Sweden enjoys a comparatively high level of social equity in a global and European perspective (Esping-Andersen, 2015; Esping-Andersen & Cimentada, 2018) but in spite of heavy investment in education and modern welfare developments, inequalities re-emerge in every new generation and more importantly, they are now widening (Swedish National Agency for Education, 2018). While previous research has evidently and extensively acknowledged the socioeconomic gradients in children's education (European Commission, 2017; Grand, Szulkin, & Tåhlin, 2005; Pong & Ju, 2000; Sirin, 2005), we know very little about the determinants of socioeconomic-related inequality in children's education at the population level in Sweden.

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Completion of upper secondary school is considered one the most important aspects of educational achievement in Sweden, although it is voluntary but attended by almost all students. Upper secondary education provides a good foundation for work, further studies, personal development and active participation in the life of society (Selin & Tydén, 2003). Failure to achieve this will consequently have negative impacts on young people's self-esteem and employment in the labour market compared to those with an upper secondary education (Gustafsson et al., 2010; Murray, 1998).

Previous research has extensively addressed the effect of socio-demographic factors such as family and contextual characteristics on children's educational achievements (Andersson & Subramanian, 2006; Erikson & Rudolphi, 2010; Jaeger & Holm, 2007; Johnson, 2012). Although less considered, it has also been shown that poor health has a negative effect on school achievements (Bortes, Strandh, & Nilsson, 2018; Champaloux & Young, 2015; Forrest, Bevans, Riley, Crespo, & Louis, 2013; Maslow, Haydon, McRee, Ford, & Halpern, 2011). Research within the field is often limited to one specific health issue and lack of access to comprehensive data at the population level seems to be a major barrier. Mental health, though, appears to be profoundly influential in affecting children's education during compulsory school (Gustafsson et al., 2010), dropouts from high school (Brännlund, Strandh, & Nilsson, 2017) and their engagement in the labour market (Frijters, Johnston, & Shields, 2010). While there is evidence that poor health negatively contributes to average educational achievements, nothing is known about its contribution to socioeconomic (i.e. income-related) inequalities in educational achievement.

Income inequality is an essential measure of inequality and inequity characterising individuals in a society that often coincides with inequalities in health, education, housing, or political participation. Nonetheless, research on income inequality has predominantly focused on health inequalities and decomposition of their causes, particularly, following a Wagstaff-type methodology (O'Donnell et al., 2008) during the last decade. This methodology is helpful to disentangle how underlying factors explain inequalities. In this study, we attempt to expand the use of a Wagstaff-type methodology (O'Donnell et al., 2008) and Dahlgren and Whitehead's (2006) theoretical framework to study the determinants of income-related inequality in a different outcome, which is educational achievement.

We aimed: (i) to assess the extent of income inequality in upper secondary school completion in Sweden; (ii) to examine the contribution of mental health and other determinants to income inequality; and (iii) to explore gender differences in the magnitude and determinants of the inequalities.

Method

Data

We utilised data from Umeå SIMSAM Lab (Lindgren, Nilsson, de Luna, & Ivarsson, 2016), which is specifically designed to address questions relating to children's health and well-being from a life course perspective. It contains longitudinal register and census data that cover the entire Swedish population between 1960 and 2010, and micro-level information from a wide number of registers. We merged data from the Swedish Prescribed Drug Register for the years 2005–2009, which has also been used in several other studies (Brännlund et al., 2017; Hollander, Bruce, Burstrom, & Ekblad, 2011; Nordin, Dackehag, & Gerdtham, 2013; Wettermark et al., 2007), Medical Birth Register, National Patient Register and Statistics Sweden. We also merged data from the Swedish National Agency for Education's Pupil Register relating to grades and upper secondary school completion, which is available through a freely accessible database of public statistics, designed to serve as a follow-up system for preschool, school and adult education. In addition, publicly available data on tax capacity and social allowance were used at the municipal level.

Study sample

For the purpose of this study, we used data from the latest cohort available in the Umeå SIMSAM Lab (http://www.org.umu.se/simsam/), which included all children who were born in Sweden in 1991 and who had completed or not completed their upper secondary education in 2010, n = 116,812 (56,612 girls and 60,200 boys).

Outcome variable

Not completing upper secondary school was used as an outcome variable to assess children's educational achievements. Students were defined as not having completed upper secondary education if they are born in Sweden in 1991 and had not obtained a degree in 2010 at the age of 19, which was retrieved from the Swedish National Agency for Education's Pupil Register.

Socioeconomic indicator

We used mean parental disposable income accumulated across 10 years prior to the event (2010) as a proxy to capture the inequalities in socioeconomic status and living standard, obtained from Statistics Sweden. Disposable income is the amount of money available to be spent or saved as one wishes, after deduction of taxes and social security charges. To estimate income-related inequality in school achievements, a continuous form of income was used. In order to facilitate interpretation, income quintiles (poorest = first quintile to richest = fifth quintile) were also used as explanatory factors in the decomposition analysis.

Explanatory factors

Gender

A dichotomous variable of gender was considered, defining the children as either boys or girls.

Health indicators

Birth weight. All children were categorised into: (i) low weight, those who were less than 2500 g; (ii) normal weight between 2500 g and 4200 g; and (iii) high weight, more than 4200 g, obtained from Medical Birth Register.

Hospitalisation. Hospitalisation was defined by any visit to a hospital, regardless of the cause, that was registered in the Swedish National Patient Register 2005–2009 and contains all in-patient medical care events. Children with no hospitalisation were considered healthy compared to those who were hospitalised during this time, as obtained from the Swedish National Patient Register.

Child mental health. Data from the Swedish Prescribed Drug Register for the years 2005–2009 were used to assess children's health based on all the Anatomical Therapeutic Chemical Classification System (ATC-codes). We initially analysed all the ATC's drug registries. The contribution of almost all of these drug registries in the inequality were very close to zero, except for poor mental health. For that reason, we only included poor mental health in the final analysis. Poor mental health was defined based on ATC-codes N05 and N06. The ATC-code N05, psycholeptics, includes treatment of psychological disorder, bipolar disorder, anxiety and insomnia, and ATC-code N06 involves psychoanaleptics, which includes treatment of depression and attention deficit hyperactivity disorder (ADHD). Children with no prescription were considered healthy compared to those who have been prescribed for during the last five years.

Family characteristics

Family status. Children were categorised into two categories if: (i) living with both parents; and (ii) not living with both parents. Data were obtained from Statistics Sweden.

Parents' level of education. This was obtained from the longitudinal integration database for health insurance and labour market studies. The highest level of education obtained by any parent was categorised into: (i) compulsory; (ii) two years of upper secondary; (iii) three years of upper secondary; (iv) three years of university; and (v) more than three years of university. Data were obtained from Statistics Sweden.

Parents' country of birth. Children were categorised into three groups: (i) both parents born in Sweden; (ii) one parent born in Sweden; and (iii) none born in Sweden. Data were obtained from Statistics Sweden.

Parents' hospitalisation. Hospitalisation was defined by visits to a hospital that were registered in the Swedish National Patient Register during the last five years prior to 2010. This was measured separately for fathers and mothers. Those with no hospitalisation were considered healthy compared to those compared to those who were hospitalised during this time.

Parents' mental health. Data from the Swedish Prescribed Drug Register for the years 2005–2009 were used to assess parents' health based on ATC-codes N05 and N06. The ATC-code N05, psycholeptics, includes treatment of psychological disorder, bipolar disorder, anxiety and insomnia, and ATC-code N06 involves psychoanaleptics, which includes treatment of depression and ADHD. Parents with no prescription were considered healthy compared to those who have been prescribed for during the last five years prior to 2010.

Number of siblings. Children were categorised into four categories based on the number of siblings: (i) no sibling; (ii) one sibling; (iii) two siblings; and (iv) more than two siblings. Data were obtained from Statistics Sweden.

Municipal characteristics

Social allowance or income support. Income support is a form of financial assistance intended to act as a last-resort safety net for a person who has temporary financial problems and includes costs for food, clothes and hygiene. We used publicly available data from municipalities' resource allocation within compulsory schools on the amount of social allowance at the municipal level and categorised it into tertiles (lowest = the first tertile and highest = the third tertile).

Tax capacity. It describes the taxable income per inhabitant in the municipalities and is based on aggregated data from Statistics Sweden in 2018. The variable is a measure of the municipal tax base by representing the sum of municipal taxable income for physical persons categorised into tertiles (lowest = the first tertile and highest = the third tertile).

Statistics

Estimation of income inequality in drop outs

Two parameters were used to measure income inequality in drop outs: (i) concentration index (CI) and (ii) concentration curve (CC), using parents' mean income during the last ten years prior to 2010. The CI quantify the degree of socioeconomic-related inequality in an outcome variable which is defined as twice the area between the CC and the line of equality (the 450 line) and assumes values between −1 and + 1. Concentration Curve shows the cumulative percentage of drop outs (y axis) plotted against the cumulative percentage of the population, ranked by mean income (x axis) (O'Donnell, Doorslaer, Wagstaff, & Lindelow, 2008). A negative value of the C when the concentration curve lies above the line of equality means that drop outs are concentrated among people with low income. Conversely, a concentration curve below the line of equality indicates that drop outs are concentrated among people with high income. The CI would be zero if there is no socioeconomic-related inequality.

Decomposition of income inequality in drop outs

Wagstaff-type decomposition analysis of concentration indices was used to estimate the contribution of each factor or covariate to the observed income-related inequality in drop outs (O'Donnell et al., 2008). The decomposition of the CI is based on regression analysis (maximum-likelihood probit model in case of binary outcomes) of the relationship between an outcome variable and a set of determinants. CI can be decomposed into the contributions of individual factors to income-related inequality, in which each contribution is the product of the sensitivity of drop outs with respect to that factors and their degree of income-related inequality in that factor (O'Donnell et al., 2008). We reported both absolute contribution (expressed in the same unit as the CI) and relative contribution (percentage of the total CI) of each covariate to the observed income-related inequality in drop outs.

Results

General characteristics of the population

Table 1 shows that of all children born in 1991, 25.7% did not finish upper secondary school in 2010, more boys (28.2%) than girls (23.0%). In general, the frequency of not completing upper secondary school was higher among disadvantaged groups. For instance, there was a strong gradient across the quintiles of family income, where not completing upper secondary school was twice as common among those in the poorest quintile (38.6%) compared to the richest quintile (16.8%).

Income-related inequality in school completion

Fig. 1 provides a graphical illustration of the share of upper secondary school incompletion accounted for by a cumulative proportion of individuals in the population ranked from poorest to richest, separately for boys and girls. As indicated by the concentration curves (CC), located above the diagonal line of equality, boys and girls with lower family income had a greater proportion of incompletion of school than those with higher family income.

The CI, which quantifies the magnitude of the inequalities directly derived from the CC, amounted to −0.224 (SE = 0.004) for all children, and was of similar size in boys (−0.220, SE = 0.005) and girls (−0.228, SE = 0.006). The CI indicates a substantial and significant income gradient in school incompletion, to the disfavour of the poorer populations.

Determinants of income-related inequality in school completion

Decomposition analysis was conducted to study inequalities in individual, family and municipal level factors that generate income-related inequalities in school completion. Accordingly, coefficients (marginal effect) with their significance level, elasticity, CI, contribution to CI (absolute contribution) and percentage contribution to CI (relative contribution) were reported (Table 2). To facilitate interpretation, we graphed the three most important parameters of the decomposition analysis such as coefficient, CI and percentage of contribution (Fig. 2).

Fig. 2 displays the coefficients, the concentration indices (C) and relative contribution (%) of each determinant in the decomposition model, and Table 2 additionally reports the absolute contributions and the elasticity. Here, the coefficients are marginal effects that represent

Table 1
General characteristics of the population stratified based on completion of upper secondary school.

	TotalN (%)	CompletedN (%)	Not completedN (%)
Total	116,812 (100)	86,781 (74.3)	30,031 (25.7)
CHILD CHARACTERISTICS			
Gender			
Boys	60,200 (51.5)	43,204 (71.8)	16,996 (28.2)
Girls	56,612 (48.5)	43,577 (77.0)	13,035 (23.0)
Birth weight			
Low	4895 (4.2)	3340 (68.2)	1555 (31.8)
Normal	100,032 (86.2)	74,480 (74.5)	25,552 (25.5)
High	11,130 (9.6)	8432 (75.8)	2698 (24.2)
Hospitalisation			
No	94,720 (81.1)	72,961 (77.0)	21,759 (23.0)
Yes	22,092 (18.9)	13,820 (62.5)	8272 (37.5)
Poor mental health			
No	104,171 (89.2)	81,465 (78.2)	22,706 (21.8)
Yes	12,641 (10.8)	5316 (42.1)	7325 (57.9)
FAMILY CHARACTERISTICS			
Parents' country of birth			
Both Sweden	95,892 (82.1)	72,596 (75.7)	23,296 (24.3)
One Sweden	12,462 (10.7)	8514 (68.3)	3948 (31.7)
None Sweden	8458 (7.2)	5671 (67.1)	2787 (32.9)
Parents' poor mental health			
None	62,986 (53.9)	49,717 (78.9)	13,269 (21.1)
Mother	28,972 (24.8)	20,087 (69.3)	8885 (30.7)
Father	13,978 (12.0)	10,112 (72.3)	3866 (27.7)
Both	10,876 (9.3)	6865 (63.1)	4011 (36.9)
Parents' hospitalisation			
None	66,418 (56.9)	51,480 (77.5)	14,938 (22.5)
Mother	23,987 (20.5)	16,753 (69.8)	7234 (30.2)
Father	18,485 (15.8)	13,438 (72.7)	5047 (27.3)
Both	7922 (6.8)	5110 (64.5)	2812 (35.5)
Family type			
Living with both parents	68,885 (59.0)	53,921 (78.3)	14,964 (21.7)
Not living with both parents	47,927 (41.0)	32,860 (68.6)	15,067 (31.4)
Number of siblings			
None	4191 (3.6)	3154 (75.3)	1037 (24.7)
One	41,637 (35.6)	33,362 (80.1)	8275 (19.9)
Two	36,976 (31.7)	28,205 (76.3)	8771 (23.7)
Three and more	34,008 (29.1)	22,060 (64.9)	11,948 (35.1)
Parents' education			
More than three years of university	32,305 (27.7)	26,480 (82.0)	5825 (18.0)
Three years of university	22,031 (18.9)	17,597 (79.9)	4434 (20.1)
Three years of upper secondary	21,064 (18.1)	15,557 (73.9)	5507 (26.1)
Two years of upper secondary	35,904 (30.7)	24,201 (67.4)	11,703 (32.6)
Compulsory	5343 (4.6)	2859 (53.5)	2484 (46.5)
Parents' disposable income			
Richest (5th quintile)	24,702 (21.2)	20,558 (83.2)	4144 (16.8)
4th quintile	24,771 (21.2)	19,445 (78.5)	5326 (21.5)
3rd quintile	23,583 (20.2)	17,924 (76.0)	5659 (24.0)
2nd quintile	22,875 (19.5)	16,029 (70.1)	6846 (29.9)
Poorest (1st quintile)	20,881 (17.9)	12,825 (61.4)	8056 (38.6)
Municipal characteristics			
Tax capacity			
Highest (3rd quintile)	66,675 (57.1)	50,079 (75.1)	16,596 (24.9)
2nd quintile	32,149 (27.5)	23,731 (73.8)	8418 (26.2)
Lowest (1st quintile)	17,988 (15.4)	12,971 (72.1)	5017 (27.9)
Social allowance			
Highest (3rd quintile)	81,834 (70.1)	60,993 (74.5)	20,841 (25.5)
2nd quintile	22,444 (19.2)	16,547 (73.7)	5897 (26.3)
Lowest (1st quintile)	12,534 (10.7)	9241 (73.7)	3293 (26.3)

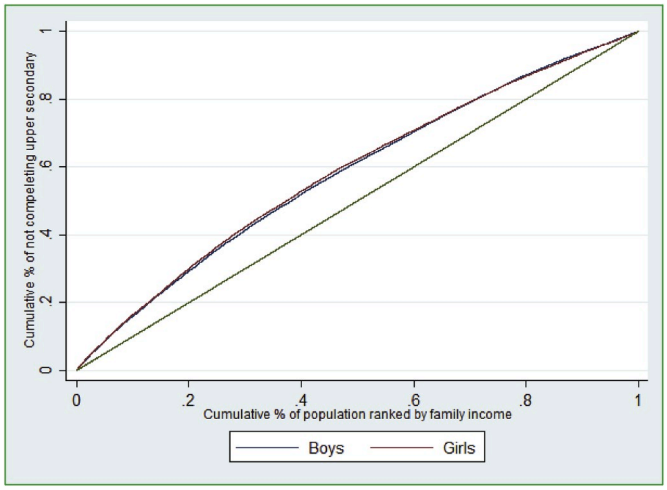

Fig. 1. Concentration curves for cumulative school completion by mean total family income for boys and girls.

the strength of the independent association between the factor and outcome, school incompletion, the concentration index and the income inequality of each factor, i.e. how the factor itself is distributed across income, interpreted analogously as the overall concentration index for school incompletion. The elasticity is the coefficient weighted for the frequency of the factor in question, with greater weight given to more frequent factors. The contribution of each factor to the overall inequality in school incompletion is the product of the elasticity and the concentration index of each factor, either expressed in absolute terms or as a relative percentage of the overall inequality. As such, for a factor to make a substantial contribution to overall inequality, it needs to be both sufficiently strongly related to school incompletion, as well as unequally distributed with respect to income (and of sufficient frequency).

Poor mental health was the factor most strongly related to school incompletion (coefficient = 0.326), was also decidedly concentrated among the poor (CI = −0.096) (Fig. 2) and was also fairly common (present among 10.8% of the population, Table 1). Together, this resulted in a notable contribution to the overall income inequalities in school incompletion (5.9%). To illustrate a contrasting example, having no Swedish parents was about as common as poor mental health (7.2%,

Table 2
Summary of results of decomposition analyses, for all, boys and girls separately.

	ALL					BOYS					GIRLS				
	Coeff	Elast	CI	Cont to C	% Cont	Coeff	Elast	CI	Cont to C	% Cont	Coeff	Elast	CI	Cont to C	% Cont
CHILD CHARACTERISTICS															
Boys															
Girls	-0,075	-0,142	0002	0,000	0,13										
Normal birth weight															
Low birth weight	0,039	0006	-0,047	0000	0,13	0,043	0007	-0,047	0000	0,15	0,036	0006	-0,047	0000	0,12
High birth weight	-0,015	-0,005	0044	0,000	0,10	-0,018	-0,007	0044	0,000	0,14	-0,008	-0,003	0044	0,000	0,06
No hospitalisation															
Hospitalisation	0,085	0063	-0,051	-0,003	1,43	0,064	0047	-0,051	-0,002	1,09	0,105	0078	-0,051	-0,004	1,74
Good mental health															
Poor mental health	0,326	0137	-0,096	-0,013	5,87	0,364	0153	-0,096	-0,015	6,68	0,287	0121	-0,096	-0,012	5,09
FAMILY CHARACTERISTICS															
Both Swedish parents															
One Swedish parent	0,037	0015	-0,139	-0,002	0,93	0,023	0010	-0,139	-0,001	0,63	0,050	0021	-0,139	-0,003	1,28
No Swedish parent	-0,002	-0,001	-0,546	0001	-0,24	0,007	0002	-0,546	-0,001	0,50	-0,012	-0,003	-0,546	0002	-0,72
Both parents' good mental health															
Mother poor mental health	0,043	0042	-0,045	-0,002	0,84	0,043	0041	-0,045	-0,002	0,84	0,043	0042	-0,045	-0,002	0,83
Father poor mental health	0,029	0014	-0,046	-0,001	0,29	0,027	0012	-0,046	-0,001	0,25	0,031	0014	-0,046	-0,001	0,28
Both parents' poor mental health	0,070	0026	-0,133	-0,003	1,54	0,069	0025	-0,133	-0,003	1,51	0,071	0026	-0,133	-0,003	1,52
Living with both parents															
Not living with both parents	0,047	0075	-0,094	-0,007	3,15	0,058	0092	-0,094	-0,009	3,93	0,035	0056	-0,094	-0,005	2,31
No sibling															
One sibling	-0,014	-0,019	0113	-0,002	0,96	-0,017	-0,024	0113	-0,003	1,23	-0,010	-0,014	0113	-0,002	0,69
Two siblings	0,017	0021	0,039	0001	-0,37	0,012	0014	0,039	0001	-0,25	0,023	0028	0,039	0001	-0,48
More than two siblings	0,080	0090	-0,179	-0,016	7,19	0,077	0087	-0,179	-0,016	7,08	0,082	0093	-0,179	-0,017	7,30
More than three yours University															
Less than three years University	0,018	0013	0,111	0001	-0,64	0,023	0017	0,111	0002	-0,86	0,013	0009	0,111	0001	-0,44
Three years upper secondary	0,066	0046	-0,074	-0,003	1,52	0,074	0052	-0,074	-0,004	1,75	0,056	0039	-0,074	-0,003	1,27
Two years upper secondary	0,112	0134	-0,169	-0,023	10,11	0,127	0153	-0,169	-0,026	11,75	0,094	0112	-0,169	-0,019	8,30
Compulsory	0,200	0036	-0,459	-0,017	7,38	0,206	0037	-0,459	-0,017	7,72	0,190	0034	-0,459	-0,016	6,84
5th income quintile (richest)															
4th income quintile	0,025	0021	0,365	0008	-3,42	0,037	0031	0,365	0011	-5,14	0,013	0010	0,365	0004	-1,60
3rd income quintile	0,034	0027	-0,049	-0,001	0,59	0,045	0035	-0,049	-0,002	0,78	0,023	0018	-0,049	-0,001	0,39
2nd income quintile	0,073	0055	-0,447	-0,025	10,98	0,083	0063	-0,447	-0,028	12,80	0,061	0046	-0,447	-0,021	9,02
1st income quintile (poorest)	0,121	0084	-0,821	-0,069	30,79	0,137	0096	-0,821	-0,079	35,83	0,103	0071	-0,821	-0,058	25,57
MUNICIPAL CHARACTERISTICS															
3rd tax capacity tertile															
2nd tax capacity tertile	-0,007	-0,008	-0,066	0001	-0,24	-0,006	-0,007	-0,066	0000	-0,21	-0,008	-0,009	-0,066	0001	-0,26
1st tax capacity tertile (lowest)	-0,005	-0,003	-0,159	0000	-0,21	-0,009	-0,006	-0,159	0001	-0,43	-0,001	-0,001	-0,159	0000	-0,07
3rd social allowance tertile															
2nd social allowance tertile	0,004	0003	-0,016	0000	0,02	0,001	0001	-0,016	0000	0,01	0,007	0005	-0,016	0000	0,04
1st social allowance tertile (lowest)	0,008	0003	-0,036	0000	0,05	0,001	0000	-0,036	0000	0,00	0,016	0007	-0,036	0000	0,11
Total inequality (CI)				-0,224					-0,220					-0,228	
Residuals				-0,047					-0,027					-0,070	
Total inequality unexplained (%)				-0,047	21,13				-0,027	12,23				-0,070	30,80
Total inequality explained (%)				-0,177	78,87				-0,193	87,77				-0,158	69,20

Coeff. Marginal effects from the probit model.

Table 1), and was extremely concentrated among the poor (CI = −0.55). However, since this factor was not independently related to school incompletion (coefficient = −0.002), its contribution to the overall inequality amounted to zero (−0.2%) (Fig. 2).

In general, from 78.87% of total inequality explained jointly by all factors (Table 2, Fig. 2), the contribution of child characteristics was 7.7%, family characteristics was 71.7%. Family characteristics such as parents' low income (first quintile (30.8%) and second quintile (11.0%)), low education (two years upper secondary (10.1%) and compulsory (7.4%)) and having more than two siblings (7.2%)

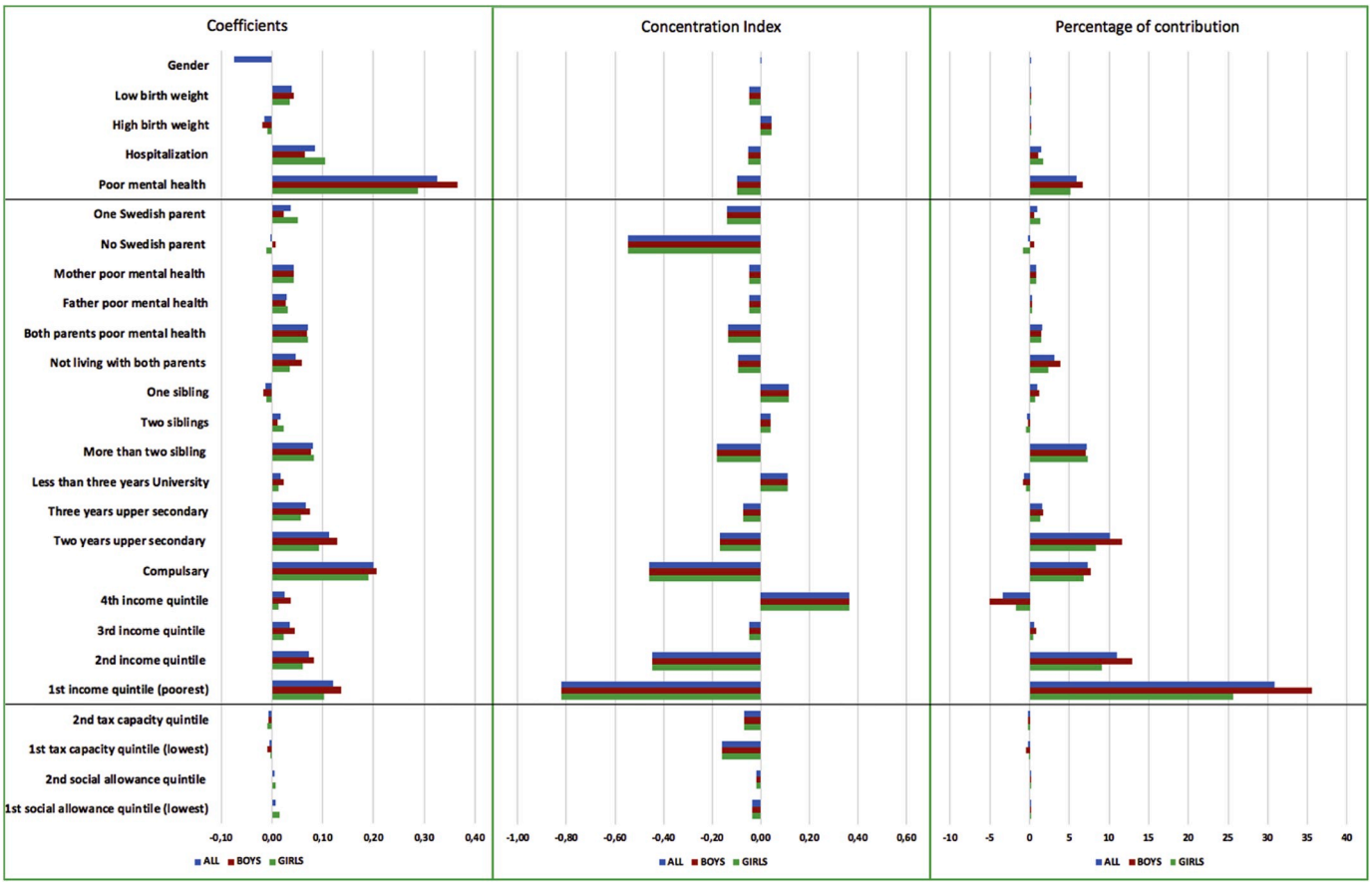

Fig. 2. Coefficients (marginal effects), Concentration index (CI), and Percentage contribution of individual, family, and municipal level factors in income-related inequalities in school completion derived from decomposition analysis.

contributed most to the inequality. As indicated by coefficients and concentration indices, all these factors were significantly associated with upper secondary school incompletion and considerably concentrated among the poor. The remaining factors made small to no contributions to the overall concentration index.

Overall assessment of the model

The residuals presented in Table 2 indicate the non-explained part of income-related inequality in school incompletion. The small residual values of −0.047 for all, −0.027 for boys and −0.070 for girls show the explanatory strengths of the decomposition models. Overall, the social determinants included in this study jointly explained a considerable part of the observed inequalities (78.87% for all, 87.77% for boys and 69.20% for girls) (Table 2). This means that if children with lower family income were identical in endowment of observed characteristics to the children with higher family income, a very large proportion of the observed gap in income-related inequality in upper secondary school incompletion would disappear.

Discussion

The main findings

One interesting finding in our study was the contribution of poor mental health in income-related inequality in school completion. As we mentioned in the introduction, decomposition analyses are mainly applied to health-related outcomes. In turn, our study showed that poor health itself can contribute greatly in explaining socioeconomic inequalities in other outcomes of interest including school achievement.

In sum, our study is among the very few that addressed socioeconomic inequality in educational achievements by decomposition analysis. The results first show substantial income-related inequality in upper secondary school incompletion concentrated among the poor in the Swedish setting. Second, these inequalities were in turn to a large degree explained jointly by parental, family and child factors; primarily parents' income and education, number of siblings and child's poor mental health. Third, these inferences remained when boys and girls were considered separately, although the determinants explained a greater share of the inequalities for boys than girls.

General discussion

Despite the widening gap in educational achievement between rich and poor (European Commission, 2017), very few studies attempt to explain the gap in socioeconomic factors using decomposition analysis. This methodology is grounded in a theoretical framework which defines systematic differences in determinants of health status between socioeconomic groups known as the 'determinants of social inequities in health' (Dahlgren & Whitehead, 2006). However, the determinants of overall population health have often been mixed up with the determinants of social inequities in health and treated the same for policy considerations (Dahlgren & Whitehead, 2006). Knowledge of the social determinants of health is important to improve overall population health, but not sufficient for identifying and analysing the determinants of social inequalities in health. Among the very few studies that applied a similar approach to educational outcome is a study by Sandra Nieto and Raul Ramos in 2015 using data from the Programme for International Student Assessment (PISA) (Nieto & Ramos, 2015). They analysed the factors that explain the gap in educational outcomes between the top

and bottom quartiles of the Economic, Social and Cultural Status index. Focusing mainly on school characteristics, their model could explain almost half of the observed inequalities. In addition, a 2011 study – working paper, not peer-reviewed – using Wagstaff-type decomposition analysis showed that income inequalities in education emerge in all PISA countries (including Sweden) and in both periods, but decreased in Germany (Oppedisano & Turati, 2015). Covering a wide range of determinants from childhood (especially inclusion of their health characteristics from birth) to family and municipal level, our model was capable of explaining a great deal (about 80%) of income-related inequality in upper secondary school incompletion in Sweden.

The large income-related inequalities in school completion have significant implications and go against the goals of Swedish educational policies which struggle to bring equality for all. Therefore, the future outlook for equitable and positive child development in Sweden – with regard to both health (Lundberg, 2018) and education (Björklund et al., 2003) – appears particularly challenging while society as a whole is facing increasing social inequalities. Considering the formative influence of early educational failure for later life circumstances – for instance, its negative impacts on young people's self-esteem and employment – the inequalities we observed might act as roots for enduring social inequalities across the life course, and thus, for health inequalities as well. Children's health and living conditions affect their education and inequalities in their educational attainment accounts for differences in income, employment status and health outcomes when they become adults. The inequalities in adulthood conditions, in turn, account for the health of their own children, emphasising the importance of intergenerational transmission of inequalities (Suhrcke & de Paz Nieves, 2011). The fact that the largest part of inequalities in our study were explained by social inequality themselves, i.e. parents' income and education, reinforces intergenerational 'social inheritance' when it comes to socioeconomic prospects.

Previous studies in Sweden and internationally have documented robust links between truncated education and mental disorders or social and emotional problems. Our study, however, revealed the importance of mental health not only for school completion rate but also for explaining income inequalities which has not been previously addressed. Therefore, it represents a central target for both increasing the population average in upper secondary school completion and for reducing the gap in income-related inequalities in Sweden. According to the Swedish National Board of Health and Welfare in 2013, mental health problems such as depression, anxiety, personality disorder and drug dependence have progressively increased among young people in recent decades which poses a growing public health problem. These negative changes in youth mental health corresponded to a significant decrease in children's school achievements in Sweden. For instance, in 2015 one in four had dropped out or failed to complete their education in upper secondary school compared with 2012 when 98% of all youths entered upper secondary right after completing their compulsory schooling (Swedish National Agency for Education, 2015). However, the causal link between poor mental health and poor educational achievements needs further investigation to avoid the issue of reverse causality. In conjunction with the Psychiatry Reform in 1995, much of the responsibility for following up people with mental health issues was reassigned to the municipalities that work together with the county councils, the Public Health Insurance Agency of Sweden and the Public Employment Service to rehabilitate people with mental health problems (Murray, 1998). However, early identification of mental health problems within primary health services, which provides the first line of psychiatry services, may play a significant role among preschool children, before it becomes a bigger problem in older ages (Sommer, 2016). In addition to that, school and pupil health services are particularly important as these services are the points of contacts when getting help with mental health for Swedish young people.

The negative contribution of number of siblings (more than two siblings) and its contribution to income-related inequality could be expected because intrafamilial resources such as time, energy, money, etc. are concentrated in smaller families and diluted in larger ones as sibship size increases. This can refer to recourse dilution theory, when bigger is not necessarily better (Blake, 1989; Downey, 2001). Therefore, it is possible that parents in smaller families can provide more concentration, attention and interaction per child, which in turn affects their children's intellectual quotient. Other factors that may play a big role here are the birth order or health of the siblings which requires further investigation in this context.

Municipalities are also the key administrative level for educational policies, as the vast majority of schools in Sweden are municipally run. Despite all the efforts from the Swedish Education Act that all children and youths have, in principle, equal access to education, regardless of gender, location or social or economic factors (Marmot, 2005), still, there are geographical variations in children's school achievements (Johnson, 2012). It has been shown that municipal level factors (i.e. social allowance) greatly contribute and explain the geographical differences in school achievements (Andersson & Subramanian, 2006). In regard to upper secondary school completion, however, our study showed that municipal level characteristics such as tax capacity and social allowance neither contributed to the population average nor explained the socioeconomic inequalities. Further research on contextual level factors and socioeconomic inequalities in school achievement are needed to investigate when, how and for which educational outcomes context may play a bigger role. In addition, some statistical considerations maybe taken into account such as over adjustments of individual level factors or modifiable area unit problems.

Methodological considerations

One major strength in your study was the use of big, rich and high-quality data which covered the entire population of students in Sweden in 2010. The combination of data from many different legitimate sources provided us with a unique opportunity to study the issue of school completion from very different perspectives. However, our study had some limitations that need to be acknowledged. In this analysis, we did not differentiate between those who attended upper secondary school and failed to complete, and those who did not attend upper secondary school after finishing compulsory schooling. This will not alter the results, as almost all students attend upper secondary school in Sweden. In addition, our findings (i.e. the association between mental health and school completion) were in line with another study on the same data that made such a distinction on the outcome variable (Brännlund et al., 2017). We did not take drug dosage and frequency into consideration when defining mental health. Therefore, those who received a low-dosage drug prescription only once are in the same category as those who received multiple high-dosage drug prescriptions. This may result in an underestimation of the association between mental health and school incompletion among high risk groups. At the same time, reliance on drug prescriptions means those who have health problem symptoms but are not on medication are not included, simply because the data rely on registry information. Although, this can be considered as a limitation, as the vast majority of disorders do not come to clinical attention and are not treated. In addition, we did not investigate the causal link between mental health and school completion in this analysis as it was not our initial aim. Thus, any causal interpretation of the results should be with great care, as it is possible that children's mental health itself is affected by poor educational achievement or failure in school. It is also possible that children's familial and contextual characteristics affect both their mental health and educational achievements, making any obvious causal relationship between the two spurious. Furthermore, school characteristics were not included in our analysis. Yet, we tried to make use of school level characteristics publicly available at the municipal level. However, this information is only available for public schools. Had we included school level factors, we probably would have been able to explain more of the observed

income-related inequality in school completion in our analysis.

Conclusion

Our results highlighted substantial family income-related inequality in children's upper secondary school incompletion concentrated among the poor in the Swedish setting. Apart from some family level characteristics (i.e. number of siblings, parents' income and education) which explained a large portion of the inequalities, mental health problems appeared to be of particular importance as they represent a central target for both increasing the population average in upper secondary school completion and for reducing the gap in income-related inequalities in Sweden.

Ethics approval

The Regional Ethical Vetting Board in Umeå approved all research based on data from the Umeå SIMSAM Lab, including the present study.

Data availability statement

Our data analysis is based on a record linked register database available at the Umeå SIMSAM Laboratory at Umeå University, Sweden. The database is built as a combination of different population-based registers linked through Swedish personal numbers and was compiled in collaboration with different Swedish authorities. Both the approval from the Ethical vetting board and the contracts we have signed with the Swedish authorities do not allow us to give away the data to a third party. The data can however be accessed by any researchers wanting to replicate the analysis, although this can be done only locally at the Umeå SIMSAM Laboratory where the data is stored on servers disconnected from the internet. Contact information: http://www.org.umu.se/simsam/english/about-us/contact-information/Specific contact for arranging data access: jenny. haggstrom@umu.se.

Declaration of competing interestCOI

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

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2020.100566.

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