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Published online: 15 Oct 2017.

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How socioeconomic circumstances, school achievement and reserve capacity in adolescence predict adult education level: a three-generation study in Finland

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ABSTRACT

Family socioeconomic circumstances directly influence adult education level. Adolescent psychosocial resources and health-promoting behaviour collectively termed as 'reserve capacity' and school achievement may likely mediate the effect of family socioeconomic circumstances on adult education level. We tested these relationships using 1985–1995 survey data on 12–18-year-old Finns ($N = 41,822$) linked with three-generation registry data of Statistics Finland until 2009. Results of the multinomial logistic regression models, adjusted for sex and age at end of follow-up, showed that socioeconomic circumstances of parents and grandparents predicted adult education level. School achievement and reserve capacity dimensions of perceived health, health-promoting behaviour and social support in adolescence also positively predicted adult education. Moreover, these tended to decrease the effect of family socioeconomic circumstances on educational level. Our findings suggest that formulating interventions which build reserve capacity and improve school performance, especially among adolescents from disadvantaged socioeconomic backgrounds, could likely reduce educational inequalities.

Introduction

Education is a strong predictor of health (Freudenberg & Ruglis, 2007; Liu & Hummer, 2008). Studies have robustly shown that a low educational attainment is associated with poorer health outcomes (Fergusson, Horwood, & Boden, 2008; Matthews & Gallo, 2011) and shorter life expectancies (Mackenbach et al., 2015; Spittel, Riley, & Kaplan, 2015). Additionally, education predicts an individual's future occupational prospects and earning capacities (Adler & Newman, 2002; Matthews & Gallo, 2011) and influences one's life-course opportunities, including those of the offspring (Fergusson et al., 2008). It is commonly used as an indicator of socioeconomic status (SES) and recognized as a key marker of success in adulthood (Slominski, Sameroff, Rosenblum, & Kasser, 2011). Thus, one of the goals included in the 2030 Agenda for Sustainable Development by multilateral groups in partnership with the United Nations, is universal access to education at all levels (United Nations, n.d.).

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Evidence points to socioeconomic circumstances of the family as largely shaping the mechanisms and processes of an individual's educational attainment (Conger, Conger, & Martin, 2010; Fergusson et al., 2008; Koivusilta, West, Saaristo, Nummi, & Rimpelä, 2013; Merritt & Buboltz, 2015; Slominski et al., 2011). The socioeconomic circumstances of the family determine available resources for investments in the human capital formation of children, such as health and education (Bird, 2007), and also the transfer of these resources from one generation to another (Albertini & Radl, 2012). Hence, even in high income countries, children born in low SES families have higher risk of educational failure and underachievement (Fergusson et al., 2008). They also have increased tendencies to acquire low SES in adulthood (Matthews, Gallo, & Taylor, 2010).

Aside from family SES, cognitive ability, usually measured through academic competence or school achievement, strongly determines educational attainment in adulthood. Good grades obtained in secondary school were strong predictors of enrolment in higher education (Brekke, 2015). Even grades obtained early in elementary school had predicted adult educational attainment (Entwisle, Alexander, & Olson, 2005). Academic competence incites higher academic aspirations and enables one to meet the rigors of post-secondary education (Merritt & Buboltz, 2015).

A low SES family background is the earliest exposure and risk factor for having less education and low adult SES in the life-course perspective (Kuh, Ben-Shlomo, Lynch, Hallqvist, & Power, 2003). Adolescence follows this early life environment and further shapes psychosocial development, (Kroenke, 2008) which is a potential pathway for adult educational outcomes (Murasko, 2007). Researchers found that low SES families who provided psychosocial resources through cognitive and emotional support raised resilient children who succeeded academically (Merritt & Buboltz, 2015) and functioned well in life compared to their low SES counterparts without such resources (Kroenke, 2008). These psychosocial resources were integrated as the concept of reserve capacity and include interpersonal resources such as social support and integration and intrapersonal characteristics such as self-efficacy, mastery or a sense of perceived control (Gallo, Espinosa de los Monteros, & Shivpuri, 2009; Gallo & Matthews, 2003; Matthews & Gallo, 2011; Matthews et al., 2010). It was proposed that individuals with high reserve capacity gain the coping skills necessary to attain higher education while those with low reserve capacity may lack these skills and attain lower education (Matthews et al., 2010). Such a mechanism raises the question of how reserve capacity can mediate the effect of family SES on future educational attainment. We further extend the reserve capacity framework to include dental brushing behaviour and physical activity as these have been shown to improve with high self-efficacy (Cinar, Tseveenjav, & Murtomaa, 2009; Pakpour & Sniehotta, 2012; Robbins, Pender, Ronis, Kazanis, & Pis, 2004). Our study, therefore, focuses on three dimensions of reserve capacity: perceived health, health-promoting behaviour and social support.

While most empirical data dealt with transmission of SES from parents to offspring, recent findings have demonstrated that grandparents' occupational class could be transmitted to grandchildren (Chan & Boliver, 2013; Erola & Moisio, 2007) and that other capital of grandparents could influence their grandchildren's educational success (Møllegaard & Jæger, 2015). This implies that transmission of low education across generations of families could perpetuate a cycle of socioeconomic disadvantage. In order to break this, it is important to elucidate the origin of inequalities in education and understand the processes which create these. It is in this perspective that we aim to investigate if the effect of family SES on adult education level persists across three generations, implying that educational inequalities may have originated from socioeconomic circumstances of grandparents. Moreover, we want to determine how reserve capacity and school achievement in adolescence modify the associations between family socioeconomic circumstances and adult education level.

Methods

Study design

A longitudinal study design was constructed using two data sources linked through unique national personal identification numbers. Baseline data were obtained from the Adolescent Health and Lifestyle

Surveys (AHLS) of 1985, 1987, 1991, 1993 and 1995. The AHLS, conducted biennially since 1977, monitors the health and health-related lifestyle of adolescents in Finland. Nationally representative samples of 12-, 14-, 16-, and 18-year-old Finns born on certain days in June, July and August were drawn each study year from the Population Register Centre. Variables measured across all survey rounds were used. A self-administered questionnaire was sent in February, followed by two re-inquiries to non-respondents. Eligible data from 41,822 adolescents (79.2% response rate) were included. Response rates by sex and age groups were as follows: 72.4% in boys ($n = 19,504$), 86.3% in girls ($n = 22,318$), at least 80% in adolescents aged 12 years ($n = 3,948$), 14 years (12,583) and 16 years ($n = 13,582$), respectively and 75.4% in those aged 18 years ($n = 11,709$).

Follow-up data were obtained from registries of Statistics Finland, which contained socioeconomic information for the AHLS participants, their parents and grandparents. The data from Statistics Finland covered censuses every fifth year from 1970 to 1995 and yearly registry data from 2000 until the end of 2009. Follow-up started on 30 April, each survey year, and ended on 31 December 2009. At the end of the follow-up, the participants' ages ranged from 27 to 43 years.

Statistics Finland had constructed family formation data to link generations. In the earlier censuses, children (parents in this study) who were no longer living with their parents (grandparents in this study) during the time of the census could not be linked to their families, which explains the large number of grandchildren with unknown data for grandparents (Table 1). Part of the missing information is due to the late digitalization of the censuses (from 1970 onwards). The proportion of adolescents with unknown grandparents' data by adult education level was similar to those of adolescents whose grandparents had low education and rented dwellings. In terms of other variables, the pattern of distribution found in adolescents with unknown grandparents followed the distributions obtained in the total population. Further analyses were made to assess the effect of including this group in our study (Appendix 1).

Statistics Finland performed the data linkage according to a contract specifying the rights and duties of both parties. The Institutional Review Board of Statistics Finland and the Data Protection Ombudsman approved the study protocol. Identification of the study participants was withheld from the investigators.

Outcome variable

Adult education level
The adolescent's highest educational level was used and grouped according to years of schooling: low (9 years or less), middle (10–12 years), and high education (>12 years).

Predictor variables

Several indicators of family socioeconomic circumstances were used. All parents' and grandparents' data were obtained nearest to the year when the adolescent was aged 15 years. Parental data obtained more than five years away from the child's 15th birthday and data from those whose parents died before the AHLS year were considered missing to ensure that only parental influences within adolescence were measured.

Education level of father, mother, maternal and paternal grandparents
Education levels of parents and grandparents were categorized in the same way as that of the adolescents'. Data on grandfather and grandmother from either maternal or paternal side were combined. Where both grandparents existed and information was different, the one with the higher category was used. In case of missing data from one grandparent, the available information from the other grandparent was used.

Table 1. Distribution of family socioeconomic circumstances, school achievement and reserve capacity variables in adolescence according to education level in adulthood.

Family socioeconomic circumstances, school achievement and reserve capacity in adolescence			Education level in adulthood				
			Total population $N = 41,822$		Low $n = 3801$	Middle $n = 23,073$	High $n = 14,948$
			No.	%	Row %	Row %	Row %
Family variables							
Education	Father	Low	17,212	41.2	12.0	62.2	25.8
		Middle	18,481	44.2	7.7	55.2	37.1
		High	5500	13.1	3.3	32.4	64.3
		Missing	629	1.5	18.4	63.0	18.6
	Mother	Low	16,186	38.7	12.5	63.0	24.5
		Middle	22,121	52.9	7.5	53.1	39.4
		High	3483	8.3	3.4	31.5	65.1
		Missing	32	.1	31.3	53.1	15.6
	Paternal grandparents	Low	18,643	44.6	8.4	55.8	35.8
		Middle	3969	9.5	7.1	48.1	44.8
		High	1070	2.5	4.6	37.2	58.2
		Unknown	18,140	43.4	10.5	57.1	32.4
	Maternal grandparents	Low	19,144	45.8	8.4	56.1	35.5
		Middle	4324	10.3	7.6	48.4	44.0
		High	938	2.3	4.5	36.0	59.5
		Unknown	17,416	41.6	10.4	56.9	32.7
Dwelling ownership	Father	Rented	5972	14.3	16.9	60.1	23.0
		Owner-occupied	32,711	78.2	7.2	53.7	39.1
		Missing	3139	7.5	14.1	60.7	25.2
	Mother	Rented	7052	16.9	17.6	60.4	22.0
		Owner-occupied	33,659	80.4	7.1	53.9	39.0
		Missing	1111	2.7	14.1	60.7	25.2
	Paternal grandparents	Rented	3364	8.0	10.5	56.4	33.1
		Owner-occupied	19,302	46.2	7.5	53.2	39.3
		Unknown	19,156	45.8	10.4	67.0	32.6
	Maternal grandparents	Rented	3554	8.5	11.6	58.2	30.2
		Owner-occupied	19,975	47.8	7.5	53.2	39.3
		Unknown	18,293	43.7	10.4	56.7	32.9
Employment status	Father	Unemployed	4430	10.6	13.1	60.8	26.1
		Employed	35,076	83.9	8.2	54.1	37.7
		Missing	2316	5.5	14.9	60.4	24.7
	Mother	Unemployed	4923	11.8	13.9	58.3	27.8
		Employed	36,415	87.0	8.4	54.6	37.0
		Missing	484	1.2	14.5	62.0	23.5
Adolescence variables							
School achievement		Low	19,533	46.7	15.8	68.2	16.0
		Average	13,152	31.4	3.9	51.8	44.3
		High	8697	20.8	1.3	30.5	68.2
		Missing	440	1.1	24.1	62.0	13.9
Reserve capacity							
Perceived health	Chronic disease	Yes	3905	9.3	11.8	54.8	33.4
		No	37,917	90.7	8.8	55.2	36.0
	Perceived stress symptoms	4–8/week	5100	12.2	12.3	55.4	32.3
		2–3/week	10,376	24.8	9.4	53.7	36.9
		1/week	9308	22.3	8.5	54.8	36.7
		None	17,038	40.7	8.2	56.2	35.6
	Self-rated health	Poor	785	1.9	16.3	54.9	28.8
		Average or good	27,198	65.0	9.3	55.8	34.9
		Very good	13,695	32.8	8.3	53.8	37.9
		Missing	144	.3	13.9	55.5	30.6

(*Continued*)

Table 1. (*Continued*).

Family socioeconomic circumstances, school achievement and reserve capacity in adolescence			Education level in adulthood				
			Total population N = 41,822		Low n = 3801	Middle n = 23,073	High n = 14,948
			No.	%	Row %	Row %	Row %
Health-promoting behaviour	Physical activity	Does not exercise	8169	19.5	13.6	60.8	25.6
		Occasional/low efficient exerciser	11,868	28.4	8.7	57.0	34.3
		Active efficient exerciser	12,639	30.2	7.9	52.8	39.3
		Very active efficient exerciser	9040	21.6	7.0	51.1	41.9
		Missing	106	.3	22.6	51.9	25.5
	Regular tooth brushing	<1–5 times/week	7443	17.8	17.6	62.9	19.5
		About once/day	19,421	46.4	8.3	56.5	35.2
		Several times/day	14,807	35.4	5.8	49.5	44.7
		Missing	151	.4	13.9	60.9	25.2
Social support	Nuclear family	No	9192	22.0	15.6	59.0	25.4
		Yes	32,398	77.5	7.2	54.0	38.8
		Missing	232	.5	17.7	59.0	23.3
	Talking about issues to father	Difficult/No father	22,363	53.5	9.3	54.8	35.9
		Easy	18,572	44.4	8.4	55.3	36.3
		Missing	887	2.1	17.6	62.6	19.8
	Talking about issues to mother	Difficult/No mother	11,384	27.2	10.1	55.2	34.7
		Easy	29,930	71.6	8.5	55.1	36.4
		Missing	508	1.2	18.3	59.5	22.2
	Talking about issues to friends	Difficult/No friends	6379	15.2	10.1	55.2	35.7
		Easy	34,833	83.3	8.7	55.1	36.2
		Missing	610	1.5	17.5	60.7	21.8

Dwelling ownership of father, mother, maternal and paternal grandparents
Dwelling ownership was classified as either owner-occupied (owned a house or had shares in the housing unit) or rented (living in a rented apartment).

Employment status of father and mother
Employment status was based on the indicated response (employed, unemployed, unknown) about one's main activity. The category 'unemployed' also included those who had at least one month of unemployment during the preceding twelve months of the census. Because most grandparents had retired, this variable was used for parents only.

Reserve capacity
Reserve capacity was measured in three distinct dimensions of intra- and interpersonal factors. Within each dimension of reserve capacity (AHLS data), correlations and associations of the variables were calculated. We found moderate positive correlations (Spearman's) and statistically significant associations (Pearson chi-square tests) within the items described per dimension.

(a) *Perceived health* included three items: reported chronic disease, injury or disability that restricts daily activities (no/yes); a summary index of weekly perceived stress symptoms (stomachaches, tension or nervousness, irritability or outbursts of anger, trouble falling asleep or waking at night,

Table 2. Bivariate associations of each predictor variable with education level in adulthood (using low education as reference category), adjusting for sex and age at end of follow-up.

Family socioeconomic circumstances, school achievement and reserve capacity in adolescence			Odds ratios, 95% confidence intervals	
			Middle	High
Family variables				
Education	Father	Low	1.0	1.0
		Middle	1.3 (1.3–1.5)***	2.1 (1.9–2.3)***
		High	1.8 (1.5–2.1)***	8.3 (7.0–9.8)***
	Mother	Low	1.0	1.0
		Middle	1.4 (1.3–1.5)***	2.6 (2.4–2.8)***
		High	1.9 (1.5–2.4)***	9.4 (7.6–11.6)***
	Paternal grandparents	Low	1.0	1.0
		Middle	1.1 (.9–1.2)	1.5 (1.3–1.7)***
		High	1.2 (.9–1.6)	2.9 (2.1–4.0)***
		Unknown	.8 (.8–.9)***	.8 (.8–.9)***
	Maternal grandparents	Low	1.0	1.0
		Middle	1.0 (.9–1.2)	1.4 (1.2–1.6)***
		High	1.2 (.8–1.6)	3.1 (2.2–4.3)***
		Unknown	.8 (.8–.9)***	.9 (.8–.9)**
Dwelling ownership	Father	Rented	1.0	1.0
		Owner-occupied	2.1 (1.9–2.3)***	4.0 (3.6–4.4)***
	Mother	Rented	1.0	1.0
		Owner-occupied	2.2 (2.0–2.4)***	4.3 (3.9–4.7)***
	Paternal grandparents	Rented	1.0	1.0
		Owner-occupied	1.3 (1.1–1.5)***	1.6 (1.4–1.9)***
		Unknown	1.0 (.9–1.2)	1.2 (1.0–1.3)*
	Maternal grandparents	Rented	1.0	1.0
		Owner-occupied	1.5 (1.3–1.8)***	2.1 (1.9–2.5)***
		Unknown	1.2 (1.0–1.3)*	1.4 (1.3–1.7)***
Employment status	Father	Unemployed	1.0	1.0
		Employed	1.4 (1.3–1.6)***	2.4 (2.2–2.8)***
	Mother	Unemployed	1.0	1.0
		Employed	1.6 (1.4–1.8)***	2.4 (2.1–2.6)***
Adolescence variables				
School achievement		Low	1.0	1.0
		Average	3.0 (2.7–3.3)***	10.7 (9.6–12.0)***
		High	5.6 (4.5–7.0)***	53.6 (43.0–66.8)***
Reserve capacity				
Perceived health	Chronic disease	Yes	1.0	1.0
		No	1.2 (1.1–1.4)**	1.3 (1.1–1.5)***
	Perceived stress symptoms	4–8/week	1.0	1.0
		2–3/week	1.3 (1.2–1.5)***	1.6 (1.4–1.8)***
		1/week	1.6 (1.4–1.8)***	1.8 (1.6–2.1)***
		None	1.7 (1.5–2.0)***	2.0 (1.8–2.3)***
	Self-rated health	Poor	1.0	1.0
		Average or good	1.4 (1.1–1.8)**	1.5 (1.2–2.0)**
		Very good	1.5 (1.2–1.9)**	1.9 (1.5–2.5)***
Health-promoting behaviour	Physical activity	Does not exercise	1.0	1.0
		Occasional/low efficient exerciser	1.3 (1.2–1.5)***	1.8 (1.6–2.0)***
		Active efficient exerciser	1.4 (1.2–1.6)***	2.3 (2.1–2.6)***
		Very active efficient exerciser	1.6 (1.4–1.8)***	2.9 (2.5–3.3)***
	Regular tooth brushing	<1–5 times/week	1.0	1.0
		About once/day	1.7 (1.6–1.9)***	3.2 (2.8–3.5)***
		Several times/day	1.9 (1.7–2.2)***	4.9 (4.4–5.5)***
Social support	Nuclear family	No	1.0	1.0
		Yes	2.2 (2.0–2.4)***	3.8 (3.4–4.2)***
	Talking about issues to father	Difficult/No father	1.0	1.0
		Easy	1.1 (1.0–1.2)	1.1 (1.0–1.2)*
	Talking about issues to mother	Difficult/No mother	1.0	1.0
		Easy	1.1 (1.0–1.2)	1.1 (1.0–1.2)
	Talking about issues to friends	Difficult/No friends	1.0	1.0
		Easy	1.0 (.9–1.1)	.9 (.8–1.0)

$^*p < .05$; $^{**}p < .01$; $^{***}p < .001$ – Significance levels.

headache, trembling of hands, feeling tired or weak, feeling dizzy) categorized as no symptoms, one symptom/week, 2–3/week, 4–8/week; and self-rated health categorized as very good, good to average, poor.

(b) *Health-promoting behaviour* included frequency of tooth brushing (several times a day, once a day, 1–5 times/week or less) and efficiency of physical activity. Efficiency of physical activity was measured by combining information from two variables: frequency of physical activity in leisure time and intensity of exercise (shortness of breath/sweating). This combination used the following categories: does not exercise, exercises with low/occasional efficiency, active efficient exerciser, very active efficient exerciser.

(c) *Social support* was measured by four items: nuclear family (living with both parents or not); ease of talking about troubling issues to father, to mother and to friends (easy or difficult). Those who did not have a father (5%), mother (1%) or friends (.5%) were included in the 'difficult' category.

School achievement

Adolescents were categorized as having low, average or high academic achievement. The respondents were asked to assess whether their end-of-term school performance was much better, slightly better, average, slightly poorer or much poorer than the class average. For 12–14-year-olds (all in comprehensive schools), those who reported much better performance were classified as 'high', those with slightly better performance as 'average' while the rest were all classified as having 'low' achievement. For 16–18-year-olds, in addition to self-assessment of their school performance, school status (academic upper secondary school/vocational school/not attending school) was also used. Their achievement was classified as follows: high (in academic upper secondary school with better performance); average (in vocational school with better performance or academic upper secondary school with average performance); and, low (in vocational school with poor to average performance or high school with poor performance or not at school).

Statistical analysis

Descriptive statistics were presented as percentages for categorical variables. We used multinomial logistic regression analysis to investigate the associations of predictor variables with the outcome. In both bivariate and multivariate analyses, we adjusted for sex and age at the end of follow-up because of unequal follow-up times among the participants.

Three multivariate models were fitted using a backward elimination approach. Variables included were only those statistically significant in bivariate analyses (Table 2). The first model named Model 1 examined family SES variables; Model 2 included the Model 1 variables plus school achievement; and, Model 3 (final model) consisted of all statistically significant family socioeconomic variables, school achievement and reserve capacity variables. Due to the numerous predictors considered in each model, statistical significance was set at $p < .01$ for retaining variables in the models. Model fit was assessed using Akaike information criterion (AIC) values and likelihood ratio tests. The model parameters were presented as odds ratios (ORs) with 95% confidence intervals (CIs). All analyses were performed using STATA version 12.1.

Results

A third (35.7%) of the adolescents achieved high education in adulthood, about half (55.2%) attained a middle education and less than a tenth (9.1%) had low adult education level. Table 1 presents the distributions of the predictor variables by adolescents' adult education level. Generally, the proportion of adolescents who obtained high adult education level increased with better family socioeconomic circumstances, high achievement in school and positive reserve capacity characteristics. The opposite

Table 3. Multivariate associations of each predictor variable with education level in adulthood (using low education as reference category) in three models, adjusting for sex and age at end of follow-up.

Family socioeconomic circumstances, school achievement and reserve capacity in adolescence		Model 1[a]		Model 2[b]		Model 3 (final model)[c]	
		Odds ratios, 95% confidence intervals		Odds ratios, 95% confidence intervals		Odds ratios, 95% confidence intervals	
		Middle	High	Middle	High	Middle	High
Family variables							
Education							
Father	Low	1.0	1.0	1.0	1.0	1.0	1.0
	Middle	1.2 (1.1–1.3)**	1.7 (1.6–1.9)**	1.2 (1.1–1.3)**	1.5 (1.4–1.7)**	1.2 (1.1–1.3)**	1.5 (1.4–1.7)**
	High	1.4 (1.2–1.7)**	4.5 (3.7–5.4)**	1.2 (1.0–1.5)	2.7 (2.3–3.3)**	1.1 (.9–1.4)	2.6 (2.1–3.1)**
Mother	Low	1.0	1.0	1.0	1.0	1.0	1.0
	Middle	1.3 (1.2–1.4)**	1.9 (1.8–2.1)**	1.2 (1.1–1.3)**	1.8 (1.6–1.9)**	1.3 (1.2–1.4)**	1.8 (1.6–2.0)**
	High	1.4 (1.1–1.8)*	3.6 (2.9–4.6)**	1.2 (1.0–1.5)	2.4 (1.9–3.0)**	1.3 (1.0–1.6)	2.5 (2.0–3.2)**
Dwelling ownership							
Father	Rented	1.0	1.0	1.0	1.0	1.0	1.0
	Owner-occupied	1.4 (1.2–1.6)**	1.7 (1.5–2.0)**	1.4 (1.2–1.6)**	1.8 (1.6–2.2)**	1.4 (1.2–1.5)**	1.7 (1.5–2.0)**
Mother	Rented	1.0	1.0	1.0	1.0	1.0	1.0
	Owner-occupied	1.6 (1.4–1.9)**	2.3 (2.0–2.7)**	1.5 (1.3–1.7)**	1.9 (1.6–2.2)**	1.3 (1.1–1.5)**	1.5 (1.3–1.7)**
Maternal grand-parents	Rented	1.0	1.0	1.0	1.0	1.0	1.0
	Owner-occupied	1.3 (1.2–1.5)**	1.6 (1.4–1.8)**	1.3 (1.1–1.5)**	1.5 (1.3–1.8)**	1.3 (1.1–1.5)*	1.5 (1.3–1.8)**
	Unknown	1.0 (.9–1.2)	1.2 (1.0–1.4)	1.0 (.9–1.1)	1.1 (.9–1.3)	1.0 (.8–1.1)	1.0 (.9–1.2)
Employment status							
Father	Unemployed	1.0	1.0	1.0	1.0	1.0	1.0
	Employed	1.2 (1.0–1.3)*	1.5 (1.4–1.8)**	1.1 (1.0–1.3)	1.4 (1.2–1.6)**	1.0 (.9–1.2)	1.2 (1.1–1.4)*
Mother	Unemployed	1.0	1.0	1.0	1.0	1.0	1.0
	Employed	1.3 (1.2–1.5)**	1.6 (1.4–1.8)**	1.3 (1.2–1.4)**	1.4 (1.3–1.6)**	1.2 (1.1–1.4)**	1.4 (1.2–1.5)**
Adolescence variables							
School achievement							
	Low	–	–	1.0	1.0	1.0	1.0
	Average	–	–	2.8 (2.5–3.1)**	9.0 (8.0–10.1)**	2.6 (2.3–2.9)**	7.9 (7.0–8.9)**
	High	–	–	5.1 (4.1–6.4)**	38.9 (31.1–48.6)**	4.6 (3.7–5.8)**	32.4 (25.9–40.6)**
Reserve capacity							
Perceived health							
Chronic disease	Yes	–	–	–	–	1.0	1.0
	No	–	–	–	–	1.3 (1.1–1.4)**	1.3 (1.2–1.5)**
Perceived stress symptoms	4–8/week	–	–	–	–	1.0	1.0
	2–3/week	–	–	–	–	1.2 (1.1–1.4)*	1.5 (1.3–1.7)**
	1/week	–	–	–	–	1.4 (1.3–1.7)**	1.6 (1.4–1.9)**
	None	–	–	–	–	1.6 (1.4–1.8)**	1.8 (1.5–2.0)**

Health-promoting behaviour		Model 1[a]	Model 2[b]	Model 3[c]
Physical activity	Does not exercise	1.0	1.0	1.0
	Occasional/low efficient exerciser	1.2 (1.0–1.3)*	1.2 (1.0–1.3)*	1.4 (1.2–1.6)**
	Active efficient exerciser	–	1.2 (1.0–1.3)*	1.5 (1.4–1.8)**
	Very active efficient exerciser	–	1.2 (1.1–1.4)*	1.6 (1.4–1.8)**
Regular tooth brushing	<1–5 times/week	1.0	1.0	1.0
	About once/day	–	1.5 (1.3–1.6)**	2.1 (1.9–2.4)**
	Several times/day	–	1.5 (1.4–1.7)**	2.5 (2.2–2.9)**
Social support	Nuclear family			
	No	–	1.0	1.0
	Yes	–	1.7 (1.5–1.8)**	2.3 (2.0–2.5)**

Note: Includes statistically significant variables from Table 2.
[a]Model 1: Family SES.
[b]Model 2: Family SES + school achievement.
[c]Model 3: Family SES + school achievement + reserve capacity variables.
*$p < .01$; **$p < .001$ – Significance levels.

was observed among those with low adult education level. No marked differences in distribution of family- and adolescent-related variables were found among those with middle adult education level.

The odds of getting either middle or high adult education relative to low education increased when parents and grandparents had middle or high education (Table 2). There was also higher likelihood of obtaining either middle or high adult education level compared to low when family members owned their dwellings and when parents were employed. Parental and grandparental socioeconomic circumstances were more strongly associated with a high adult education than middle education. Adolescents who were high achievers in school had markedly greater odds of obtaining a middle or high adult education level than a low one. In terms of reserve capacity, positive categories predicted higher likelihood of getting either middle or high education. Clear gradients existed in the associations of most variables within dimensions of perceived health and health-promoting behaviour with adult education level. In the social support dimension, family structure was strongly associated with both adult education levels while talking to father was weakly related to high adult education only.

In multivariate analyses, parental socioeconomic variables were found to be associated with adult education level. However, among grandparental variables, only maternal grandparents' dwelling ownership retained its statistically significant associations (Table 3, Model 1). The strength of the associations observed for family socioeconomic circumstances were similar to those found in the bivariate analyses but the odds ratios were attenuated. Family socioeconomic circumstances strongly predicted high adult education than a middle education. When school achievement was added (Model 2), the odds ratios for the associations of almost all socioeconomic predictors with high education level decreased distinctly but minimal or no changes were seen in the associations with middle education level. School achievement was independently and strongly associated with both middle and high education. When reserve capacity variables were added (Model 3), the odds ratios obtained for socioeconomic circumstances of the family did not vary considerably from those in Model 2 but there were marked reductions in the associations of both parents' employment status and dwelling ownership with high adult education level. The odds ratios for school achievement also decreased but this remained the strongest predictor of adult education level. Independent associations of reserve capacity variables with adult education level were also found, with clear gradients for perceived stress symptoms and health-promoting behavioural factors. As regards social support, only family structure was related to adult education level. The final model showed that one's family socioeconomic circumstances significantly predicted one's adult education level but both school achievement and reserve capacity tended to decrease their effects.

Excluding unknown grandparents

Multivariate analyses excluding data from those with unknown grandparents showed slightly increased associations between some of the predictors (parents' education, school achievement and perceived stress symptoms in the perceived health dimension) and adult education level (Appendix 1). On the other hand, father's employment status and chronic disease in the perceived health dimension lost their statistically significant associations with the outcome. Overall results, however, showed the same directions and magnitude of associations as the analyses which included data from this group.

Discussion

Main findings of this study

The socioeconomic circumstances of parents and grandparents directly predicted adult education level. School achievement and reserve capacity dimensions of perceived health, health-promoting behaviour and social support in adolescence also positively and independently predicted adult education. Moreover, these tended to decrease the effect of family socioeconomic circumstances on educational level. Using polytomous categories for the outcome allowed us to disentangle the effects of the

predictors on different adult education levels. Results showed that all predictors were more strongly related with high than middle education.

Family socioeconomic circumstances

Consistent with previous research, our study found that family socioeconomic circumstances are positively associated with adult education level (Brekke, 2015; Fergusson et al., 2008; Koivusilta et al., 2013; Merritt & Buboltz, 2015; Slominski et al., 2011). We also provide evidence about the persistence of grandparents' effect on grandchildren's later educational outcomes, elucidating the origin of socioeconomic inequalities. Several mechanisms have been proposed for these associations. According to the Family Investment Model (FIM), greater SES implies greater parental material investments through financial transfers for tuition or maintenance during education (Albertini & Radl, 2012; Conger et al., 2010; Martin et al., 2010), primarily to prevent downward social mobility of children (Albertini & Radl, 2012). Likewise, wealthy grandparents might help finance their grandchildren's education through such monetary transfers (Chan & Boliver, 2013). High SES families value education more and have higher educational aspirations for their children compared to low SES families (Albertini & Radl, 2012; Fergusson et al., 2008; Martin et al., 2010). Conversely, low SES families are more likely exposed to stressful events such as unemployment which hinder their access to economic resources and limit their children's educational achievements (Fergusson et al., 2008).

Varying socioeconomic backgrounds also lead to different parenting practices, values and priorities which affect developmental and educational outcomes of children (Conger et al., 2010; Martin et al., 2010). Lower SES in childhood and adolescence were found to be associated with greater problem behaviours (Martin et al., 2010), probably due to poor quality of parenting which affect children's cognitive development and educational performance (Astone & McLanahan, 1991; Bird, 2007).

Adolescent-related predictors

Other than family SES, our results showed similar evidence with literature that school achievement was a strong predictor of adult education level (Brekke, 2015; Koivusilta et al., 2013; Slominski et al., 2011). Academic achievement implies academic ability and attachment level to school (Astone & McLanahan, 1991). During adolescence, school achievement likely influences enrolment in higher education (Brekke, 2015; Koivusilta et al., 2013). Thus, high achievers have been found to complete more years of schooling (Slominski et al., 2011).

Current research suggests that psychosocial resources in early childhood influence socioeconomic trajectories (Conger et al., 2010; Kroenke, 2008). However, there is limited evidence on psychosocial resources as a possible pathway to educational outcomes as these are more commonly considered in SES-health relationships. Moreover, there is a broad spectrum of psychosocial characteristics but to-date, few were studied and found to be associated with educational success: greater optimism, satisfaction (Boehm, Chen, Williams, Ryff, & Kubzansky, 2015), locus of control (Murasko, 2007) and self-efficacy (Merritt & Buboltz, 2015). We covered a different set of resources, including both psychosocial and behavioural factors, which were independently and positively associated with adult education level. Our findings enhanced available literature on reserve capacity and showed that good perceived health, health-promoting behaviour and social support protect adolescents from having a low adult education level. We surmise that these factors influence educational inequalities probably through the same mechanisms by which the reserve capacity framework causes SES-health related disparities (Gallo et al., 2009; Matthews et al., 2010). In other words, individuals with high reserve capacity are able to manage stressful school environments and meet academic demands, building competencies and skills necessary to pursue higher education (Matthews et al., 2010).

Although our findings did not show statistically significant associations between social support from friends and adult education level, related literature pointed to the existence of peer effects on education. Essentially, supportive and caring friendships positively influence school adjustment and

academic motivations (Nelson & DeBacker, 2008) while having academically weak peers tend to reduce one's academic performance (Winston & Zimmerman, 2004).

Limitations of this study

We note some limitations of our study. First, since the study was not initially conceptualized to measure reserve capacity, we used best available proxy measures. Despite this, our indicators measured important aspects of this multidimensional concept (Matthews & Gallo, 2011) but more research is needed to validate our findings. Second, almost half of the grandparents' data on socioeconomic circumstances were not available in the database of Statistics Finland. In order to preserve a robust sample size, we considered these groups as separate category and included in our analyses. Further analyses showed that if we had excluded these groups, we would have obtained similar results, albeit, some of the associations would slightly be overestimated (Appendix 1). Last, we acknowledge that other predictors of adult education level such as the school environment (Ryan & Patrick, 2001) and associated costs of continuing higher education and educational aspirations (Becker & Hecken, 2009) were unmeasured in our study. Future research should also try to account for the effect of these factors or assess other factors among those with preference for middle education instead of higher education.

Conclusions

Our study highlights the role of family socioeconomic circumstances in attaining high adult education and contributes to further understanding of the interplay between familial and personal factors in adolescence. Indeed, family socioeconomic circumstances, including those of grandparents, produced a dynamic effect in adolescence and influenced educational outcomes. However, since these associations were mediated by school achievement and reserve capacity in adolescence, it seemed that these personal predictors play more important roles in higher educational attainment (Koivusilta et al., 2013; Murasko, 2007; Slominski et al., 2011). Our findings suggest that formulating interventions which build reserve capacity and improve school performance, especially among adolescents from families with disadvantaged socioeconomic backgrounds, could likely reduce educational inequalities.

Acknowledgments

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

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Appendix 1. Comparison of final model on associations with education level in adulthood (using low education as reference category), adjusting for sex and age at end of follow-up between population with unknown GP data and without unknown GP data.

Family socioeconomic circumstances, school achievement and reserve capacity in adolescence			Final model[a] N = 36,517		Final model[a] N = 15,328 (unknown GP data excluded in analysis)	
			Odds ratios, 95% confidence intervals		Odds ratios, 95% confidence intervals	
			Middle	Middle	Middle	High
Family variables						
Education	Father	Low	1.0	1.0	1.0	1.0
		Middle	1.2 (1.1–1.3)**	1.5 (1.4–1.7)**	1.3 (1.1–1.5)**	1.7 (1.4–1.9)**
		High	1.1 (.9–1.4)	2.6 (2.1–3.1)**	1.2 (.9–1.6)	3.1 (2.2–4.2)**
	Mother	Low	1.0	1.0	1.0	1.0
		Middle	1.3 (1.2–1.4)**	1.8 (1.6–2.0)**	1.2 (1.1–1.4)*	1.8 (1.6–2.2)**
		High	1.3 (1.0–1.6)	2.5 (2.0–3.2)**	1.8 (1.2–2.8)*	3.5 (2.3–5.4)**
Dwelling ownership	Father	Rented	1.0	1.0	1.0	1.0
		Owner-occupied	1.4 (1.2–1.5)**	1.7 (1.5–2.0)**	1.4 (1.1–1.6)*	1.7 (1.4–2.2)**
	Mother	Rented	1.0	1.0	1.0	1.0
		Owner-occupied	1.3 (1.1–1.5)**	1.5 (1.3–1.7)**	1.3 (1.1–1.6)*	1.6 (1.2–2.0)**
	Maternal grandparents	Rented	1.0	1.0	1.0	1.0
		Owner-occupied	1.3 (1.1–1.5)*	1.5 (1.3–1.8)**	1.2 (1.0–1.4)	1.4 (1.1–1.7)*
		Unknown	1.0 (.8–1.1)	1.0 (.9–1.2)	–	–
Employment status	Father	Unemployed	1.0	1.0	–	–
		Employed	1.0 (.9–1.2)	1.2 (1.1–1.4)*	1.0	1.0
	Mother	Unemployed	1.0	1.0		
		Employed	1.2 (1.1–1.4)**	1.4 (1.2–1.5)**	1.2 (1.0–1.4)	1.3 (1.1–1.6)*
Adolescence variables						
School achievement		Low	1.0	1.0	1.0	1.0
		Average	2.6 (2.3–2.9)**	7.9 (7.0–8.9)**	2.6 (2.1–3.1)**	7.6 (6.2–9.2)**
		High	4.6 (3.7–5.8)**	32.4 (25.9–40.6)**	6.4 (4.1–10.0)**	42.0 (26.9–65.4)**
Reserve capacity						
Perceived health	Chronic disease	Yes	1.0	1.0	–	–
		No	1.3 (1.1–1.4)**	1.3 (1.2–1.5)**	1.0	1.0
	Perceived stress symptoms	4–8/week	1.0	1.0	1.5 (1.2–1.9)**	2.2 (1.7–2.8)**
		2–3/week	1.2 (1.1–1.4)*	1.5 (1.3–1.7)**	1.5 (1.2–1.9)**	2.1 (1.7–2.7)**
		1/week	1.4 (1.3–1.7)**	1.6 (1.4–1.9)**	1.8 (1.5–2.2)**	2.7 (2.2–3.4)**
		None	1.6 (1.4–1.8)**	1.8 (1.5–2.0)**		

(Continued)

Appendix 1. (*Continued*).

Family socioeconomic circumstances, school achievement and reserve capacity in adolescence			Final model[a] N = 36,517			Final model[a] N = 15,328 (unknown GP data excluded in analysis)		
			Odds ratios, 95% confidence intervals			Odds ratios, 95% confidence intervals		
			Middle	Middle		Middle	Middle	High
Health-promoting behaviour	Physical activity	Does not exercise	1.0	1.0		1.0	1.0	1.0
		Occasional/low efficient exerciser	1.2 (1.0–1.3)*	1.4 (1.2–1.6)**			1.1 (.9–1.3)	1.2 (1.0–1.5)
		Active efficient exerciser	1.2 (1.0–1.3)*	1.5 (1.4–1.8)**			1.0 (.9–1.2)	1.3 (1.1–1.6)*
		Very active efficient exerciser	1.2 (1.1–1.4)*	1.6 (1.4–1.8)**			1.1 (.9–1.4)	1.5 (1.2–1.9)**
	Regular tooth brushing	<1–5 times/week	1.0	1.0		1.0	1.0	1.0
		About once/day	1.5 (1.3–1.6)**	2.1 (1.9–2.4)**			1.4 (1.2–1.6)**	2.1 (1.7–2.5)**
		Several times/day	1.5 (1.4–1.7)**	2.5 (2.2–2.9)**			1.5 (1.2–1.8)**	2.6 (2.1–3.2)**
Social support	Nuclear family	No	1.0	1.0		1.0	1.0	1.0
		Yes	1.7 (1.5–1.8)**	2.3 (2.0–2.5)**			1.8 (1.6–2.1)**	2.6 (2.3–3.1)**

Note: Includes statistically significant variables from Table 2.
[a]Final Model: Family SES + school achievement + reserve capacity variables.
*p < .01; **p < .001 – Significance levels.