Children's Resources and Parents' Survival: The Value of Education, Class, Income, and Geographic Proximity

Jenny Torssander, Swedish Institute for Social Research, Sweden

Abstract

Recent research shows that parents' survival is associated with their adult children's education, net of parents' own socioeconomic position. Why children's education is linked to their parents' longevity is, however, an unanswered question.

Utilising a multi-generation register that connects parents to children in the Swedish population, the first part of this paper examines the net associations of children's various socioeconomic resources (education, occupation, and income) and parents' mortality. In subsequent analyses of the role of children's education, five causes of death are distinguished (circulatory disease mortality, overall cancer, lung cancer, breast cancer, and prostate cancer). The second part of the analysis focuses on the geographic distance between children and parents and how distance interacts with the association between children's education and parents' survival.

The results show net associations between all included indicators of children's socioeconomic position and parents' mortality risk, with the clearest association for education. Children's education is significantly associated with all examined causes of deaths except prostate cancer. Breast cancer mortality is negatively related to offspring's education but not the mothers' own education. Lastly, distance to parents does not interact with the association between children's education and parents' mortality.

To conclude, children's education seems to be a key factor in comparison to other dimensions of socioeconomic position in the offspring generation. This suggests that explanations that are linked to, e.g., behavioural norms or knowledge and support with health care contacts, are more plausible than, e.g., access to material resources. However, distance does not interact with this association, which may point towards non-causal explanations, i.e., children's schooling captures unmeasured parental characteristics or circumstances. Alternatively, geographic factors do not prevent parents from benefitting from their adult children's resources.

Introduction

Studies from the US and Sweden have recently shown that adult children's education is associated with their parents' survival (Friedman and Mare 2010; Torssander 2013). This association persists after adjustment of parents' education and other socioeconomic resources in the household as well as in a fixed effects model in which characteristics shared between siblings is held constant (Torssander 2013). Furthermore, the relationship between children's education and parents' mortality seems to be particularly strong for causes of death that are closely related to health behaviours, such as smoking (Friedman and Mare 2010).

If the association between children's education and parents' survival reflects an influence of the 'social foreground', suggested explanations include access to resources, health-related advice and guidance, and impact on health behaviours. However, we cannot confidently state that parents gain health benefits from having well-educated children. The association may simply reflect unmeasured third variables, such as parents' preferences, personalities or abilities.

The aim of the present study is to gain additional knowledge about the relationship between children's socioeconomic position and parents' survival. The first part of the paper aims to separate the independent associations with parental mortality for various indicators of children's socioeconomic resources. Such an analysis has previously been conducted for own social position and mortality (e.g., Geyer et al. 2006; Torssander and Erikson 2010) and one's partner's position (e.g., Skalická et al. 2008; Torssander and Erikson 2009).

The second part of the paper relates to geographic distance, children's socioeconomic position, and parents' mortality. Distance between adult children and parents is clearly linked to frequency of contact across generations (Fors and Lennartsson 2008; Kalmijn 2006; Smith 1998). Therefore, residential proximity to adult children may benefit parents' health. Geographic distance may also interact with the association between child resources and parents' health if, for example, such resources are more accessible to parents who reside near their adult children. On the other hand, children's assets facilitate frequent visits over long distances.

Background

Parents and children share many environmental and genetic circumstances (Lawlor and Mishra 2009), and the parent-child relationship has been described as reciprocal, permanent and involuntary (Umberson 1992). Moreover, adult children and their parents, on average, have frequent contact and support each other in various ways (Björnberg and Ekbrand 2008; Ermisch 2009; Hank 2007; Lye 1996). However, children's social position is not clearly related to the amount of support to parents. For example, parents with well-educated children do not receive more practical or emotional assistance from their offspring than do parents with less-educated children (Friedman and Seltzer 2010). The opposite might even be the case (Ermisch 2009; Fors and Lennartsson 2008). In a Swedish study on family ties between generations, there was no association between social class and giving or receiving practical support, but professional classes were more likely to both give and receive financial help (Björnberg and Ekbrand 2008).

In the social networks literature, access to resources is described as one potential explanation for the association between networks and health (Berkman et al. 2000). In addition to partners, adult children are key persons in their ageing parents' networks (Due et al. 1999); therefore, their resources may be important for parents' health and survival.

Indicators of children's social position and parents' survival

Access to resources refers to both material and non-material assets. Children's income is the socioeconomic indicator that most directly reflects the younger generation's material assets. However, because upward intergenerational transmission of economic capital is rare in Sweden (Fritzell and Lennartsson 2005), a direct effect of children's income on parents' mortality is perhaps unlikely. Still, approximately forty per cent of Swedes agree that adult children should help their parents financially if, for example, the parent is sick (Björnberg and Latta 2007).

Moreover, some parents may be more likely to retain a greater amount of their own means because financial transfers from parents to adult children are less common when children are affluent (Ermisch 2009) and low income is associated with increased likelihood of receiving financial help from a family member (Björnberg and Latta 2007). In addition, children's financial problems predict poorer parental well-being, whereas children's success is associated with greater parental well-being (Fingerman et al. 2012).

Previous research on children's resources and parents' mortality primarily focused on children's education (Friedman and Mare 2010; Torssander 2013, Zimmer et al. 2007). In addition to improving labour market prospects, education reflects knowledge and cognitive abilities. A spillover effect of education between people has not been verified, but has been suggested for partners (e.g., Monden 2003) and between relatives, such as siblings (Kravdal 2008). One hypothesis is that such a spillover effect exerts an impact through health behaviours, use of health care, and adherence to medical treatment. Active or passive imitation of behaviour – which is more likely to be health-enhancing among well-educated individuals – is another possibility (cf. Kravdal 2008). Social influence may be related to not only children's education but also, for example, occupational class or status.

Compared to economic resources, which can be directly transferred, the role that others' occupation plays in an individual's health is less straightforward. Physical and mental working conditions affect the individual but may not directly influence the health of others. However, an influential labour market position could involve advantages that benefit other people, particularly family members. For example, some occupational positions may provide access to knowledge and contacts that increase the health of kin.

The Swedish health care system aims at equity and distribution according to need (Burström 2002). However, recent reports demonstrate that this goal is not always achieved (SKL and Socialstyrelsen 2012). For example, improved cancer treatment has mainly benefited patients with intermediate or higher education (Cavalli-Björkman et al. 2011). Treatment differences may equally appear according to children's education, class, status or income.

Health behaviours can be affected by other people's guidance, both through direct advice and in a normative sense. There are, however, reasons to be cautious with such reasoning, as clustering of behaviour may also be due to homophily (i.e., equals meet equals) or exposure to similar factors (e.g., environmental confounding). There is some support for the existence of social influence within networks (e.g., Christakis and Fowler 2007; 2008). Such research has focused on friend and partner relationships, but a similar influence from children to parents is possible. In comparison to other social contacts, the child-parent relationship is long-lasting and constant over time. Hence, children may be viewed as an important source of influence. Because health behaviours differ across socioeconomic groups (e.g., Stringhini et al. 2010), children's positions may predict whether this influence is positive or negative. Friedman and Mare (2010) showed that children's education is associated

with smoking and exercise in the parent generation, irrespective of parents' education and income.

It has further been suggested that friends with more education influence each other's behaviour to a greater extent than friends with less education. In fact, higher educated people are both more influential and more likely to be influenced (Christakis and Fowler 2008). If this is applicable to the influence of children on parents, it is likely that well-educated parents benefit more from children's socioeconomic resources than do less-educated parents. Previous studies have shown inconsistent results for such an interaction (Zimmer et al. 2007; Friedman and Mare 2010).

Geographic distance

Proximity has been described as a key factor of adult child-parent relationships (Silverstein et al. 1997), and face-to-face contact is more common if children and parents live near each other (Fors and Lennartsson 2008; Kalmijn 2006; Smith 1998).

Geographic distance between adult child and parent is linked to socioeconomic factors. A positive relationship between children's education and distance to parents is well established (Kalmijn 2006; Shelton and Grundy 2000; Holmlund et al. 2013; Malmberg and Pettersson 2007). A common explanation for why children with higher education live further from their parents is labour market constraints. Whereas occupations with minor or no educational demands can be found in most regions, many higher educated jobs are only available in specific areas.

Well-educated children meet with parents more seldom than less-educated children largely due to differences in geographic distance; thus, the greater part of the educational effect on contact is indirect via proximity (Kalmijn 2006).

Although geographic proximity might be a fairly good proxy of face-to-face contact and perhaps domestic help, other types of support may not be primarily shaped by distance. For example, social and emotional support is equally provided through frequent telephone calls as through frequent visits (Litwak and Kulik 1987). Furthermore, financial help may not be associated with distance (Hoyert 1991).

Given these arguments, geographic distance is likely to be important for assistance with household tasks but not necessarily other types of support. Still, face-to-face meetings of children and parents may be important for parents' health because children may have greater possibilities to become aware of their parents' health status. On the other hand, an association between distance and parents' mortality does not

simply reflect a causal effect. Several decisions are involved in migrations, and parents' health may be one factor that is considered (Hank 2007).

Previous research has shown that social distance is of greater importance for health behavioural influences than is geographic distance (Christakis and Fowler 2007; 2008). It is possible, though, that geographic distance is one barrier that parents face in taking advantage of children's resources. Therefore, the current study examines whether geographic distance modifies the effect of children's socioeconomic resources on parents' survival.

Data, variables, and method

Data

For the current study, data from various Swedish population registers were used. The Multi-generation Register (Statistics Sweden 2008), which connects parents to children, was used as the starting point for including individuals into the study sample.

The initial population consisted of mothers and fathers who were born between 1926 and 1940 and were residing in Sweden in 2001 (N=978,434). Parents who bore their first child in 1967 or later were excluded (N=124,077; 12.7%) because their children were too young to have reached a stable labour market position in 2001 (the year before the start of the mortality follow-up).

Thereafter, a few minor exclusions were made. If all children of a parent died before the start of the follow-up, the parent was excluded from the analyses (N=3,621; 0.4%). This primarily concerned parents with one child and was otherwise very rare. In addition, the parents had to reside in Sweden in 1990, when their socioeconomic position was measured, excluding another 3,535 individuals (0.4%). Parents for whom there was no information about their own education (1.3%) or their children's education (0.4%) were also excluded from the analyses. Otherwise, variables included missing categories.

The final study sample consisted of 832,762 individuals. Those who emigrated before the age of 75 and during the follow-up period between 2002 and 2007 were included in the analyses up until the time that they moved abroad (N=1,580 or 0.2% were censored at time of emigration).

Socioeconomic position of parents

Parents' socioeconomic position is a key control variable in the analyses because it influences parents' own health and survival as well as their children's socioeconomic positions. Parents' positions can either be measured in children's youth and adolescence (the period when parents' socioeconomic resources influence their children's attainments) or later in the parents' life (closer to the mortality follow-up). Both time periods are relevant for predicting mortality; however, because socioeconomic position in adult life is relatively stable (especially in regards to education), only one of the alternatives could be included due to a high

degree of multicollinearity. Here, the second alternative – socioeconomic position later in life – was selected.[1]

The following three indicators of socioeconomic position were included: education, occupational class and disposable income. All of these indicators were collected from the Census of 1990, the latest year for which we have comprehensive occupational information for the parent generation before the start of the mortality follow-up. The oldest parents were then 64 years of age, i.e., one year below the standard retirement age in Sweden. Around one-fifth of the parents were not working in 1990, and a specific 'not employed' category was specified.

Five levels of *education* were distinguished, as follows: Longer (3 years or more) and shorter (less than 3 years) tertiary education, longer (3 years or more) and shorter (less than 3 years) secondary education, and compulsory education. Shorter secondary schooling was mainly vocational, and longer secondary education was primarily academic. *Occupational class* for parents follows the Swedish socioeconomic classification (similar to the EGP class schema, Erikson and Goldthorpe 1992). In this classification system, self-employed and farmers are separated from employed and manual occupations are distinguished from non-manual occupations.

Income was measured as disposable income during one year and included labour and capital incomes, benefits and transfers. In the analyses, parents' income was included as a continuous variable. Disposable income was selected to reflect economic circumstances in general rather than only work-related circumstances (as a non-negligible proportion of the parents did not work in 1990).

Parents' partners and their socioeconomic positions

Cohabitation and marriage are related to low mortality risks (Lund et al. 2002; Manzoli et al. 2007), and there is an association between one partner's socioeconomic position and the other's individual mortality, also given own position (Martikainen 1995; Skalická et al. 2008; Torssander and Erikson 2009). Each parent's education or social class is important for children's attainments (Ermisch and Francesconi 2001; Beller 2009). Therefore, control for partner position is likely to be particularly important when the current partner is the other parent of the child (cf Torssander 2013). The inclusion of partner characteristics also provides a more comprehensive picture of the household's total socioeconomic resources.

[1] Sensitivity analyses show similar results for the two approaches.

Information about partners – married or cohabiting – and their education, occupational class and disposable income was also collected in 1990. The socioeconomic variables of partners were measured in the same manner as those of the parent (described above).

Outcome: Parental deaths

All deaths in the national Cause of Death Register between January 2002 and December 2007 were linked to the other registers using personal identification numbers. All-cause mortality was the main outcome, but some specific groups of causes were also analysed, including the two major cause groups, cancer (ICD-10: C00-D48) and circulatory diseases (I00-I99), and three specific types of cancer: lung (C32-34, including larynx and trachea), breast (C50) and prostate (C61). Lung cancer was selected because educational smoking patterns have changed over time and across cohorts and, therefore, may show different associations with parents' and children's education (cf. Friedman and Mare 2013). Breast and prostate cancer were distinguished because they are common cancer types but are not, or even reversely, related to individual socioeconomic position (e.g., Erikson and Torssander 2008; Lagerlund et al. 2005; Vågerö and Persson 1987).

Descriptive statistics of parents' characteristics

The distribution of parents' background characteristics is shown in Table 1. The total number of mothers was greater than the total number of fathers primarily due to two factors. Compared to mothers, more fathers were missing from the Multi-generation Register and more fathers died before the start of the follow-up in January 2002.

On average, mothers had scarce socioeconomic resources compared to fathers. Many were not active in the labour market because they were comparatively old in 1990, when occupational class was measured (18 per cent of the fathers and 26 per cent of the mothers). However, to some degree, disposable income reflects prior labour market positions. Within the study sample, 15 per cent of the fathers and 25 per cent of the mothers did not have a partner in 1990. Between January 2002 and December 2007, 15 per cent of the fathers and 9 per cent of the mothers within the study sample died.

Table 1 – Descriptive statistics of parents

	Fathers		Mothers	
	No.	**%**	**No.**	**%**
Birth year				
1926-1930	119,920	33%	157,811	34%
1931-1935	125,219	35%	156,893	33%
1936-1940	116,628	32%	156,291	33%
Nr of children				
1	55,299	15%	80,594	17%
2	158,912	44%	203,528	43%
3	95,085	26%	119,003	25%
4+	52,471	15%	67,870	14%
Partner				
No	56,064	15%	117,448	25%
Yes	305,703	85%	353,547	75%
Education				
Compulsory	177,006	49%	254,010	54%
Upper sec 2y	72,492	20%	136,733	29%
Upper sec 3-4y	52,691	15%	16,896	4%
Tertiary<3y	24,776	7%	32,180	7%
Tertiary>=3y	34,802	10%	31,176	7%
Social class				
Unskilled manual (VII)	56,603	16%	138,789	29%
Routine non-manual (IIIb)	9,226	3%	37,017	8%
Skilled manual (VI)	54,942	15%	26,212	6%
Intermediate (IIIa)	24,987	7%	39,351	8%
Lower managerial/ professional (II)	56,726	16%	50,211	11%
Higher managerial/ professional (I)	48,141	13%	22,400	5%
Farmers	24,964	7%	12,879	3%
Other self-employed	11,246	3%	7,083	2%
Unclassified	10,945	3%	12,441	3%
Not in labour market	63,987	18%	124,612	26%
Disposable income in 1,000 SEK	*Mean*	1283	*Mean*	855
	Sd	863	*Sd*	414
Died 2002-2007				
No	308,481	85%	427,228	91%
Yes	53,286	15%	43,767	9%
Total N	361,767	100%	470,995	100%

Socioeconomic position of children

Five out of six parents in the study sample had more than one child. To compare parents with different numbers of children, children's resources were combined into one measure for each socioeconomic indicator. In a previous paper (Torssander 2013), only the first-born child in each family was selected because the parents were born later and, therefore, it was less common for their later-born children to have completed higher education before the start of the follow-up. If possible, however, a more comprehensive measure of children's resources is preferable. The ambition is a measure that captures parents' access (or non-access) to resources in the younger generation. The present paper applied a 'dominance' approach; thus, the highest or dominant position was selected to represent children's resources. This approach is similar to household class measures that rest on the principle that some occupations tend to 'dominate' the overall lifestyle within a household (Erikson 1984). In the present case, the dominance approach reflects whether any child has a tertiary education, professional occupation or high disposable income.

One shortcoming of this method is that the child with the highest position may not be the child that meets and helps the parent. In the models of geographic distance, the position of the closest living child was selected to better correspond to frequency of contact between children and parents.

Children's socioeconomic position was measured in 2001, the year before the start of the mortality follow-up of the parents. The children were then between 35 and 61 years of age. Parents' and children's positions were measured at different time points (1990 and 2001), which may be a limitation. However, such measurement was necessary so that parents would not be too old (>65) and children would not be too young (<35) when occupation and income data were collected. However, the models controlled for birth cohort.

The coding of educational levels in the registers underwent changes, with the latest change in year 2000. However, it is possible to reconstruct the previous coding of highest educational level (Wass 2001). For comparability, children's education follows the same coding as parents' education.

Information on children's occupation was obtained from the Swedish Occupational Register in 2001, in which occupational data were collected from private and public employers – either through wage statistics or questionnaires to private employers (i.e., no individual report). Unfortunately, the coverage of this register is poor for the study period, with between 6 and 9 per cent of the employed (mostly from smaller

firms in the private sector) missing from the register (Statistics Sweden 2011a). The Swedish Standard Classification of Occupations (SSYK) available from the register was used to group children into social classes (EGP)[2], and Erikson's (1984) dominance approach was followed.

In the current study, children's income referred to highest disposable annual income in 2001 (of all children) and was divided into quintiles in the multivariate analyses.

Table 2 – Descriptive statistics of offspring

	No.	%
Highest education of all children		
Compulsory	48,989	6
Upper sec 2y	264,384	32
Upper sec 3-4y	124,061	15
Tertiary<3y	183,535	22
Tertiary>=3y	211,793	25
'Dominant' occupational class (EGP) of all children		
Unskilled manual (VII)	55,374	7
Routine non-manual (IIIb)	109,701	13
Skilled manual (VI)	84,882	10
Intermediate (IIIa)	112,477	14
Lower managerial/ professional (II)	231,580	28
Higher managerial/ professional (I)	155,440	19
Self-employed	27,866	3
No information	55,442	7
Highest income of all children (in 1,000 SEK)		
Mean	2563	
Sd	2040	
Distance closest child - parent in kilometres		
Mean	36	
Sd	98	
Same SAMS %	218,294	26
Total N of parents	832,762	100

[2] I thank Erik Bihagen for sharing syntaxes that linked occupational codes to classes.

Descriptive statistics of children's socioeconomic position

The dominance approach for socioeconomic indicators resulted in a higher proportion of parents with children in tertiary education and a lower proportion with compulsory-educated children, compared to the average numbers in these cohorts. For example, only six per cent of the parents had children with compulsory education only (Table 2), compared to 13 per cent of parents with firstborns with compulsory schooling. The same pattern occurred for class and income, as the 'higher' categories became more common than average numbers in these cohorts. The concentration in advantaged categories of socioeconomic positions may influence the results and should, therefore, be interpreted cautiously. As a sensitivity test, all analyses were repeated for parents with one child. All major deviations are reported.

For correlations between socioeconomic indicators of children, see Table A, and for a cross tabulation of parents' and children's education, see Table B (both in appendix).

Parent-child geographic distance

Geographic distance to the closest living child was derived from SAMS (Small Areas for Market Statistics) of individuals' homes. These areas contain, on average, approximately 1,000 individuals and are compared to municipalities closer to the definition of neighbourhoods (Edling and Rydgren 2012). From the north-east coordinates of each SAMS's population density midpoint, I calculated the distance 'as the crow flies' by means of Pythagoras' theorem.

I assumed that if parents and children lived in the same SAMS, there were no or few geographic obstacles to frequent face-to-face contact. Residence in nearby SAMS was also assumed to facilitate frequent contact.

Ageing parents and their adult children lived rather close to each other in Sweden in 2001; 14 per cent lived in the same SAMS as their first-born child in the current sample. It was even more common for *any* child to reside in the same SAMS (shown in Table 2), which was the case for one-fourth of the parents. Following a complete Swedish cohort, Kolk (2013) showed that the geographic distance to parents did not change much after the age of 25. The youngest children included in the current study were 35 years old.

Because tertiary education is concentrated to larger cities – as are some professional occupations – it is reasonable to assume that well-educated children live farther away from their parents than do less-educated children. There was a clear positive association between

parents' and children's education and distance in the present population sample. For example, children with at least three years of tertiary education lived, on average, 130 km from their parents, compared to 52 km for the least-educated children. The association between children's education and geographic distance to parents was not explained by parents' education or home county (results not shown).

The distribution of geographic distance between child and parent was skewed, with many parents living in the same SAMS as their children and few parents living far from their children. Therefore, in the multivariate analyses, geographic distance was collapsed into the following four categories: (1) same SAMS; (2) <30 km; (3) 30-100 km; (4) >100 km.[3]

Method

In the initial bivariate analyses, incidence rates were defined as number of deaths divided by number of personyears in each group (using the statistical software Stata's *stptime* command).

Cox regression (*stcox* in Stata) was used to estimate hazard ratios (HR) of mortality, with age in months as the time variable and death as the event. Censoring occurred at emigration, child's death or December 2007 (end of follow-up). Individuals entered the analyses in January 2002; therefore, those who died or emigrated before year 2002 were not included.

Mortality was registered for six years, but occurred at different ages (between 62 and 81 years of age). The proportional hazard assumption (tested with Stata's *schoenfeld()* option) was met for key variables (children's socioeconomic indicators). All models controlled for birth cohort and number of children, and analyses were conducted separately for mothers and fathers.

[3] It can be discussed whether a possible benefit from living close is contingent on living next door/very close or whether a couple of hours of travel is sufficient to receive help when needed. In a sensitivity analysis, categories > 150 km and > 300 km were also tested.

Results

Independent variables and mortality – unadjusted associations

The unadjusted mortality rates (nr of deaths per 1,000 personyears) across independent variables are shown in Table 2. Most of these associations are well known from previous research. For example, men and singles had higher death risks than females and married/cohabiting individuals. Parents with one child had higher death rates than parents with two or three children.

For parents' socioeconomic indicators, gradients were mostly clear, with lower survival for individuals with short education and manual occupations compared to people in more advantaged positions. Particularly high mortality rates were found among men outside of the labour market and men with low income.

Concerning adult children's resources, both education and income were negatively associated with parents' mortality rate. For class, parents with children with professional occupations displayed lower mortality than parents with children with manual or routine non-manual occupations.

Fathers who lived farther from their children showed a slight tendency of higher mortality, but no clear association was found for mothers. However, these unadjusted rate differences may be largely explained by confounding factors. Several potential confounders were controlled in the subsequent analyses.

Table 3 – Mortality rates Number of deaths per 1,000 personyears

Parent variables	Fathers	Mothers
Birth cohort		
1926-1930	41.37	25.49
1931-1935	23.98	14.63
1936-1940	14.62	8.71
Nr of children		
1	31.77	19.38
2	24.01	14.62
3	24.82	15.00
4+	31.14	19.21
Partner		
No	39.03	21.17
Yes	24.20	14.56
Education		
Compulsory	29.73	18.87
Upper sec 2y	26.00	14.50
Upper sec 3-4y	23.44	12.90
Tertiary<3y	21.19	10.27
Tertiary>=3y	18.99	9.92

Parent variables	Fathers	Mothers
Occupational class		
Unskilled manual	25.78	13.69
Routine non-manual	26.01	12.67
Skilled manual	22.56	11.77
Intermediate occupations	22.00	12.14
Lower managerial/ professional	20.07	10.15
Higher managerial/ professional	18.09	9.91
Farmers	23.54	11.77
Self-employed	21.28	10.85
Not in labour market	45.35	26.68
Income (quintiles)		
1st (lowest)	38.61	19.69
2	29.92	18.73
3	24.59	16.56
4	21.62	13.90
5th (highest)	17.99	12.09
Distance parent-child		
Same SAMS	25.05	15.99
<30 km	26.53	16.32
30-100 km	27.19	16.40
>100 km	28.35	15.64

Child variables	Fathers	Mothers
Children's education		
Compulsory	34.38	22.71
Upper sec 2y	28.90	18.30
Upper sec 3-4y	26.23	16.29
Tertiary<3y	24.74	14.56
Tertiary>=3y	23.01	13.52
Children's occupational class		
Unskilled manual	29.27	19.01
Routine non-manual	28.96	17.91
Skilled manual	28.57	18.01
Intermediate	26.83	16.18
Lower managerial/ professional	25.21	15.00
Higher managerial/ professional	23.05	13.84
Self-employed	25.87	15.87
No information	28.55	19.49
Children's income (quintiles)		
1st (lowest)	30.92	19.18
2	27.55	16.94
3	26.20	15.82
4	25.18	14.92
5th (highest)	22.01	13.07

Indicators of children's social position and parents' mortality

As previously shown with a somewhat younger study sample[4] (Torssander 2013), children's education was associated with parents' mortality risk (Model I, Tables 4 and 5). This association was expected because children's education reflects parents' resources and, therefore, reveals little about the possible importance of children's education for parents' longevity. The addition of children's class and income did not remove the association between children's education and parents' mortality; the indicators were all independently associated with survival of the older generation (Model II). Gradients – from relatively low risks for advantaged groups to relatively high risks for less advantaged groups – were noticeable for all indicators. However, not all classes differed significantly from the reference category of unskilled manual occupations.

After controlling for socioeconomic indicators of parents and parents' partners (Model IV), significant differences remained for all child indicators. The clearest difference was for children's education, as all categories were significantly different from the reference group of parents with compulsory-educated children. Given children's occupation and income, and net of parents' own position, parents with at least one child with longer tertiary education displayed an approximately 20 per cent lower hazard of dying during the follow-up compared to parents of children with compulsory schooling (HR=0.79 for mothers and 0.81 for fathers).

For class, only parents with children in the higher classes of employed or with self-employed children displayed lower mortality risks than the reference category of unskilled manual occupations. The income gradient became less clear, at least for fathers, when parents' and partners' positions were taken into consideration.

In sum, children's level of education was a key factor when comparing children's various socioeconomic resources. However, children's class and income were also independently related to parents' mortality risk. In particular, parents with children in the lowest income quintile and those with children with unskilled manual occupations faced excess mortality.

There was no apparent evidence that parents' education interacts with the association between children's schooling and parents' survival. The p-value of an increased model fit in Model IV, when adding the product term of children's and parents' education, was 0.43/0.17 (male/female

[4] I analyse older parents to include child factors that preferably should be measured when children are around 35 years old or older.

sample). This result is consistent with a related study on education of offspring and mortality of parent in the US (Friedman and Mare 2010).

In my previous paper on this topic, no significant interaction between parent's gender and children's education was found (Torssander 2013). For the current study population of older parents, however, education of offspring was more strongly related to mothers' survival than to fathers' survival (significant interaction parents' gender *x* children's education in Model IV). However, this was not the case for parents with one child. Furthermore, cohort-stratified analyses did not demonstrate any interactions between gender of parent and schooling of children. A more thorough gender analysis is needed in future research; how children's resources are measured, parents' age, and parity are likely to have an impact.

Table 4 – Socioeconomic position of children. Hazard ratios (HR) from Cox regressions, **mothers**. N=470,995 (43,767 deaths)

	Model I		*Model II*		*Model III*		*Model IV*	
Children's education	**HR**	**95 % CI**	**HR**	**95 % CI**	**HR**	**95 % CI**	**HR**	**95 % CI**
Compulsory	1 (ref)		1 (ref)		1 (ref)		1 (ref)	
Upper sec 2y	**0.88**	0.85,0.91	**0.90**	0.87,0.94	**0.92**	0.89,0.96	**0.94**	0.90,0.97
Upper sec 3-4y	**0.77**	0.74,0.80	**0.81**	0.78,0.85	**0.85**	0.81,0.89	**0.87**	0.84,0.91
Tertiary<3y	**0.69**	0.66,0.71	**0.75**	0.72,0.78	**0.80**	0.77,0.84	**0.83**	0.80,0.87
Tertiary>=3y	**0.60**	0.58,0.63	**0.68**	0.65,0.71	**0.76**	0.73,0.80	**0.79**	0.76,0.83
Children's class								
Unskilled manual			1 (ref)		1 (ref)		1 (ref)	
Routine non-manual			**0.95**	0.91,0.99	0.96	0.92,1.00	0.97	0.93,1.01
Skilled manual			0.96	0.91,1.00	0.96	0.92,1.01	0.97	0.92,1.01
Intermediate			**0.91**	0.87,0.95	**0.92**	0.88,0.96	**0.93**	0.89,0.98
Lower managerial/ professional			**0.89**	0.85,0.93	**0.90**	0.87,0.94	**0.93**	0.89,0.97
Higher managerial/ professional			**0.86**	0.82,0.90	**0.89**	0.85,0.94	**0.92**	0.88,0.97
Self-employed			**0.84**	0.79,0.90	**0.86**	0.81,0.92	**0.90**	0.84,0.96
Children's income								
1st quintile (lowest)			1 (ref)		1 (ref)		1 (ref)	
2			**0.94**	0.92,0.97	**0.95**	0.92,0.98	**0.97**	0.94,0.99
3			**0.91**	0.89,0.94	**0.92**	0.89,0.95	**0.94**	0.91,0.97
4			**0.90**	0.87,0.93	**0.91**	0.88,0.94	**0.94**	0.91,0.97
5th quintile (highest)			**0.86**	0.83,0.89	**0.88**	0.85,0.91	**0.91**	0.88,0.94
Control for parents' and partners' education					**X**		**X**	
Control for parents' and partners' class and income							**X**	

Models include control for number of children and birth cohort.

Table 5 – Socioeconomic position of children. Hazard ratios (HR) from Cox regressions, **fathers**. N=361,767 (53,286 deaths)

	Model I		*Model II*		*Model III*		*Model IV*	
Children's education	**HR**	**95 % CI**	**HR**	**95 % CI**	**HR**	**95 % CI**	**HR**	**95 % CI**
Compulsory	1 (ref)		1 (ref)		1 (ref)		1 (ref)	
Upper sec 2y	**0.88**	0.85,0.91	**0.89**	0.86,0.92	**0.91**	0.88,0.94	**0.92**	0.89,0.95
Upper sec 3-4y	**0.79**	0.76,0.82	**0.82**	0.79,0.85	**0.86**	0.82,0.89	**0.88**	0.84,0.91
Tertiary<3y	**0.72**	0.70,0.75	**0.77**	0.74,0.80	**0.83**	0.79,0.86	**0.85**	0.82,0.89
Tertiary>=3y	**0.64**	0.61,0.66	**0.70**	0.67,0.73	**0.78**	0.75,0.82	**0.81**	0.78,0.84
Children's class								
Unskilled manual			1 (ref)		1 (ref)		1 (ref)	
Routine non-manual			0.99	0.95,1.03	0.99	0.96,1.03	1.00	0.96,1.04
Skilled manual			0.97	0.93,1.01	0.97	0.93,1.01	0.98	0.94,1.02
Intermediate			**0.94**	0.91,0.98	**0.95**	0.92,0.99	0.97	0.93,1.01
Lower managerial/ professional			**0.92**	0.88,0.95	**0.94**	0.91,0.98	**0.96**	0.92,1.00
Higher managerial/ professional			**0.87**	0.83,0.90	**0.90**	0.86,0.94	**0.92**	0.88,0.96
Self-employed			**0.86**	0.81,0.91	**0.88**	0.83,0.93	**0.92**	0.87,0.97
Children's income								
1st quintile (lowest)			1 (ref)		1 (ref)		1 (ref)	
2			**0.93**	0.91,0.96	**0.94**	0.92,0.97	**0.96**	0.93,0.99
3			**0.93**	0.90,0.95	**0.94**	0.92,0.97	**0.97**	0.94,0.99
4			**0.93**	0.90,0.95	**0.95**	0.92,0.97	0.97	0.95,1.00
5th quintile (highest)			**0.87**	0.85,0.90	**0.91**	0.88,0.94	**0.94**	0.91,0.97
Control for parents' and partners' education					**X**		**X**	
Control for parents' and partners' class and income							**X**	

Models include control for number of children and birth cohort.

Children's education and cause of death

In the following analyses, five causes of death were analysed separately (circulatory, all cancers, lung cancer, breast cancer, prostate cancer, and all other causes of deaths grouped). The mortality risks were estimated for educational levels of children, parents and partners (simultaneously), as children's education demonstrated the clearest relationship with parents' mortality compared to the other socioeconomic indicators.

The model of all-cause mortality showed that the education of children, parents, and partners were all associated with parents' risk of dying (Model I, Tables 6 and 7). In line with previous research, mothers and fathers without a cohabiting or married partner had relatively high mortality. However, the partner status variable was derived from the 1990 Census, more than a decade before the start of the follow-up, and should merely be viewed as a category for those with no partner socioeconomic resources at the time of collection of information. Thus, further comment on a partner effect requires more recent and, preferably, time-varying data.

For most specific causes of death, and for both mothers and fathers, children's education was associated with parents' death risks, net of education of the parent him/herself and the partner's education. The exception was fathers' prostate cancer death risks, as there were no significant risk differences across educational groups of children.

Breast cancer and prostate cancer both has a higher incidence (but better survival prognosis) among the higher educated (Harvei & Kravdal 1997; Lagerlund et al. 2005; Nilsen et al. 2000; Vågerö and Persson 1987), resulting in no or reversed socioeconomic mortality patterns. The association between own education and mothers' risk of dying of breast cancer here was in line with these previous results. However, mothers' risk of dying of breast cancer differed according to the education of their children (Model V, Table 6). Mothers with few children displayed higher breast cancer mortality than mothers with many children; number of children was controlled in the analyses. Moreover, mother's age at first birth did not explain this relationship.

The mortality differences across children's education persisted when controls for class and income of parent and partner were added (results not shown). Hence, other socioeconomic indicators at the parental level did not account for the relationship between children's education and cause-specific mortality.

Table 6 – Causes of death, mothers. Hazard ratios (HR) for education of children, self (i.e., parent), and partner for different causes of death.

	I All causes		*II Circulatory*		*III Cancer*		*IV Lung cancer*		*V Breast cancer*		*VI Other*	
	HR	**95 % CI**	**HR**	**95 % CI**	**HR**	**95 % CI**	**HR**	**95 % CI**	**HR**	**95 % CI**	**HR**	**95 % CI**
Children's education												
Compulsory	1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)	
Upper sec 2y	**0.90**	0.87,0.93	**0.86**	0.81,0.92	**0.93**	0.87,0.98	0.89	0.78,1.02	**0.81**	0.68,0.97	**0.92**	0.86,0.99
Upper sec 3-4y	**0.81**	0.78,0.84	**0.74**	0.69,0.79	**0.88**	0.82,0.94	**0.77**	0.66,0.90	**0.79**	0.65,0.97	**0.82**	0.76,0.89
Tertiary<3y	**0.74**	0.72,0.77	**0.65**	0.61,0.70	**0.84**	0.79,0.89	**0.71**	0.61,0.82	**0.77**	0.64,0.93	**0.74**	0.68,0.79
Tertiary>=3y	**0.69**	0.67,0.72	**0.62**	0.58,0.66	**0.78**	0.73,0.83	**0.60**	0.52,0.70	**0.74**	0.61,0.90	**0.69**	0.64,0.74
Parent's education												
Compulsory	1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)	
Upper sec 2y	**0.89**	0.87,0.91	**0.84**	0.81,0.88	**0.91**	0.88,0.94	**0.90**	0.83,0.97	0.94	0.84,1.04	**0.90**	0.87,0.94
Upper sec 3-4y	**0.86**	0.81,0.91	**0.75**	0.67,0.83	0.96	0.88,1.04	1.02	0.84,1.24	0.85	0.65,1.11	**0.83**	0.74,0.93
Tertiary<3y	**0.73**	0.69,0.76	**0.63**	0.58,0.69	**0.83**	0.78,0.89	**0.68**	0.57,0.81	1.18	0.99,1.40	**0.67**	0.61,0.74
Tertiary>=3y	**0.70**	0.67,0.74	**0.55**	0.49,0.61	**0.82**	0.76,0.88	**0.55**	0.45,0.68	1.20	0.99,1.45	**0.69**	0.62,0.76
Partner's education												
Compulsory	1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)	
Upper sec 2y	0.98	0.95,1.01	0.99	0.94,1.05	0.97	0.93,1.02	0.98	0.87,1.10	1.12	0.97,1.28	0.96	0.90,1.02
Upper sec 3-4y	**0.94**	0.90,0.97	**0.86**	0.80,0.92	0.96	0.90,1.01	0.93	0.81,1.07	1.09	0.94,1.28	0.98	0.91,1.05
Tertiary<3y	**0.92**	0.87,0.97	**0.83**	0.75,0.92	0.98	0.90,1.06	1.00	0.82,1.22	1.17	0.95,1.45	0.92	0.82,1.02
Tertiary>=3y	**0.89**	0.85,0.94	**0.75**	0.68,0.84	0.97	0.90,1.04	0.94	0.77,1.15	1.18	0.97,1.43	**0.89**	0.80,0.99
No partner	**1.31**	1.29,1.35	**1.39**	1.33,1.44	**1.16**	1.12,1.20	**1.54**	1.42,1.68	1.08	0.97,1.22	**1.47**	1.41,1.54
N	470,995		470,995		470,995		470,995		470,995		470,995	
Nr of deaths	43,767		14,013		17,993		3,145		2,026		11,761	

Models include control for number of children and birth cohort.

Table 7 – Causes of death, fathers. Hazard ratios (HR) for education of children, self (i.e., parent), and partner for different causes of death.

	I All causes		*II Circulatory*		*III Cancer*		*IV Lung cancer*		*V Prostate cancer*		*VI Other*	
	HR	**95 % CI**	**HR**	**95 % CI**	**HR**	**95 % CI**	**HR**	**95 % CI**	**HR**	**95 % CI**	**HR**	**95 % CI**
Children's education												
Compulsory	1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)	
Upper sec 2y	**0.90**	0.87,0.93	**0.86**	0.81,0.91	**0.94**	0.88,0.99	**0.88**	0.78,0.99	0.98	0.85,1.13	**0.92**	0.86,0.99
Upper sec 3-4y	**0.83**	0.80,0.87	**0.79**	0.74,0.84	**0.88**	0.83,0.94	**0.75**	0.65,0.86	0.91	0.78,1.06	**0.85**	0.79,0.92
Tertiary<3y	**0.79**	0.76,0.82	**0.76**	0.72,0.80	**0.84**	0.79,0.90	**0.73**	0.64,0.83	0.88	0.76,1.03	**0.77**	0.72,0.84
Tertiary>=3y	**0.73**	0.71,0.76	**0.70**	0.65,0.74	**0.80**	0.75,0.85	**0.65**	0.56,0.75	0.89	0.77,1.04	**0.70**	0.65,0.76
Parent's education												
Compulsory	1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)	
Upper sec 2y	**0.96**	0.94,0.98	**0.95**	0.92,0.99	**0.95**	0.92,0.99	**0.88**	0.81,0.96	0.92	0.84,1.01	0.99	0.94,1.03
Upper sec 3-4y	**0.91**	0.88,0.93	**0.84**	0.80,0.88	0.96	0.92,1.00	0.91	0.82,1.00	0.95	0.86,1.05	**0.94**	0.89,0.99
Tertiary<3y	**0.85**	0.82,0.88	**0.79**	0.74,0.84	**0.92**	0.87,0.98	**0.78**	0.67,0.90	1.00	0.87,1.14	**0.84**	0.77,0.91
Tertiary>=3y	**0.78**	0.75,0.81	**0.72**	0.68,0.77	**0.85**	0.80,0.90	**0.68**	0.59,0.80	**0.84**	0.73,0.96	**0.77**	0.71,0.83
Partner's education												
Compulsory	1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)	
Upper sec 2y	**0.96**	0.94,0.98	**0.91**	0.88,0.95	0.99	0.95,1.02	0.95	0.88,1.03	1.04	0.95,1.13	0.98	0.93,1.03
Upper sec 3-4y	**0.93**	0.89,0.99	**0.87**	0.79,0.95	0.96	0.89,1.05	0.95	0.78,1.15	0.89	0.73,1.10	1.00	0.89,1.11
Tertiary<3y	**0.91**	0.87,0.95	**0.84**	0.78,0.90	0.99	0.93,1.06	**0.75**	0.63,0.89	1.12	0.97,1.29	**0.88**	0.80,0.96
Tertiary>=3y	**0.84**	0.80,0.88	**0.76**	0.70,0.82	**0.90**	0.84,0.97	**0.66**	0.54,0.80	1.03	0.88,1.21	**0.87**	0.79,0.96
No partner	**1.59**	1.55,1.63	**1.64**	1.58,1.70	**1.27**	1.22,1.32	**1.56**	1.44,1.69	**1.15**	1.05,1.27	**2.05**	1.96,2.14
N	361,767		361,767		361,767		361,767		361,767		361,767	
Nr of deaths	53,286		20,873		19,743		3,912		3,800		12,670	

Models include control for number of children and birth cohort.

Parent-child geographic distance and parents' survival

According to the mortality rates in Table 3, fathers who lived farther from their offspring displayed higher mortality, but there was no clear difference for mothers. However, at least two factors could blur a possible relationship between parent-child geographic distance and parents' survival. First, life expectancy differs between regions (Statistics Sweden 2011b) and distance between parents' and children's homes may equally vary across parts of Sweden. Second, it is clear that both children's and parents' education is associated with geographic distance.

To examine this pattern further, Model I from Tables 6 and 7 were repeated for those parents for whom it was possible to derive information about geographic distance to their children (469,541 mothers and 360,331 fathers, representing 99.7 per cent of the previously included individuals). The measure of children's education was changed from highest education of all of a parent's children to the education of the closest living child. The correlation between the different measurements of children's education was 0.76, and the hazard ratios for children's education were similar between the models (compare Model I in Table 8 to Model I in Tables 6 and 7). Hence, the minor changes of study population and children's education did not alter the results.

In Model II (Table 8), geographic distance and a control for county were added. As the distance between the adult child and parent increased, the parent's mortality risk increased. This pattern persisted when all three indicators of parental socioeconomic position were added (Model III). Compared to living in the same SAMS, parents whose children lived more than 100 km away had a relative death hazard of 1.07 (mothers) or 1.14 (fathers).[5] To some extent, education obscured the association between geographic distance and parents' survival (compare Table 3), as less-educated family members lived closer to each other.

The inclusion of an interaction term (combinations of geographic distance and children's education) to Model III yielded no significance, and the model fit was not improved ($p=0.19$ for fathers and $p=0.74$ for mothers). The hypothesis that children's education is more important if the parent and child reside in close proximity was, thus, not supported.

[5] Most parents lived close to their children, and this categorical distance variable did not distinguish between long distances (>100 km). Hazard ratios for > 150 km were 1.14 (1.10-1.18) for fathers and 1.08 (1.03-1.13) for mothers; > 300 km 1.16 (1.10-1.22) for fathers and 1.07 (1.00-1.14) for mothers, all compared to the reference category of living in the same neighborhood and controlled for education of children and socioeconomic indicators of parents and partners (i.e. as in Model III, Table 8).

Moreover, a sensitivity analysis of parents with one child yielded no significant association between mothers' survival and geographic distance to the adult child. For fathers with one child, the hazard ratio of living more than 100 km away from the child (compared to living in the same neighbourhood) was significant but had a wide confidence interval that was close to 1 (HR=1.08; 1.002-1.15).

Table 8 – Geographic distance. Hazard ratios (HR) from Cox regressions.

	Mothers						Fathers					
	Model I		*Model II*		*Model III*		*Model I*		*Model II*		*Model III*	
	HR	**95 % CI**	**HR**	**95 % CI**	**HR**	**95 % CI**	**HR**	**95 % CI**	**HR**	**95 % CI**	**HR**	**95 % CI**
Distance to closest living child												
Same SAMS			1 (ref)		1 (ref)				1 (ref)		1 (ref)	
<30 km			**1.04**	1.02,1.07	**1.05**	1.02,1.07			**1.06**	1.04,1.09	**1.06**	1.04,1.08
30-100 km			**1.08**	1.04,1.12	**1.07**	1.03,1.11			**1.09**	1.06,1.13	**1.07**	1.04,1.11
>100 km			**1.08**	1.04,1.12	**1.07**	1.03,1.12			**1.16**	1.13,1.20	**1.14**	1.10,1.17
Education of closest living child*												
Compulsory	1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)		1 (ref)	
Upper sec 2y	**0.88**	0.86,0.91	**0.88**	0.86,0.90	**0.90**	0.88,0.92	**0.91**	0.89,0.93	**0.91**	0.89,0.93	**0.92**	0.90,0.95
Upper sec 3-4y	**0.81**	0.79,0.84	**0.80**	0.78,0.83	**0.84**	0.81,0.87	**0.84**	0.81,0.87	**0.83**	0.81,0.86	**0.86**	0.83,0.89
Tertiary<3y	**0.76**	0.74,0.79	**0.75**	0.73,0.78	**0.79**	0.77,0.82	**0.79**	0.76,0.81	**0.78**	0.75,0.80	**0.81**	0.79,0.84
Tertiary>=3y	**0.72**	0.70,0.75	**0.71**	0.69,0.74	**0.75**	0.72,0.78	**0.75**	0.73,0.78	**0.74**	0.71,0.76	**0.78**	0.75,0.80
Control for												
parent's education	X		X		X		X		X		X	
partner's education	X		X		X		X		X		X	
class and income of parent and partner					X						X	
county			X		X				X		X	
Total N	469,541		469,541		469,541		360,331		360,331		360,331	

All models include control for birth cohort and number of children

*The distribution of this variable is as follows: compulsory: 14%, secondary 2 y: 39%, secondary 3-4 y: 14%, tertiary<3 y: 17%, tertiary ≥ 3 y: 16%

Discussion

Compared to research on the importance of parents' socioeconomic position for children's later-life health, the transmission of resources from children to parents is an understudied topic. The purpose of the current study is to further examine this subject. In the comparison of children's various socioeconomic resources, education, class and income all seem to be associated with parents' survival.

The association – and gradient – is particularly clear for children's education. This points towards non-material explanations in which the education of children might yield health advantages regardless of children's labour market position and returns. Still, the influence from children to parents is not yet verified. The relationship between children's education and parents' mortality is equally strong across distances between children's and parents' homes, pointing towards non-causal explanations. The underlying assumption to such an interpretation is that children's resources are likely to be more available to the parent if they reside in close proximity.

Geographic distance to children is associated with parents' mortality per se. When the socioeconomic positions of both generations were controlled, parents' who lived farther from their children had a higher risk of dying compared to parents with children who lived in the same neighbourhood. However, this result should not be overemphasised because it was not significant for all subgroups (for example, mothers with one child only) and other factors must also be considered. For example, migration decisions may be influenced by the health status of parents. Hence, before further conclusions can be drawn about geographic distance and parents' health and mortality, additional aspects of parents' and children's lives must be considered.

My hypothesis, however, is that there are at least two separate processes at work. One process concerns practical domestic help, which benefits parents who live near their children. The other process concerns the gains of having children with substantial resources, e.g., informational advantages and social influence or non-causal mechanisms reflected in these variables. It is also possible that the assumption that geographic proximity is important for access to resources is not fully correct for all types of resources. For example, several issues may be solved through phone calls and visits from far distances (which children with advantaged positions can afford).

Although children's education shows the clearest association with parents' survival, class and income also have significant effects (net of

parents' socioeconomic position). Parents of children in the lowest income quintile have higher mortality than parents of children in other income categories. Apart from a possible selection effect, this may have two causal interpretations. First, these parents must support their adult children economically and, hence, are less able to retain their own resources. Second, these parents worry more about their children and, therefore, have higher degrees of ill-health.

One explanation of the net effect of children's occupational class is an association between class and possibility of having contact with an individual with knowledge of the health care system. These explanations are tentative, and more research on specific links is needed.

The parental causes of death that are associated with children's education may provide insight into why adult children's resources are associated with parents' survival. Previous research has shown that causes of death related to alcohol and smoking are more strongly related to children's schooling than are other causes (Friedman & Mare 2010). The current cause-specific analyses reveal that children's education seems to be related – however to varying degrees – to the major cause groups of circulatory and cancer diseases, which are both linked to numerous proximate and distant risk factors (as well as more and less preventable conditions). In line with the estimates for individual social position, the gradient across children's education is steeper for circulatory mortality than for cancer mortality.

Lung cancer mortality, which in nearly all cases hit smokers (Doll and Peto 1981), also has a strong association with children's education. This may imply that children's educational level is associated with the parents' likelihood of smoking (or quit smoking), which has been previously suggested by Friedman and Mare (2010). Still, many parents who quit smoking plausibly did so before their children completed their education. Thus, it is possible that children's education reflects the parental characteristics or circumstances that influence the likelihood of (quitting) smoking. Interestingly, however, the association reveals that there are certain factors – linked to children's education net of parents' own socioeconomic resources – that are central to survival.

There is a significant association between breast cancer mortality and children's education. The risk of developing breast cancer is merely linked to reproductive factors that occur before children's attainments, such as parity and mother's age at first birth (Leon 1989). Any effect of children's education (net of these aspects) is likely to run through treatment or, perhaps, timing of diagnosis/early detection. If such factors are, indeed, related to adult children's resources, this relationship must be evaluated in future research.

To sum, although the present study does not provide a clear answer to why children's resources are linked to parents' survival, the picture of the association is somewhat clearer. The cause-specific and geographic analyses were conducted for children's education, which seems to be the key factor. However, the other indicators of children's socioeconomic position – class and income – are also (independently of each other) associated with parents' all-cause mortality risk. If a causal effect is operating, it is not determined by geographic proximity.

The intriguing finding that children's education is linked to breast cancer survival among mothers points towards treatment differences according to children's socioeconomic resources. However, children's education may also capture a level of general advantage of parents. The topic of whether children's socioeconomic positions are linked to the likelihood of developing disease and/or the chances of treating them should be central in future research on the importance of children's resources for parents' survival.

References

Beller E. 2009. Bringing intergenerational social mobility research into the twenty-first century: why mothers matter. *American Sociological Review*, 74: 507-528.

Berkman LF, Glass T, Brissette I & Seeman TE. 2000. From social integration to health: Durkheim in the new millennium. *Social science & medicine* 51: 843-857.

Björnberg U & Latta M. 2007. The Roles of the Family and the Welfare State The Relationship between Public and Private Financial Support in Sweden. *Current sociology*, 55: 415-445.

Björnberg U & Ekbrand H. 2008. Financial and practical kin support in Sweden. *Journal of Comparative Family Studies*, *39:* 73-95.

Burström B. 2002. Increasing inequalities in health care utilisation across income groups in Sweden during the 1990s? *Health Policy* 62: 117-129.

Cavalli-Björkman N, Lambe M, Eaker S & Sandin F. 2011. Differences according to educational level in the management and survival of colorectal cancer in Sweden. *European Journal of Cancer* 47: 1398-1406.

Christakis NA & Fowler JH. 2007. The spread of obesity in a large social network over 32 years. *New England journal of medicine* 357: 370-379.

Christakis NA & Fowler JH. 2008. The collective dynamics of smoking in a large social network. *New England journal of medicine* 358: 2249-2258.

Doll R & Peto R. 1981. *The causes of cancer: Quantitative estimates of avoidable risks of cancer in the United States today*. Oxford: Oxford University Press.

Due P, Holstein B, Lund R, Modvig J & Avlund K. 1999. Social relations: network, support and relational strain. *Social science & medicine*, 48: 661-673.

Edling C & Rydgren, J. 2012. Neighborhood and friendship composition in adolescence. *Sage Open 2*(4).

Erikson R. 1984. Social class of men, women and families. *Sociology*, 18:500–14.

Erikson R & Goldthorpe JH. 1992. *The constant flux: A study of class mobility in industrial societies*. Oxford: Clarendon Press.

Erikson R & Torssander J. 2008. Social class and cause of death. *The European Journal of Public Health*, 18: 473-478.

Ermisch J & Francesconi M. 2001. Family matters: Impacts of family background on educational attainments. *Economica* 68: 137-156.

Ermisch J. 2009. "Adult child-parent relationships" Pp 127-145 in Brynin and Ermisch (eds) *Changing relationships* New York: Routledge.

Fingerman KL, Cheng YP, Birditt K & Zarit S. 2012. Only as Happy as the Least Happy Child: Multiple Grown Children's Problems and Successes and Middle-aged Parents' Well-being. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 67: 184-193.

Fors S & Lennartsson C. 2008. Social mobility, geographical proximity and intergenerational family contact in Sweden. *Ageing & Society,* 28: 253-270.

Friedman EM & Mare RD. 2010/2013. Education of children and differential mortality of parents: Do parents benefit from their children's attainments? *California Center for Population Research: On-line Working Paper Series*. PWP-CCPR-2010-011. [Updated and extended version from 2013 (unpublished).]

Friedman EM & Seltzer JA. 2010. Providing for older parents: Is it a family affair? *California Center for Population Research: On-line Working Paper Series*. PWP-CCPR-2010-012.

Fritzell J & Lennartsson C. 2005. Financial transfers between generations in Sweden. *Ageing and Society* 25: 397-414.

Geyer S, Hemström Ö, Peter R & Vågerö D. 2006. Education, income, and occupational class cannot be used interchangeably in social epidemiology. Empirical evidence against a common practice. *Journal of Epidemiology and Community Health* 60: 804-810.

Hank K. 2007. Proximity and contact between older parents and their children. A European comparison. *Journal of Marriage and the Family,* 69: 157-173.

Harvei S & Kravdal Ø. 1997. The importance of marital and socioeconomic status in incidence and survival of prostate cancer. *Preventive medicine*, 26: 623-632.

Holmlund H, Rainer H & Siedler T. 2013. Meet the parents? Family size and the geographic proximity between adult children and older mothers in Sweden. *Demography,* 50: 903-931.

Hoyert DL. 1991. Financial and household exchanges between generations. *Research on aging,* 13: 205-225.

Kalmijn M. 2006. Educational inequality and family relationships: Influences on contact and proximity. *European Sociological Review,* 22: 1-16.

Kolk M. 2013. A life course analysis of geographical distance to siblings, parents and grandparents in Sweden. Unpublished working paper.

Kravdal Ø. 2008. A broader perspective on education and mortality: Are we influenced by other people's education? *Social Science & Medicine,* 66: 620-636.

Lagerlund M, Bellocco R, Karlsson P, Tejler G and Lambe M. 2005. Socio-economic factors and breast cancer survival – a population-based cohort study (Sweden). *Cancer Causes and control,* 16: 419-430.

Lawlor DA & Mishra GD. 2009. "Why family matters: An introduction." Pp 1-9 in Lawlor and Mishra (eds.) *Family Matters* Oxford: University Press.

Leon DA. 1989. A prospective study of the independent effects of parity and age at first birth on breast cancer incidence in England and Wales. *International Journal of Cancer*, 43: 986-991.

Litwak E & Kulis S. 1987. Technology, proximity, and measures of kin support. *Journal of Marriage and Family,* 49: 649-661.

Lund R, Due P, Modvig J, Holstein BE, Damsgaard MT & Andersen PK. 2002. Cohabitation and marital status as predictors of mortality—an eight year follow-up study. *Social science & medicine*, 55: 673-679.

Lye DN. 1996. Adult child–parent relationships. *Annual review of sociology*, 22: 79-102.

Malmberg G & Pettersson A. 2007. Distance to elderly parents: Analyses of Swedish register data. *Demographic Research* 17: 679-704.

Manzoli L, Villari P, Pirone G & Boccia A. 2011. Marital status and mortality in the elderly: a systematic review and meta-analysis. *Social Science & Medicine*, 64: 77-94.

Martikainen P. 1995. Socioeconomic mortality differentials in men and women according to own and spouse's characteristics in Finland. *Sociology of Health & Illness*, 17: 353-375.

Monden CW, van Lenthe F, De Graaf ND & Kraaykamp G. 2003. Partner's and own education: does who you live with matter for self-assessed health, smoking and excessive alcohol consumption?. *Social Science & Medicine*, 57: 1901-1912.

Nilsen TL, Johnsen R & Vatten LJ. 2000. Socio-economic and lifestyle factors associated with the risk of prostate cancer. *British Journal of Cancer*, 82: 1358-1363.

Shelton N & Grundy E. 2000. Proximity of adult children to their parents in Great Britain. *International Journal of Population Geography,* 6: 181-195.

Silverstein M, Bengtsson VL & Lawton L. 1997. Intergenerational solidarity and the structure of adult child-parent relationships in American families. *American Journal of Sociology,* 103: 429-460.

Skalická V & Kunst AE. 2008. Effects of spouses' socioeconomic characteristics on mortality among men and women in a Norwegian longitudinal study. *Social Science & Medicine, 66,* 2035-2047.

SKL (Swedish Association of Local Authorities and Regions) & Socialstyrelsen (The National Board of Health and Welfare). 2012. Öppna jämförelser av hälso- och sjukvårdens kvalitet och effektivitet: Jämförelse mellan landsting 2012. Rapport.

Smith GC. 1998. Residential separation and patterns of interaction between elderly parents and their adult children. *Progress in Human Geography*, 22: 368-384.

Statistics Sweden [Statistiska centralbyrån]. 2005. *En longitudinell databas kring utbildning, inkomst och sysselsättning (LOUISE) 1990-2002.* Örebro: Serien bakgrundsfakta 2005:1.

Statistics Sweden [Statistiska centralbyrån]. 2008. Multi-generation Register 2007 – A Description of Contents and Quality. Retrieved from http://www.scb.se/statistik/_publikationer/BE9999_2007A01_BR_BE96BR0802.pdf

Statistics Sweden [Statistiska centralbyrån]. 2011a. *Yrkesregistret med yrkesstatistik. En beskrivning av innehåll och kvalitet.* Örebro: Serien bakgrundsfakta 2011:5.

Statistics Sweden [Statistiska centralbyrån]. 2011b. Livslängden i Sverige 2001-2010. Livslängdstabeller för riket och länen. Demografiska rapporter 2011:2.

Stringhini S, Sabia S, Shipley M, Brunner E, Nabi H, Kivimaki M & Singh-Manoux A. 2010. Association of socioeconomic position with health behaviors and mortality. *JAMA: the Journal of the American Medical Association*, 303: 1159-1166.

Torssander J & Erikson R. 2009. Marital partner and mortality: The effects of the social positions of both spouses. *Journal of Epidemiology and Community Health, 63,* 992-998.

Torssander J & Erikson R. 2010. Stratification and mortality: A comparison of education, class, status, and income. European Sociological Review, 26: 465-474.

Torssander, J. 2013. From Child to Parent? The Significance of Children's Education for Their Parents' Longevity. *Demography* 50: 637-659.

Umberson D. 1992. Relationships between adult children and their parents: Psychological consequences for both generations. *Journal of Marriage and the Family*, 54: 664-674.

Vågerö D and Persson G. 1987. Cancer survival and social class in Sweden. *Journal of Epidemiology and Community Health,* 41: 204-209.

Wass C. 2001. *Tidsseriebrott i utbildninsregistret.* Statistics Sweden, retrieved from www.scb.se/statistik/UF/UF0506/_documents/MetodstudieslutverRev.pdf

Zimmer Z, Martin LG, Ofstedal MB & Chuang YL. 2007. Education of adult children and mortality of their elderly parents in Taiwan. *Demography*, 44: 289-305.

Appendix

Table A Spearman correlation coefficients for socioeconomic indicators of children (due to the dominance approach, it is not necessarily the same child that determines all indicators).

	Education	**Income**	**Class**
Education	1		
Income	0.27	1	
Class	0.59	0.39	1

Table B Proportions of parents' education by children's education (%)

	Children's education				
Parent's education	**Compulsory**	**Upper sec 2y**	**Upper sec 3-4**	**Tertiary<3y**	**Tertiary>=3y**
Compulsory	8	39	16	20	17
Upper sec 2y	5	31	16	24	24
Upper sec 3-4	3	21	15	27	34
Tertiary<3y	2	16	13	27	43
Tertiary>=3y	1	7	9	21	62