Examining the Effects of Children's Education and their Geographical Location on Parents' Health in Europe

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Abstract

Although an association between children's education and their parents' health is expected because children's level of education largely reflects the socioeconomic resources in the parental household, we still know too little about this complex relationship. The aim of this paper is to further explore the effect of children's education on parents' health in the European setting by taking into consideration potential confounding variables such as parents' education and socioeconomic characteristics as well as specific information on the geographical proximity between adult children and their parents. Examining the potential interaction of child-to-parent health transmission is seen as fundamental in today's ageing societies, particularly in a context where family members are less likely to co-reside or to live in close proximity than in the past. For this purpose, we use data from the Survey on Health, Age and Retirement in Europe (SHARE). After controlling for a set of potential confounding variables, our results suggest that parents whose children are highly educated are less likely to experience poor health (OR of high educated=0.884, p-value<0.01) or hypertension (OR of high educated=0.889, p-value<0.01) compared to their counterparts whose children have lower levels of education. Our results also reveal that the effect of children's education on parents' health operates at various geographical distances, thus highlighting that such association is important regardless of whether geographical proximity or co-residence takes place. Although this correlation does not necessarily represent causality, it does suggest that parents with high educated children may have an advantage for their health.

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Introduction

There has been a growing debate about how far changes in the demographic profile of European societies will constitute a burden on national healthcare systems and social care. Generally, there seems to be widespread consensus that the increase in the elderly population will put much greater pressure on healthcare systems and care-home capacity while, at the same time, the prevalence of informal care given by adult children will remain pivotal (see, for instance, OECD 2005).

The motivation of adult children to provide social support to their older parents is partially rooted in earlier family experiences and guided by an implicit social contract that ensures long-term reciprocity (Reher, 1998; Stein et al, 1998; Klein Ikkink et al, 1999; Silverstein et al, 2002; Grundy, 2005; Gans and Silverstein, 2006). In traditional societies that feature close family ties, including co-residence between parents and children, but lack a reliable public support system, the old age security hypothesis argues that parents invest in children's education so that future 'upward' intergenerational transfers are more likely to occur (Nugent, 1985). However, although the potential significance of children's resources for parents' health is most likely to occur in countries where co-residence is more common (Torssander, 2012), it is expected that such relationship is also significant in Western countries where frequency of contact and geographical proximity between adult children and their parents have come to replace co-residence as indicator of 'family solidarity' (Silverstein and Bengtson, 1997; Dykstra and Fokkema, 2011).

Numerous studies have shown associations between indicators of socioeconomic status such as education and proximity – as education rises, mobility increases and proximity decreases (Clark and Wolf, 1992; Rogerson et al, 1993; Lin and Rogerson, 1995). Due to the greater dispersal of specialist than non-specialist jobs, the highly educated are more likely to accept a job far from their home and to migrate for that job (Börsch-Supan, 1990; van Ham, 2001). Thus, education is seen as an important predictor of migration behaviour with spatial implications for the spatial distribution of adult children and their elderly parents (Crimmins and Ingegneri, 1990; Rogerson et al, 1993, 1997; Lin and Rogerson; Silverstein, 1995; Grundy, 2000; Shelton and Grundy, 2000; Michielin et al, 2008). The results from these studies suggest that adult children with higher levels of education tend to live further away from their parents than the less well-educated. According to Kalmijn (2006) the educational gradient with regard to proximity between adult children and their parents can be expressed as follows: for each year of schooling there is a 17 percent increase in distance between them.

Geographical proximity can be expected to have an important influence on contacts and solidarity between family members. Generally, studies indicate that providing practical support to elderly parents is becoming more difficult due to ever increasing distances between parents and children, and the labour force participation of sons and daughters (Dooghe, 1992; Evandrou and Glaser, 2004). Some studies in Europe indicate a strong impact of distance on support from family members, particularly from siblings and fathers but less so from mothers and children. While some forms of support are given without frequent face-to-face contact such as social-emotional support, which is often provided more through frequent telephone than frequent visiting (Hoyert, 1991; De Jong Gierveld and Fokkema, 1998), it is well-established that some types of support (e.g. instrumental) are subject to close proximity between adult children and elderly parents (Litwak and Kulis, 1987; Litwak and Longino, 1987; Longino et al, 1991; Speare et al, 1991).

However, it is worthy of note that contact and geographical proximity are not always beneficial. For instance, some studies highlight that the excessive reliance and caregiving burden on children may even reduce elderly parents' incentive to invest in their health, thus having negative consequences for their health in later life (Cameron and Cobb-Clark, 2001; Johar and Maruyama, 2011). Similarly, it has been noted that too much support from offspring may result in passive behaviours of the elderly, which is detrimental among other things for their cognitive functioning (Bonsang and Borbone, 2013).

Despite the obvious geographical context of research on proximity to kin and health, there has been little research which refers to Western countries that considers the explicit relationship between children's education and parent's health while taking into account differences due to propinquity. For instance, research undertaken by Friedman and Mare (2010) in the US and Torssander (2012) suggests the existence of an association between children’s education and parents' longevity but without including a specific variable on geographical distance between adult children and their elderly parents.

This is of particular importance as previous studies investigating the relationship under consideration (Zimmer et al, 2002; Zimmer and Kwong, 2003; Zimmer et al, 2007) have focused on societies (e.g. China and Taiwan) which tend to experience tight familial integration and high rates of adult-child co-residency -much more so than is typical in Western countries (Becker, 1981; van de Kaa, 1994). Although children's education might be more influential on parents' outcomes in traditional societies due to sharing of health-related information between child and parent, the quality of caregiving efforts, or monetary assistance for medical and other services, further testing in Western societies is also needed (Zimmer et al, 2002). Numerous studies have shown that contacts and exchanges of support between adult children and their parents are substantial in Western countries (Finch, 1989; McGlone et al, 1998; Shelton and Grundy, 2000), and for many older Western parents ties with adult children represent a major element of their social networks, and a predominant potential source of extra household support (Smith, 1998; Silverstein et al, 2002, 2006).

The aim of this paper is to contribute to further understanding of the effects of highly educated children on parents’ health in Europe by taking into consideration whether the potential upward transfer of intergenerational health-knowledge is mediated by geographical proximity or co-residence. Our hypothesis is that adult children’s education affects positively elderly parents’ health regardless of whether geographical proximity or co-residence takes place. Despite this probable association, such hypothesis has not been tested to the best of our knowledge. Using representative survey data from SHARE, we provide a general insight into these concurrent effects in contemporary Europe.

Background

While a large and growing body of literature has investigated various relationships between individual-level socioeconomic status and health and survival (Kaplan et al, 1996; Smith and Kington, 1997; Lynch et al, 1997, 2001; Lynch, 2003; Ram, 2006; Wilkinson and Pickett, 2006), research on family-level measures is still scarce. Although various studies have analysed some important aspects such as the effect of widowhood (Waite, 1995; Elwert and Christakis, 2008; Boyle et al, 2011) as well as the effect of socioeconomic resources of one member of a married couple on the other (Smith and Zick, 1994), other aspects remain under-researched such as the effects of children's education on their parents' health and/or survival. It is worthy of note, however, that the few studies to date have highlighted the importance of this relationship. For instance, in Zimmer and colleague's work, children's education is associated with older parents' physical functioning in China and Taiwan and with mortality in Taiwan (Zimmer et al, 2002; Zimmer and Kwong, 2003; Zimmer et al, 2007).

It is generally accepted that social relationships with family and friends have the potential for both health promoting and health damaging effects in older adults (Seeman, 2000; Marmot et al, 2003). Such evidence suggests that the social environment could play an important role in health outcomes in older adults. Similarly, theories about social networks and health suggest various pathways through which social contacts may influence health (Berkman and Glass, 2000). According to Torssander (2012: 638) "three of these pathways are potentially relevant for child-to-parent transmission: provision of social support, social influence, and access to resources".

The first pathway, social support, includes various types of support, such as emotional, instrumental, and informational support. The second pathway, social influence, is another causal mechanism which is strongly linked to health behaviour. Interest in social influence or health behaviour is based upon two assumptions: (a) a significant proportion of the mortality from leading causes of death is caused by the behaviour of individuals; and (b) such behaviour is modifiable (Conner and Norman, 1996). Finally, the third pathway, access to resources, traditionally refers to material resources although, as Torssander also notes, it may be possible to share the nonmaterial returns of education. For instance, it has been suggested that education increases individuals' understanding of health issues and, therefore, it is expected that such skills benefit not only one's health but also others (Cutler and Lleras-Muney, 2010). The underlying idea is that adult children with higher levels of education are in a position of better health, better access to information, and greater financial resources to provide better care to their elderly parents than their less educated counterparts. This is in keeping with Link and Phelan's (1995) hypothesis that higher levels of education provide individuals with greater access to health information and newer medical technologies. For this reason, it could be understood that more educated children who have better health themselves are not only a good influence on parental behaviours but may also be more likely to provide support than their counterparts in poor health (Eggebeen and Hogan, 1990).

Recent work by Friedman and Mare (2010) in the US clearly demonstrates that son's and daughter's education has independent effects on parents' mortality. In addition, they also found that part of the association between children's education and parents' survival can be explained by the health behaviours of parents, particularly in terms of smoking and exercise. Similarly, research undertaken by Torssander (2012) highlights the existence of an association between children's education and parents' longevity in Sweden. Her study demonstrates that the relationship between children's education and their parents' longevity cannot be fully explained by the socioeconomic resources of either the parents or their partners after taking into account family fixed effects for the parent generation.

Within this context, it may be that highly educated children who exceed parents in educational attainment may be in a position to provide less-educated parents the health knowledge enjoyed by the more educated. One can argue that such health knowledge transfer can also occur in the case of more educated parents when they are not fully aware of the latest technology and health information. In other words, highly educated children may be generally in a good position for parents to stay abreast with the most recent developments. The situational advantage with respect to information is in line with Berkman and colleagues' (2000) theoretical contribution on how social networks –including family and even broader networks of neighbours and friends- impact health and survival. Although the idea that the health characteristics and behaviour of others in one's family and broader network can influence the whole network is hardly new (Fowler and Christakis, 2008), research to date has mostly focused on the health interdependence of the married couple (Lillard and Waite, 1995; Elwert and Christakis, 2008) and related siblings (Boyle et al, 2001; Rajan et al, 2003).

As Friedman and Mare (2010) note in the context of child-to-parent transmission of health knowledge, two broad categories of mechanisms can be considered: direct and indirect. While children may directly affect parents' health by consciously providing better access to information and care that improve their parents' health, they may also affect parents' health through health "spillover" or "contagion" effects. In practical terms, the latter means that parents' exposure to educated children's health behaviours and lifestyles influences them to adopt healthier behaviour of their own. The latter could be possibly enhanced due to the greater access to health research and health information obtained through media channels such as the internet, a situation that, as Friedman and Mare (2010: 9) highlight, "is an obvious way the younger generation can link the elderly to key health knowledge they might not otherwise obtain".

Of course, some children are in a much better position to help their parents than others. Children who themselves require assistance because of poor health or limited financial resources are less likely to help their parents (Eggebeen and Hogan, 1990), whereas children with more education who have more resources and flexible jobs are more likely to provide care (Hogan et al, 1993; McGarry, 1998). However, the findings so far are mixed. This is in part because in the relationship between children's education and parents' health, there are also further important issues that need careful consideration. For instance, numerous studies have often indicated that daughters provide more contact and social support to parents than sons (Grundy and Shelton, 2001; Silverstein et al, 2006; Suitor and Pillemer, 2006). Therefore, the gender of children, particularly the availability of a daughter, is important for intergenerational exchanges between adult children and elderly parents. The value of women's role as "kin keepers" is usually found in the majority of studies of intergenerational support and is largely associated with gender role expectations about care taking (Rosenthal, 1985; Grundy and Shelton, 2001; Silverstein et al, 2006; Suitor and Pillemer, 2006). Some recent studies (Grundy and Read, 2012) also suggest that for elderly parents, having at least one daughter is more important than the number of children for intergenerational support. As most studies of child-to-parent transmission take into account the effect of gender in upward transfers, with daughters systematically providing more help and care to parents than sons (Spitze and Logan, 1990).

Associations between the number of children and health are also known to be important. Many studies have found that having children is related to receipt of informal help for elderly parents (Dykstra, 1993; Connidis and McMullin, 1999; Larsson and Silverstein, 2004). It is also generally understood that educated children may provide different types of help than their lesser educated siblings (Henretta et al, 1997). For instance, highly educated adult children provide less time-consuming help than lesser-educated siblings, but they do provide more financial assistance to their parents (Henretta et al, 1997; Couch et al, 1999). However, there is also growing evidence which highlights that the quality of parent-child relationships is inversely associated with sibship size (Grundy and Shelton, 2001; Grundy and Read, 2012). In fact, recent research has signalled how adult children without siblings may make up for kin deficit by spending more time with their parents (Trent and Spitze, 2011). A straightforward interpretation is that adult only children might be more able to allocate more time to parents because they do not spend time with siblings (Trent and Spitze, 2011). Therefore, although the number of children is usually seen as advantageous for older parents compared with childless individuals (Grundy and Read, 2012), the presence of multiple or alternative sources of support can also lead to weaker norms of obligation, which means that people might feel less responsible for supporting the older generation (Liefbroer and Mulder, 2006; Keck, 2008; Van Gaalen et al, 2008; Dykstra and Fokkema, 2012).

Although most intergenerational transfers occur from parents down to their children (Attias-Donfut et al, 2005; Albertini et al, 2007), it is widely acknowledged that children provide a fair amount of time and help once parents need it (Spitze and Logan, 1990; Lye, 1996; McGarry, 1998; Silverstein et al, 2002). According to McGarry (1998), children and children-in-law provide over a third of the care older adults receive and account for half of the care elderly widows and widowers receive. Given that an increasing number of older adults rely on their adult children to act as carers (Bonsang 2009; Brandt et al, 2009; Dykstra and Fokkema, 2011), as those now attaining older ages include larger proportions who have had children, larger proportions not yet widowed, and smaller proportions who have never married, it is surprising how few studies have considered family-level measures of socioeconomic status that take into consideration the influence of children's education on parents' health.

Data and Methods

This paper uses data from the Survey of Health, Ageing and Retirement (SHARE), which allow us to provide comparative evidence for 16 European countries (wave 4, year 2010). The dataset contains samples of non-institutionalized people aged 50 and older. In our sample, we include all respondents having at least one child aged 25 and over. The countries included in this cross-national panel database are a balanced representation of the various regions in Europe, including Scandinavia (Estonia, Denmark and Sweden), Central Europe (Austria, Belgium, Czech Republic, France, Germany, Hungary, the Netherlands, Poland, Slovenia and Switzerland) and the Mediterranean (Portugal, Spain, and Italy).

In our analysis, we considered as parents the direct respondents of the survey. They were asked to answer a number of questions on their health, demographic and socioeconomic status, as well as to provide information on a set of demographic and socioeconomic characteristics of their offspring.

Dependent variables

Health variables: We assess health through a measure of self-rated health (SRH). Respondents were asked to answer the question "would you say your health is" by ranking their health in scale ranging from excellent to poor. We dichotomize self-rated health coding answers "poor" and "fair" 1 and "good", "very good" and "excellent" 0. We combine SRH with a less subjective measure of health, consisting in diagnosis of high blood pressure or hypertension. Respondents were asked whether a doctor has ever told them that they have high blood pressure or hypertension. We select this indicator because it is a prevalent health condition (Mensah, 2002) and is often used as a critical measure for assessment of population health (Mentz et al, 2012). Although its relative significance may vary depending on whether or not it is measured by a nurse rather than self-reported (Johnston et al, 2009), its use can be seen as advantageous compared to analysis with general self-perceived health only, as the latter is subject to discrepancies caused by cultural norms as well as individual social status (Bago d'Uva et al, 2008).

Independent variables

Education: We consider both parents' and children's education. Respondents provided information on the number of years of schools they attended and the highest degree obtained, while for their children only the latter variable is available. In order to use the same indicator for parents and children, we measure education as the highest degree obtained, classified according to the International Standard Classification of Education (ISCED-97). However, given the intergenerational improvement in educational attainments, we categorise high and low educated parents and children according to two different scales. High educated parents are those who have any post-secondary education, while high educated children have at least tertiary education. As most of families have more than one child, following a common approach in literature (Zimmer et al., 2005; Friedman and Mare 2010), we consider only the most educated of the children, aged at least 25.

Co-residence/proximity variables: We use the existing information on co-residence and geographical proximity between adult children and elderly parents to distinguish the following: adult children who live in the same household of building with elderly parents, and children who live within 5 kilometers, between 5 and 25 kilometers, between 25 and 100 kilometers, kilometers and more than 100 kilometers away and/or in a different country.

Controls: We control for a range of variables pertaining to parents as well as to adult children. At baseline we control for parents' basic demographic characteristics including age, gender, marital status, number of children and children's gender. We then include into the analysis also a range of indicators of parents' socioeconomic position, consisting in their income, occupational status and financial strain (i.e. capacity to pay for monthly basic expenses).

Statistical analysis

We use a logistic regression model to predict how children education affects parental health. As a first part of the analysis, we adopt a nested modelling approach and test the different specifications using likelihood ratio test. The baseline model only includes children education and gender and controls for parents' age, sex, marital status and number of children. In the second specification parents' education is added as a control and the third includes all the variables summarizing parents' SES. In the second part of the analysis we investigate whether proximity between children and parents has any impact on parental health. First, we select only high educated children and look at parent-child proximity's effect. Then, we combine together the effect on parental health of proximity and education including both variables in the same model. We estimate robust standard errors to take into account clustered sample. Indeed some of the respondents are partners and their highest educated child is the same. To this aim, we run again logistic regression with robust standard errors.

Results

Table 1 shows the descriptive statistics for SHARE respondents in wave 4 (2010). Descriptive statistics are displayed stratified by respondents aged 50 and over depending on whether or not they have children with lower (up to secondary level) or higher (tertiary level) education.

Table 2 provides information about the odds ratios of the logistic regression models assessing self-rated health (SRH) and having problems with hypertension (HPH) respectively after controlling for demographic variables (model 1), parents' education (model 2) and parents' SES (model 3). The results from all six specification models clearly denote how parents with high educated children compared to their counterparts with lower educated children are less likely to perceive their health as poor or to report having hypertension problems. In other words, exposure of parents to children with high education has a positive effect on parents' health.

As shown in the first part of Table 2 the positive association between children's education and self-rated health (SRH) is always statistically significant (p-value<0.01). Although the upward effect is mediated after introducing controls for parents' education, the results clearly reveal how the exposure variable is associated with lower odds of outcome. For instance, Table 2 displays how the odds ratio of high educated children change from 0.691 to 0.739 from the baseline model to model 2 (with previous controls and parents' education), and to 0.884 for model 3 (with the addition of parents' SES).

More specifically, the analysis of socio-demographic covariates on SRH from Table 2 indicates that parents report worse health when they have daughters rather than sons, although the effect is only significant for models 1 (baseline, OR of female=1.049, p-value<0.1) and 2 (with parents' education, OR of female=1.046, p-value<0.1) as the significance disappears after including parents' SES. The age dimension of parents shows a statistically significant gradient with older parents being more likely to report poor health in all model specifications, whereas the gender effect of parents illustrates how females compared to males are more likely to declare poor self-rated health in model 1 (baseline, OR of female=1.127, p-value<0.01) and model 2 (with parents' education, OR of female=1.118, p-value<0.01), albeit the effect becomes insignificant in model 3 with SES. The variable on marital status reflects two things. First, respondents who live alone compared to those who live with their spouse are less likely to report poor health once all the controls are incorporated in model 3 (OR of living alone=0.879, p-value<0.01). Second, respondents who have widowed are more likely to declare poor self-rated health in models 1 (OR of widowed=1.189, p-value<0.01) and 2 (OR of widowed=1.176, p-value<0.01), although the effect is reversed and is not statistically significant in model 3. The variable on number of children reveals how parents with more descendants are less likely to report poor health compared to those with one child only. However, this effect is statistically significant and only seen for parents whose number of descendants range between two and four children, not for those with five or more children. As expected, the results also corroborate the existence of a statistically significant and positive association between parents' education and their health status in model 2 (OR of high educated=0.736, p-value<0.01) and model 3 (OR of high educated=0.875, p-value<0.01).

The use of controls such as SES in addition to parents' education allow us to be sure that we are truly picking up a child effect and not just some other component of parents' SES that was missed in our models indirectly. To this end, we employ three measures of SES, including income, occupational status and financial strain. The analysis of SES-based covariates from table 2 indicates how they are all strong and statistically significant health predictors. The results clearly display how parents with higher levels of income are less likely to report poor health than their counterparts with lower income levels (OR of 5th quintile=0.253, p-value<0.01). The state of being employed compared to retired appears to be associated with a lower chance of declaring poor health (OR of employed=0.571, p-value<0.01), whereas the variable on financial strain signals how respondents without the capacity to pay for monthly basic expenses are more likely to report poor health than their counterparts without financial stress (OR of parents with financial stress=1.784, p-value<0.01).

As shown in the second part of Table 2 a positive association is also found between children's education and parents' hypertension (HPH), a relationship which is always statistically significant (p-value<0.01). The level of this association between the exposure variable and the outcome remains very stable from the baseline model to the final specification with all the control variables - OR of high educated children change from 0.808 to 0.828 from the baseline model to model 2 (with previous controls and parents' education), and to 0.889 for model 3 (with the addition of parents' SES). Therefore, the results illustrate how both the strength and direction of the association is very similar for the two outcome variables under consideration (SRH and HPH). The results can also be seen as a way to test the validity between these two self-reported health variables due to common concerns which include possible systematic response distortions, method variance or mono-method bias.

The analysis of socio-demographic covariates on HPH from Table 2 indicates that there are not evidence for an association between child's gender and having problems with hypertension As expected, the age dimension of parents shows a statistically significant gradient with older parents being more likely to report having problems with hypertension while, at the same time, female parents are more likely to declare problems with hypertension compared to their male counterparts. Unlike the models with self-rated health, the gender effect of parents is statistically significant for all models (p-value<0.01), although the strength of the relationship is considerably reduced from model 1 (baseline, OR of female=1.120) to models 2 (with parents' education, OR of female=1.116) and 3 (with parents' SES, OR of female=1.088). The analysis of marital status reveals, on the one hand, how parents living alone are systematically less likely to have problems with hypertension in all three models than parents living with their spouse (a situation that largely replicates the third model with the outcome self-rated health). On the other hand, the condition of being widowed appears to be associated with a greater chance of having problems with hypertension in models 1 and 2, although this association becomes not statistically significant after controlling for parent's SES in model 3. Contrarily to the models with self-rated health, the variable on number of children does not show a statistically significant relationship with parents' health after including all covariates. The results also show how parents' education is positively associated with their health status, in a way that those with higher education are less likely to have problems with hypertension. However, the effect becomes not statistically significant after including parents' SES, a results that differs from the models with self-rated health.

In a similar fashion to the models with self-rated health, the analysis of SES-based covariates from Table 2 indicates how these are all strong and statistically significant health predictors. Parents with higher levels of income are less likely to report having problems with hypertension than their counterparts with lower income levels. The results also show how employed parents have a lower risk of having problems with hypertension compared to retired parents. Finally, the variable on financial strain indicates how parents whose capacity to pay for monthly basic expenses are more likely to declare having problems with hypertension.

Table 3 provides information about the odds ratios of the logistic regression models assessing self-rated health (SRH) and having problems with hypertension (HPH) respectively. The first model only refers to highly educated children with controls for geographical proximity, children's gender and parents' basic demographic characteristics, including age, gender, marital status and number of children. Using the first model specification and self-rated health as the outcome variable, the results indicate that all distances compared to the reference category (i.e. parents and children living within 5 kilometres, although not in the same building or household) are positively associated to parents' health (odds ratios smaller than one). However, the strength of this relationship is greatest and statistically significant for parents and children who live between 5 and 25 kilometres (OR=0.871, p-value<0.01) as well as for parents and children who live more than 100 kilometres apart (OR=0.902, p-value<0.05). The fact that among parents of high educated children there is not a proximity gradient explaining parental health may suggest that exposure of highly educated children to parents' health would operate both at closer and longer geographical distances. The analysis of model 2, which includes all children and their gender and education as well as parents' basic demographic characteristics, reveals a different association for parents and children who live between 5 and 25 kilometres (OR=0.906, p-value<0.05), and between 25 and 100 kilometres (OR=1.082, p-value<0.1). These results would imply that the effect of geographical distance on parents' health after including all children is positive at closer distances (5-25 kilometres) but negative at longer distances (25-100 kilometres). Similarly, the effect of geographical distance is negative and statistically significant in model 3 with controls for children's education and parents' SES (OR=1.125, p-value<0.01), thus reinforcing the idea that the health-knowledge transfer would operates only when highly educated children are available.

The results for all models which employ hypertension as the outcome variable offer a more distinct pattern with regard to geographical proximity: all distances compared to the reference category (i.e. parents and children who live between 0 and 5 kilometres apart) are positively associated to parents' health (odds ratios smaller than one), including those who live in the same building or household. This basically means that there is not a detectable proximity gradient, and living close or distant may have the same effect on parental health. The analysis of the first model with the group of highly educated children only displays once more a significant association between parent-child distance and parents' health in terms of hypertension, a relationship which operates at closer and longer proximities, although the strength of the association is greatest among those who live between 25 and 100 kilometres (OR=0.828, p-value<0.01) and between 5 and 25 kilometres (OR=0.890, p-value<0.01). In addition, the results from this first model specification with highly educated children only also suggests that the exposure of children to parents' health is also positive when they live within the same household or building (OR=0.925, p-value<0.1), and at more than 100 kilometres apart (OR=0.926, p-value<0.1). Thus, in line with the previous results for self-rated health, highly educated children appear to have an influence on parents' health irrespective of whether or not they live in close proximity. The analysis of model 2, which includes all children and their gender as well as parents' basic demographic characteristics, indicates the presence of a positive gradient of distance as well as a positive effect of living in the same household or building. Such gradient is valid up to the category of children and parents who live between 25 and 100 kilometres apart, where the strength of the association is greatest (OR=0.872, p-value<0.01). The analysis of model 3, which adds controls for parents' SES, also reflects the same tipping point, with the greatest association found among those who live between 25 and 100 kilometres (OR=0.877, p-value<0.01). The exposure of children within the same household or building also seems to be negatively linked with having problems with hypertension, although the strength of this association is clearly weaker (OR=0.929, p-value<0.1). While the results from this model are less clear with regard to the existence of a positive gradient of distance, it seems that the greatest effect of geographical distance on parents' health is replicated at the category 25-100 kilometres.

Overall, when parents of all children are included into the models (models 2 and 3) and both children’s education and parents-children proximity are taken into account, education seems to play a major role on parental health, both in terms of significance and magnitude of the results. This is especially true in the case of self-rated health.

Discussion

While extensive evidence indicates a strong relationship between people’s own socioeconomic status (e.g. Elo, 2009), those of their partners (e.g. Skalická and Kunst, 2008), and those of their parents (e.g. Galobardes et al, 2004), research into the relationship between children’s socioeconomic resources and parents’ health is just starting to emerge. The results from our analysis provide further new insights into this relationship between children’s education and parental health in the European context as a whole. Although our results do not tell us about the possible mechanisms that may explain this relationship between children's education and parents' health, they provide further evidence of why we should start investigating not only whether, but whose, education matters (Friedman and Mare, 2010).

Our findings clearly indicate that adult children’s education affects positively elderly parents’ health. After controlling for a set of potential confounding variables, our results suggest that parents whose children are highly educated are less likely to experience poor health (OR of high educated=0.884, p-value<0.01) or hypertension (OR of high educated=0.889, p-value<0.01) compared to their counterparts whose children have lower levels of education. Our results also reveal that the effect of children’s education on parents’ health operates at various geographical distances for either self-rated health or hypertension, thus highlighting that such association is important regardless of whether geographical proximity or co-residence takes place. Although this correlation does not necessarily represent causality, it does suggest that parents with high educated children may have an advantage for their health.

Our results are consistent with the findings from previous studies. For instance, Zimmer and colleague’s showed how children’s education is associated with older parents’ physical functioning in China and Taiwan and with mortality in Taiwan (Zimmer et al, 2002; Zimmer and Kwong, 2003; Zimmer et al, 2007). Similarly, recent work by Friedman and Mare (2010) in the US and by Torssander (2012) in Sweden highlighted the positive effect of children's education in parents' longevity. Our findings agree with the abovementioned studies for the European context in that a positive association is always found between highly educated children and parents' health.

In addition to the most apparent confounding factors (education, occupational status, income and financial strain of both partners), our study also attempted to address whether or not children's education affect parents' health regardless of their geographical proximity. For this purpose, we added a measure of geographical distance between adult children and their parents, since this factor is related to children’s education as well as parental longevity. Although the introduction of this variable further attenuated the association between children’s education and parental health, much of the association remains when geographical proximity between adult children and their parents has been adjusted for either in the most comprehensive model with self-rated health (OR of high educated=0.839, p-value<0.01) or with hypertension (OR of high educated=0.89, p-value<0.01).

In terms of optimal distance, our results indicate that the effect of children's education on parents' health is strongest in the range between 25 and 100 kilometres, thus suggesting that closer distances are not necessarily associated with better parents' health. Indeed, the reverse causality problem may be a major concern in the relationship between parents' health and children proximity. Parents' health may determine their children proximity, rather than the opposite, and children's education is an important predictor of proximity. Therefore, in interpreting our results, the limitations of the data and the complexity of the relationships must be borne in mind, as our sample includes parents and children at different life stages from all countries and geographical settings (i.e. urban and rural).

It is worthy of note, that although the use of socio-demographic controls for children and parents as well as controls for parents' SES allow us to minimise possible bias in the analysis of children effects on parents, there are still potential problems that are difficult to address using conventional analytical methods. For instance, children's education is likely to be correlated with family characteristics which, in turn, are related to parents' health. While the inclusion of variables for parents such as income, occupational status and financial strain attempt to deal with this issue, the approach still remains limited, as it is possible that we are still missing important variables that may bias our results. Another source of bias descends from the fact that children's education itself may have been affected by parents' health. A possible way to deal with this reverse causality problem -representing a possible future implementation of this study- would be to carry out a longitudinal analysis selecting at baseline only healthy parents and see whether their children's education affects changes in their health.

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Table 1. Descriptive statistics

	Low educated children	High educated children
Children		
Gender		
Male	6,901 (49.9)	5,976 (43.9)
Female	6,922 (50.1)	7,637 (56.1)
Proximity		
Same household or building[1]	2,157 (19.5)	1,352 (12.4)
0-5 km	3,644 (33)	2,604 (23.9)
5-25 km	2,380 (21.5)	2,419 (22.2)
25-100 km	1,364 (12)	1,779 (16.3)
100+ km	1,514 (13.7)	2,753 (25.2)
Parents[2]	13,823 (50.4)	13,613 (49.6)
Self-rated health		
Good health	7,028 (50.8)	8,179 (60.1)
Poor health	6,795 (49.2)	5,434 (39.9)
Having hypertension	6,263 (45.3)	5,455 (40.1)
Age[3]	66.4	66.4
Gender		
Male	5827 (42.2)	5971 (43.9)
Female	7996 (57.9)	7642 (56.1)
Number of children[3]	2.3	2.4
Marital status and living arrangment		
Living alone	1,910 (13.8)	1,660 (12.2)
Living with partner	9,428 (68.2)	10,036 (73.7)
Widowed	2,485 (18)	1,917 (14)
Education		
Up to upper secondary	12,029 (87)	8,768 (64.4)
Higher than secondary	1,794 (13)	4,845 (35.6)
Employment status		
Retired	8,461 (61.2)	8,243 (60.6)
Employed	3,038 (22)	3,579 (26.3)
Other	2,324 (16.8)	1,791 (13.2)
Total household income		
1st quintile	3,923 (28.4)	2,604 (19.1)
2nd	3,068 (22.2)	2,647 (19.4)
3rd	2,558 (18.5)	2,736 (20.1)
4th	1,984 (14.4)	2,747 (20.2)
5th quintile	2,290 (16.6)	2,879 (21.2)
Financial strain		
No	6,903 (49.9)	8,948 (65.7)
Yes	6,920 (50.1)	4,665 (34.3)

Source: SHARE wave 4 (2010). Percentage in brackets.

NB: (1) Different sample size. Sample size include respondents having missing values for proximity. (2) Divided into parents having low and high educated children. (3) Average.

Table 2. Odds ratio of poor self-rated health and having problems with hypertension

	Self-rated health			Hypertension		
	(1)	(2)	(3)	(1)	(2)	(3)
Children						
Education						
High	0.691***	0.739***	0.884***	0.808***	0.828***	0.889***
	-0.0173	-0.0192	-0.0246	-0.0201	-0.0214	-0.0235
Sex						
Female	1.049*	1.046*	1.019	0.992	0.991	0.98
	-0.0263	-0.0262	-0.0272	-0.0247	-0.0247	-0.0247
Parents						
Age						
65-74	1.478***	1.477***	1.196***	1.720***	1.718***	1.393***
	-0.0427	-0.0427	-0.0433	-0.0496	-0.0496	-0.0479
75-84	2.662***	2.638***	2.054***	2.110***	2.102***	1.644***
	-0.0956	-0.095	-0.0886	-0.0747	-0.0744	-0.0669
85+	2.865***	2.830***	2.403***	1.480***	1.472***	1.182**
	-0.193	-0.191	-0.18	-0.0963	-0.0959	-0.0813
Sex						
Female	1.127***	1.118***	0.981	1.120***	1.116***	1.088***
	-0.0292	-0.029	-0.0275	-0.0289	-0.0288	-0.0288
Marital status and living arrangement						
Living alone	1.064	1.080**	0.879***	0.866***	0.871***	0.810***
	-0.0403	-0.041	-0.0361	-0.033	-0.0332	-0.0313
Widowed	1.189***	1.176***	0.947	1.150***	1.145***	1.054
	-0.0436	-0.0432	-0.0375	-0.0416	-0.0415	-0.039
Number of children						
2	0.885***	0.879***	0.921**	1.008	1.006	1.034
	-0.0303	-0.0302	-0.034	-0.0346	-0.0345	-0.0359
3	0.846***	0.837***	0.926*	0.931*	0.927*	0.981
	-0.0334	-0.0331	-0.0393	-0.0368	-0.0367	-0.0393
4	0.753***	0.742***	0.825***	0.927	0.923	0.988
	-0.04	-0.0395	-0.0464	-0.0485	-0.0483	-0.0524
5+	1.041	1.015	1.078	0.904*	0.896*	0.939
	-0.0629	-0.0614	-0.0695	-0.054	-0.0535	-0.0567
Education						
High		0.736***	0.875***		0.896***	0.966
		-0.0226	-0.029		-0.0272	-0.0302
Cont.						

Table 2. Odds ratio of poor self-rated health and having problems with hypertension

	Self-rated health			Hypertension		
	(1)	(2)	(3)	(1)	(2)	(3)
Cont.						
Income						
2nd quintile			0.490***			0.810***
			-0.0195			-0.0305
3rd quintile			0.321***			0.678***
			-0.0135			-0.0269
4th quintile			0.252***			0.617***
			-0.0116			-0.0267
5th quintile			0.253***			0.637***
			-0.0113			-0.0269
Occupational status						
Employed			0.571***			0.649***
			-0.0237			-0.0251
Other			1.325***			0.860***
			-0.0551			-0.0336
Financial strain						
Yes			1.784***			1.251***
			-0.0527			-0.0353
Constant			1.534***	0.574***	0.586***	0.862***
			-0.0905	-0.0233	-0.024	0
Observations	27,446	27,446	27,446	27,446	27,446	27,446

Source: SHARE wave 4 (2010).
**** p<0.01, ** p<0.05, * p<0.1*

Table 3. Odds ratio of poor self-rated health and having problems with hypertension – including geographical proximity

	Self-rated health			Hypertension		
	(1)	(2)	(3)	(1)	(2)	(3)
Children						
Proximity to parents						
same hh or building	0.988	0.977	1	0.925*	0.919*	0.929*
	-0.043	-0.0427	-0.0468	-0.0402	-0.0401	-0.0411
5-25 km	0.871***	0.906**	0.994	0.890***	0.908**	0.939
	-0.0344	-0.0361	-0.0425	-0.0349	-0.0357	-0.0375
25-100 km	0.972	1.082*	1.125***	0.828***	0.872***	0.877***
	-0.0399	-0.0452	-0.0502	-0.0339	-0.0362	-0.0369
100+ km	0.902**	0.966	1.067	0.926*	0.958	0.992
	-0.0407	-0.044	-0.0517	-0.0415	-0.0432	-0.0453
Sex						
Female	1.029	1.060**	1.028	0.98	0.994	0.983
	-0.0287	-0.0298	-0.0308	-0.0273	-0.0277	-0.0278
Education						
High		0.630***	0.839***		0.796***	0.890***
		-0.018	-0.0269		-0.0226	-0.027
Parents						
Age						
65-74	1.571***	1.602***	1.275***	1.707***	1.721***	1.356***
	-0.0506	-0.0519	-0.0516	-0.0553	-0.0559	-0.0521
75-84	2.871***	2.933***	2.219***	2.047***	2.060***	1.564***
	-0.119	-0.122	-0.109	-0.0827	-0.0834	-0.0719
85+	3.000***	3.057***	2.614***	1.419***	1.424***	1.129
	-0.242	-0.25	-0.233	-0.109	-0.11	-0.0913
Sex						
Female	1.131***	1.135***	1.011	1.088***	1.090***	1.071**
	-0.033	-0.0332	-0.0321	-0.0317	-0.0318	-0.0321
Marital status and living arrangement						
Living alone	1.090**	1.057	0.843***	0.868***	0.854***	0.790***
	-0.0463	-0.045	-0.0391	-0.0372	-0.0367	-0.0347
Widowed	1.270***	1.218***	0.916*	1.243***	1.217***	1.091**
	-0.0543	-0.0525	-0.0427	-0.0522	-0.0513	-0.047
Number of children						
2	0.877***	0.896***	0.917**	0.978	0.989	1.011
	-0.0335	-0.0345	-0.038	-0.0375	-0.038	-0.0394
3	0.862***	0.876***	0.949	0.895**	0.903**	0.951
	-0.0382	-0.0391	-0.0456	-0.0399	-0.0403	-0.043
4	0.752***	0.761***	0.812***	0.863**	0.870**	0.923
	-0.0453	-0.0459	-0.0519	-0.0514	-0.0519	-0.0557
5+	1.02	1.007	1.032	0.855**	0.849**	0.884*
	-0.0688	-0.0679	-0.0741	-0.0571	-0.0566	-0.0595
Education						
High			0.830***			0.958
			-0.0313			-0.0341
Cont.						

Table 3. Odds ratio of poor self-rated health and having problems with hypertension – including geographical proximity

	Self-rated health			Hypertension		
	(1)	(2)	(3)	(1)	(2)	(3)
Cont.						
Income						
2nd quintile			0.486***			0.797***
			-0.0208			-0.0322
3rd quintile			0.311***			0.664***
			-0.0146			-0.0295
4th quintile			0.236***			0.617***
			-0.0125			-0.0306
5th quintile			0.263***			0.651***
			-0.0128			-0.0302
Occupational status						
Employed			0.587***			0.628***
			-0.0265			-0.0266
Other			1.335***			0.824***
			-0.0624			-0.0361
Financial strain						
Yes			1.704***			1.247***
			-0.0558			-0.0391
Constant	0.644***	0.756***	1.595***	0.610***	0.661***	0.976
	-0.0316	-0.038	-0.11	-0.03	0	0
Observations	21,975	21,975	21,975	21,974	21,974	21,974

Source: SHARE wave 4 (2010).
*** *p<0.01*, ** *p<0.05*, * *p<0.1*