

# Does grandparenting pay off? The effect of childcare on grandparents' cognitive functioning

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## **Abstract**

In ageing societies, it is crucial to study the factors that can help maintain good cognitive functioning in later life. Previous studies have shown that having an engaged life (e.g., being employed or involved in social activities) has a positive effect on cognitive performance. In line with this strand of the literature, we consider the provision of grandparental childcare as a way to remain active in later life. Therefore, following the use-it-or-lose-it theoretical framework, we hypothesise that providing childcare on a daily basis can help older adults maintain better cognitive functioning. In particular, we focus on grandmothers, as they are the most engaged in childcare. Contrary to our hypothesis, descriptive evidence from the Survey of Health, Ageing and Retirement in Europe (SHARE) suggests that grandmothers who look after their grandchildren daily have lower cognitive scores than grandmothers who provide care less frequently. However, we show that this negative effect of providing childcare is attributable to the background characteristics of the grandparents. Using an instrumental variable approach to address the endogeneity of grandparental childcare, we find that providing childcare has a substantial and positive effect on one of the four cognitive tests we consider, verbal fluency. This positive effect is particularly strong for older grandmothers. For the other tests of cognitive functioning, no statistically significant effect of grandparental childcare is found. These results contribute to the limited evidence on the effects of grandparenting on grandparents' outcomes.

**Keywords:** Grandparents; childcare; cognitive functioning; intergenerational relationships; instrumental variable approach.

## 1 INTRODUCTION

Today, the lives of grandparents and those of their grandchildren overlap markedly, creating an unprecedented opportunity for the development of the grandparent role (Bengtson 2001). Taking care of grandchildren is a common activity among grandparents in Western societies, especially among women: in the USA, 50% of grandmothers provide regular or occasional care to their grandchildren (Guzman 2004); and in Europe, even more grandmothers are involved in childcare (Hank and Buber 2009; see also Glaser et al. 2010 for a review).

As grandparental childcare is traditionally considered an altruistic act, research on this intergenerational exchange has focused on the effects of this type of care on younger generations. A number of studies have looked at the effects of grandparental childcare not only on the grandchildren's developmental outcomes (DeLeire and Kalil 2002), cognitive stimulation (Dunifon and Kowaleski-Jones 2007), and educational attainment (Monserud and Elder 2011; see also Coall and Hertwig (2011) for a review); but also on mothers' labour force participation (Aassve et al. 2012a; Arpino et al. 2010; Dimowa and Wolff 2008; 2011; Gray 2005) and the fertility decisions of the middle generation (Aassve et al. 2012b; Del Boca 2002; Hank and Kreyenfeld 2003).

Economic models have hypothesised that inter-vivo transfers from grandparents to grandchildren might also have an egoistic component that can help to explain why older generations transfer resources to younger generations (e.g., Becker and Tomes 1976; 1979). Monetary and time transfers may be motivated by the anticipation of future need, and the hope that younger generations will be more altruistic towards their parents or grandparents in return (e.g., Laferre're and Wolff 2006). According to this strand of literature, grandparental childcare could be considered an investment that is expected to pay off in the future.

Grandparental childcare might also be beneficial for grandparents from a more short-term perspective. However, little is known about the effects of grandparental childcare on grandparents' outcomes, and the

evidence that does exist is contradictory. The majority of the studies that have examined this question have found negative effects of grandparental childcare on grandparents' outcomes, such as a heightened risk of isolation (Fergusson et al. 2008; Giarrusso et al. 2001; Jendrek 1993) and depression (Silverstein 2007). A few studies have, however, found evidence that providing childcare has beneficial effects for grandparents, including reduced stress (Giarrusso et al. 2000), better health and health-related behaviors (Hughes et al. 2007), and greater life satisfaction (Powdthavee 2011).

There are two main factors that could explain these overwhelmingly negative findings on the provision of childcare by grandparents: the particular context of childcare provision that was generally considered in past studies, and methodological issues. Indeed, there has been a tendency to focus on caregiving grandparents; i.e., grandparents who are the primary carers of their grandchildren (see Baker and Silverstein 2008; Goodman and Silverstein 2002; Minkler and Fuller-Thomson 2005). As Muller and Litwin (2011) have noted, it is surprising that only a few studies have focused on supplementary grandparental childcare (i.e., when the childcare provided by grandparents is only complementary to parental care), even though it is far more common.

From a methodological point of view, the findings of previous studies might have been affected by an inadequate treatment of the endogeneity of grandparenting. Thus, the negative effect found for grandparental childcare might have been the result of background (observed and unobserved) characteristics of grandparents, and not a consequence of providing childcare. Hughes et al. (2007) showed that, when the disadvantages related to background characteristics were adequately taken into account, no negative effect of caregiving could be found, and that supplementary childcare even had a positive effect on grandparents' health. As Umberson et al. (2010) have pointed out, more research that better controls for selection effects is needed.

Closely linked to health, the process of cognitive ageing presents challenges for modern societies. To address this growing problem, researchers are looking for ways to halt or slow down the decline of cognitive functioning in later life. Studying how family relations can influence cognitive ageing is important, not only because it predicts health outcomes and mortality (Batty et al. 2007; Gottfredson 2004; Whalley and Deary 2001), but also because it could help us learn how to improve the ability of older people to function in their daily lives, and thereby delay the onset of care dependency (Kramer and Willis 2002).

Several authors have argued that being engaged in activities that are stimulating for the brain is helpful in maintaining good cognitive skills (see e.g., Hultsch et al. 1999). For example, research has shown that participating in leisure and social activities is associated with a slower process of cognitive ageing (Engelhardt et al. 2010; Scarmeas and Stern 2003), while retirement has negative effects (Bonsang et al. 2012; Mazzonna and Peracchi 2012). Inspired by this evidence in support of the “use-it-or-lose-it” hypothesis, we argue that childcare can have an intellectually stimulating component, and may therefore be beneficial for grandparents’ cognitive functioning. The aim of this paper is to test this hypothesis, focusing in particular on grandmothers, as they are the most engaged in grandparental childcare provision (e.g., Hank and Buber 2009); and on the effects of being involved in childcare on a regular basis (i.e., with either daily or weekly frequency). To the best of our knowledge, this is the first paper to analyse the effects of grandparental childcare on grandparents’ cognitive functioning.

## 2 BACKGROUND AND HYPOTHESES

As family forms and family-related norms and behaviours have become more diverse, horizontal ties within generations have tended to decrease, while the duration of family ties that cross generations has been

greatly increasing. Although in most developed countries there has been a decline in multi-generational households, grandparents still play an active and supportive role within the family, especially by taking care of grandchildren (for evidence on the USA, see Fuller-Thomson and Minkler 2001; Hayslip and Kaminski 2005; and for European research see, e.g., Attias-Donfut et al. 2005; Hank and Buber 2009).

## **2.1 The effects of grandparenting on younger generations**

So far, the literature on grandparental childcare has mostly focused on its downward effects—i.e., its effects on children and grandchildren. For example, Aassve et al. (2012a), Arpino et al. (2010), Dimowa and Wolff (2008; 2011), and Gray (2005) showed that grandparental childcare plays an important role in helping mothers balance work and family duties in several European countries. Other studies have found that the availability of grandparents positively affects their children's fertility decisions, especially in countries where public childcare is limited (Aassve et al. 2012b; Del Boca 2002; Hank and Kreyenfeld 2003).

Another strand of the literature has analysed the effects of grandparental childcare on grandchildren's outcomes, such as school performance, dietary habits, cognitive skills, etc. (e.g., DeLeire and Kalil 2002; Dunifon and Kowaleski-Jones 2007; Monserud and Elder 2011). Although these studies have often had a particular focus on children raised solely by grandparents (i.e., caregiving grandparents), research from the UK (e.g., Attar-Schwartz et al. 2009) has indicated that supplementary childcare is linked to better emotional adjustment and fewer behavioural problems among adolescents. Similarly, research from the US has shown that grandchildren with close and supportive relationships with grandparents are less subject to depressive symptoms than those with weak intergenerational relationships (e.g., Ruiz and Silverstein 2007).

Finally, the unpaid childcare provided by grandparents also produces benefits for the welfare system by facilitating women's labour market

participation, especially when the services offered by the market are costly and public provision is scarce. In some countries, the important role of grandparents as providers of childcare has been officially recognised: in the UK, for example, grandparents who give up paid work to provide childcare can claim credits that allow them to qualify for a basic state pension (Glaser et al. 2010).

Thus, it is widely recognised that grandparents, by providing unpaid childcare, produce benefits for the younger generations and for society as a whole. But is grandparenting beneficial for grandparents?

## **2.2 The effect of grandparenting on grandparents**

Grandparental childcare can be seen as both a downward and an upward transfer: on the one side, grandparents invest time and resources in their grandchildren; while on the other side, grandchildren are an important (emotional) resource for grandparents (e.g., Silverstein et al. 2003). It has been argued that benefits can be gained from the very act of giving (Coall and Hertwig 2011). The available evidence shows that altruistic behaviours can have beneficial consequences for the altruist in terms of his or her own physical and mental health, including a reduced risk of morbidity and mortality (Brown et al. 2005). Yet the effect of grandparenting on grandparents is an issue that has received relatively little attention, and the few studies on the subject that do exist have produced mixed evidence.

Both small-scale studies (see Grinstead et al. 2003 for a review) and research based on nationally representative US surveys (e.g., Baker and Silverstein 2008; Minkler and Fuller-Thomson 2005), such as the Health and Retirement Study (HRS), have found grandparenting to be associated with poorer health and worse well-being outcomes. However, most of this literature focused on problematic situations, such as cases in which grandparents provide full care.

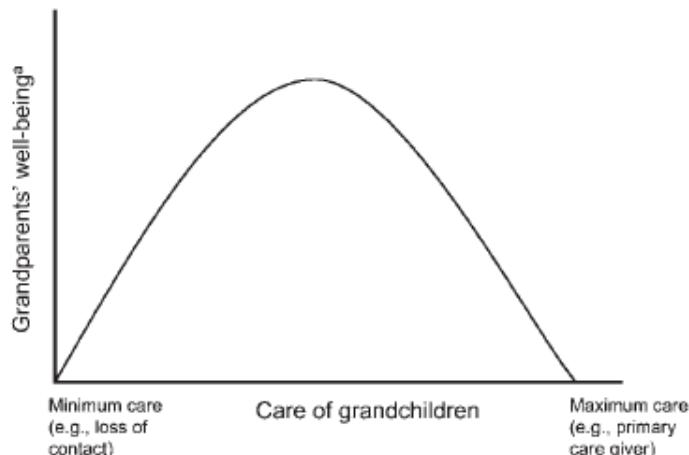
Some grandparents have reported having a more active lifestyle after assuming a caregiver role (Waldrop and Weber 2001), and four out of five

caregiving grandparents have said they find the experience of raising a grandchild “extremely rewarding” (Giarrusso et al. 2000). However, heavily committed grandparents who are raising their grandchildren may lack privacy and leisure time, have less contact with friends, and be at risk of isolation (Fergusson et al. 2008; Giarrusso et al. 2001), depression (Baker and Silverstein 2008), and the exacerbation of health problems resulting from caregiving stress (Waldrop and Weber 2001).

Providing childcare on a supplemental basis may have a completely different effect on grandparents’ outcomes than being a primary caregiver. Providing part-time care may enhance grandparents’ sense of purpose in life and help to maintain their family identity (Giarrusso et al. 2001; Jendrek 1993), and may thus have positive effects on grandparents’ wellbeing. Indeed, to the best of our knowledge, the only study analysing both primary and supplementary grandparental childcare (Hughes et al. 2007) found evidence that grandmothers raising grandchildren in skipped-generation households were in worse health and had higher rates of depression, while grandmothers providing supplementary care were in better health. The effect was shown to hold even after adjusting for the health status measured before the grandparents started providing childcare.

The amount of care provided to the grandchildren and the degree of responsibility associated with care provision are key factors that must be taken into account when interpreting the contrasting evidence on the effect of grandparental childcare on grandparents’ outcomes. As can be seen in Figure 1, Coall and Hertwig (2011) hypothesised a nonlinear relationship between grandparental childcare and grandparents’ well-being that, in their review, encompasses various positive emotions, such as satisfaction and contentment, and positive activities (e.g., spending time in company).

**Figure 1** A schematic representation of the hypothesised nonlinear relationship between grandparental childcare and grandparents' well-being.



Source: Coall and Herwig (2011)

### 2.3 Grandmothers' involvement in childcare

In this paper, as in several of the studies cited above, we focus on grandmothers. The literature has shown that grandmothers are more strongly involved than grandfathers in childcare (Hank and Buber 2009). There is considerable agreement in the literature on grandparenting that the grandparent-grandchild ties have “the maternal grandmother as the star actor” (Hagestad 2006: p. 323). Coall and Hertwig (2011: p. 5) noted that “one of the most robust findings across the grandparental investment research is that maternal grandmothers invest the most, have most contact, and the closest relationships with their grandchildren, followed by maternal grandfathers, paternal grandmothers, and, finally, paternal grandfathers”. While this would appear to indicate that a considerable share of (maternal) grandfathers are highly engaged in providing care (Attias-Donfut et al. 2005; Guzman 2004; Hank and Buber 2009), the involvement of men as providers of supplementary childcare is likely to be mediated through grandmothers’ engagement in childcare. Hank and Buber (2009) showed that there is no

significant correlation between partnership status and grandmothers' probability of looking after grandchildren, while lone grandfathers were found to be less likely to provide care than those living with a partner. Hughes et al. (2007), examining both grandmothers and grandfathers, found no significant differences in health status and behaviours among grandfathers who started, continued, or stopped providing childcare; while a positive effect was found for supplementary grandmothers. This finding points to stronger effects of grandparental childcare for grandmothers than for grandfathers due to their different levels of involvement and responsibilities.

#### **2.4 Cognitive functioning in later life**

It is widely recognised that cognitive functioning predicts mental (Martin et al. 2007) and functional status (Gottfredson 2004) as well as mortality (Batty et al. 2007; Whalley and Deary 2001) in later life. Good performance on cognitive tests has been shown to be associated with better self-reported health and lower prevalence of chronic diseases (Bosma et al. 2007). Recent demographic studies have additionally stressed that, as more of the responsibility associated with planning and managing the retirement years (financially and health-related) is shifted to individuals, it has become increasingly important that individuals maintain their mental capacities in later life (e.g., Hauser and Weir 2010). Preventing or halting cognitive ageing is therefore a goal of both the individuals who are growing old, and of ageing societies.

Several studies have shown that, in addition to genetic factors, being active in the labour market (Bonsang et al. 2012; Mazzonna and Peracchi 2012) and being involved in leisure and social activities (Engelhardt et al. 2010; Scarmeas and Stern 2003) are factors that may (positively) affect the cognitive endowment and (negatively) affect the rate of cognitive decline with age.

This line of research can be summarised by the simple motto "use-it-or-lose-it" (Hultsch et al. 1999): i.e., an undemanding environment may

accelerate the process of cognitive decline, while engaging in stimulating activities may halt the process of cognitive ageing. For example, Rohwedder and Willis (2010) cited the use-it-or-lose-it hypothesis to explain the negative effect of retirement on cognitive skills.

### 3 RESEARCH HYPOTHESES

Inspired by the use-it-or-lose-it framework, we consider grandparenting as an activity that helps grandparents maintain an “engaged life style” that can be stimulating for the brain (as it may involve activities such as helping grandchildren in doing homework, playing with them, reading, etc.). Therefore, our main hypothesis is that providing childcare helps to preserve good cognitive functioning (hypothesis 1).

The effect of grandparenting can, however vary according to different factors. First, given the nonlinear relationship between grandparental childcare and well-being, as hypothesised by Coall and Herwig (2011), we may assume that the effect of providing childcare depends on the degree of involvement of grandparents: i.e., grandparents who are “too involved” in childcare may feel physically tired and emotionally drained (e.g., Jendrek 1993). However, since we focus on supplementary childcare, we do not expect to find such a nonlinear pattern. Rather, we hypothesise that the effect will be in the “positive” part of Figure 1: i.e., we expect to find that moving from no involvement in childcare to higher involvement is associated with higher cognitive performance (hypothesis 2).

We acknowledge that some grandmothers may have to combine childcare with other activities, and therefore shoulder a burden that is too heavy. As Pruchno (1999) pointed out, combining the provision of care with paid employment may lead to time pressure and exhaustion. Therefore, we hypothesise that, for working grandmothers, more involvement in childcare is associated with lower cognitive performance (hypothesis 3).

Finally, we assume that the beneficial effects of grandparenting on cognitive functioning are stronger for those grandparents who need to be stimulated the most; i.e., those who are more subject to cognitive decline because they are older or retired (hypothesis 4).

## 4 METHODS

### 4.1 Data and sample selection

Our analyses are based on the Survey of Health, Ageing and Retirement in Europe (SHARE). SHARE is a multidisciplinary longitudinal survey, representative of the non-institutionalised population aged 50 and over (Börsch-Supan et al. 2005; 2008). All persons aged at least 50 in the selected households were interviewed. The partners of eligible persons living in the same household were also surveyed, even if they were younger than 50. Some questionnaire modules are not presented to all respondents of the same household. For example, the questions on the provision of childcare to grandchildren were answered by the so-called family respondents. These were selected as the first interviewed person in each couple. The order of interview within the couple was random, but this selection decreases the size of our working sample, as we can only retain one interviewee per household. For details on the sampling procedure, questionnaire contents, and fieldwork methodology, please see Börsch-Supan and Jürges (2005; 2008).

We used data from the first wave (2004) and the refresher sample from the second wave (2006) for those countries that participated in both waves (i.e., Austria, Belgium, Denmark, France, Germany, Greece, Israel, Italy, Spain, Sweden, Switzerland, and the Netherlands)<sup>1</sup>. We also used the second wave for the countries that joined SHARE in 2006 (i.e., Czech Republic, Ireland and Poland). Thus, we considered only the first

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<sup>1</sup> There is no refresher sample for Israel because this country only participated in the first wave. Although Austria participated in both waves, no refresher sample is available for this country either.

observation for each respondent and did not take a panel approach, for reasons we discuss in section 4.5.

We restricted our sample to women who had at least a child, who were aged 50-80 and who reported being “healthy”; thereby excluding respondents who reported being permanently sick or disabled. We expected to find that serious illness and disability decreased the probability of looking after grandchildren, based on the assumption that ill grandparents are less able (physically) to take care of grandchildren, and that parents might prefer to leave their children with fit grandparents. For similar reasons, and following Engelhardt et al. (2010), we excluded respondents who reported ever having been diagnosed with stroke, Parkinson’s disease or cancer. Moreover, it is well-known that stroke, Parkinson’s, and anti-cancer drugs negatively affect cognitive abilities (see Engelhardt et al. 2010 for a review).

We excluded from our sample grandparents who had co-resident grandchildren because their roles and their burdens in terms of responsibility and time might be completely different and more difficult to identify than the roles and responsibilities of grandparents who looked after their grandchildren more or less frequently. As we noted in the discussion in section 2.2, it would be interesting to treat primary caregivers, co-residing, and supplementary grandparents separately, rather than excluding the first two categories, but there are not enough cases in our data set to do so<sup>2</sup>.

After applying the aforementioned selection criteria, our sample included 6,733 women. Outliers for the outcome variables (i.e., values not lying within 2.5 standard deviations of the mean<sup>3</sup>) and missing values in

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<sup>2</sup> In the sample we considered, there were only 246 women living with at least one grandchild. Of these, neither of the parents of the grandchildren was living in the household in only 41 cases. Moreover, the latter group would not necessarily be composed of custodial grandparents who cannot be directly identified in SHARE.

<sup>3</sup> The regression analyses were carried out using both dependent variables with and without the outliers, and the results were not substantially different. We have therefore retained the models using variables cleaned from the outliers.

each of the variables used in the statistical analyses were other criteria for the exclusion of cases. The final sample was composed of 6,274 women aged 50-80 who had at least one child.

#### 4.2 Dependent variables

Cognitive functions were measured in SHARE using five tests: verbal fluency, numeracy, immediate recall, delayed recall, and orientation. In the current study, orientation (i.e., remembering date, month, year, and day of the week) was not included because, due to its low level of variability, it is only useful for detecting really severe cognitive deficits.

Table 1 provides some descriptive statistics on the four cognitive measures we considered as outcome variables in our analyses (the higher their values, the better the cognitive functioning).

**Table 1** Descriptive statistics on the four cognitive outcome variables

	Verbal fluency	Numeracy	Immediate recall	Delayed recall
Min	1	1	1	0
Max	37	5	9	8
First quartile	15	3	4	3
Median	19	3	5	4
Third quartile	24	4	6	5
Mean	19.39	3.36	5.34	3.91
Standard deviation	6.45	1.06	1.61	1.85
Correlations				
Verbal fluency	1.00			
Numeracy	0.34	1.00		
Immediate recall	0.39	0.33	1.00	
Delayed recall	0.36	0.32	0.65	1.00
N	6,274	6,274	6,274	6,274

**Note:** Outliers (values not lying within 2.5 standard deviations of the mean) have been deleted.

In the test of verbal fluency in SHARE, respondents were asked to name as many animals as they can think of within one minute. As Table 1 shows, after the outliers are cleaned, the range for this variable goes from 1

to 37, with an average of about 19 animals. One quarter of the respondents named no more than 15 animals and 50% named no more than 19.

The test of numeracy consisted of a few simple arithmetical calculations that assess how people use numbers in everyday life. The resulting total scores ranged from 1 to 5. The average score on the numeracy test on our sample was 3.36.

In the tests of recall, the interviewer first read a list of 10 common words to the respondent, and then asked the respondent to recall aloud as many words as possible from the list in any order (immediate recall). Up to one minute was allowed for recall. The test was repeated at the end of the cognitive function module, but without the words being read again (delayed recall). As Table 1 shows, 50% of respondents were not able to remember more than 5 words immediately after listening to them, and 75% were not able to remember more than 5 words after some time had passed. For more details on the exact formulation of the questions, please refer to the questionnaire available on <http://share-dev.mpisoc.mpg.de/home.html>.

We chose not to combine the four different measures of cognitive abilities into a single index because they refer to different dimensions of cognitive functioning (Salthouse 2010). Moreover, from an empirical point of view, the correlations among the several items were rather low, as is shown in the bottom part of Table 1: immediate and delayed recall showed a relatively high correlation (0.65), while the correlations between all of the other items ranged from 0.32 to 0.39<sup>4</sup>.

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<sup>4</sup> The low correlations were reflected in the low internal consistency (Cronbach's alpha) of the summary index we tried to create based on the four items. We also tried to combine only immediate and delayed recall (as was done, for example, by Mazzonna and Peracchi 2012), and in this case the results were similar to those presented here on the two separate items.

### **4.3 Independent variable**

The independent variable of interest to us refers to the provision of grandparental childcare. For each child who had children, grandparents were asked whether they had provided childcare without the presence of the parents during the 12 months before the interview, and, if they did, how often on average: “almost daily”, “almost every week”, “almost every month”, “less often”. Using this information, we built a binary variable equal to one if the respondent reported having provided childcare “almost daily” for the children of at least one child, and zero otherwise (labelled as “almost daily grandparenting” in Tables 3-7). As we noted in the discussion in section 2.2, our goal is to assess whether the effect of grandparenting depends on its frequency. Therefore, in our analyses we also considered a different definition of childcare by aggregating the categories “almost daily” and “almost weekly” (“at least weekly grandparenting” in tables 3-7). From Table 2, we can see that about 12% of our working sample provided grandparental care on an almost daily basis, 20% provided care almost weekly, 25% provided care less often (which includes never), and about 43% were grandchildless.

### **4.4 Control variables**

The choice of controls was motivated by past evidence on the determinants of older adults’ cognition and their provision of grandparental childcare; i.e., potential confounding variables.

**Country.** Substantial differences across SHARE countries in the average levels of cognitive abilities have been widely documented. These gaps may be partly due to differences in education systems (Dewey and Prince 2005), or they may reflect language and cultural differences that affect the measured cognitive scores (Bonsang et al. 2012). We included country fixed effects to catch these differences, and also to account for the heterogeneous role of grandparents across countries (Bordone et al. 2012; Hank and Buber 2009).

**Table 2** Descriptive statistics on the control variables by frequency of grandparenting

Control variables	Frequency of grandparenting				
	no grandchildren	less often	almost weekly	almost daily	All
age	56.85	62.59	61.51	61.97	59.81
medium education (%)	40.18	35.05	37.11	34.03	37.57
high education (%)	25.94	17.46	16.20	7.36	19.67
living with partner (%)	80.18	76.81	78.93	81.21	79.23
employed (%)	49.91	31.21	32.16	16.16	37.70
retired (%)	19.85	40.12	38.23	45.47	33.06
social activities (%)	11.34	9.84	11.33	8.54	10.63
depression (EURO-D)	2.31	2.32	2.45	2.81	2.40
self-reported health	2.68	2.90	2.84	3.15	2.82
ADL limitations	0.06	0.10	0.07	0.11	0.08
physically inactive (%)	5.58	6.97	6.54	9.20	6.55
smoking (%)	21.28	19.93	19.79	16.16	20.04
drinking (%)	13.69	12.96	11.49	7.49	12.32
N	2,725	1,535	1,253	761	6,274
(%)	43.43	24.47	19.97	12.13	100.00

Socio-demographic variables. We controlled for age using a set of dummy variables: “50-55” (reference), “56-60”, “61-65”, “66-70”, “71-75”, and “76-80”. Education is known to be strongly related to cognitive functioning (Le Carret et al. 2003). We used three binary variables: “low” (corresponding to ISCED 0-1, no or primary education; reference), “medium” (ISCED 2, lower secondary education), “high” (ISCED 3-4, higher secondary education; and ISCED 5-6, tertiary education). We also included in the regressions the binary variable “partner” (= 1 if living with a partner; = 0 otherwise).

Activity status and social activities. Studies have shown that retirement has a negative effect on cognitive functioning (Bonsang et al. 2012; Mazzonna and Peracchi 2012; Rohwedder and Willis 2010), while being involved in social activities helps in maintaining good cognitive abilities (Engelhardt et al. 2010). On the other hand, retired grandparents have more free time for both participating in social activities and caring for

grandchildren. The activity status was measured by three dummy variables: “employed” (reference), “retired”, and “other” (i.e., unemployed, homemaker, etc.). The vast majority of women in the group “other” were housewives. Regular involvement in voluntary work, religious, political or community-related organisations, educational courses, and other social activities was measured by the dummy variable “social activities” (= 1 if involved almost daily in at least one of the listed activities; = 0 otherwise).

Health. Functional impairment may be an independent risk factor for cognitive decline (Gill et al. 1995), and depressive symptoms have been found to exacerbate cognitive problems in older adults (Cronin-Stubbs et al. 2000). Thus, we controlled for the number of limitations in activities of daily living (“ADL limitations”), “self-reported health” (ranging from 1 to 5; the higher the value, the worse the health), and “depression”. The latter was measured using the EURO-D scale (it ranges from 1 to 12; the higher the value, the more depressed), which considers depressive symptoms.

Risk factors. Physical inactivity, smoking, and excessive alcohol consumption negatively influence cognition (Kalmijn et al. 2002), and may also be associated with grandparenting. The literature has shown parenthood effects pertaining to health behaviours (e.g., smoking, alcohol consumption, and physical exercise), providing evidence for the social control influences of parenthood (e.g., Kendig et al. 2007). Similarly, grandparents may, for example, feel pressure to reduce smoking when caring for a grandchild (Hughes et al. 2007). We therefore controlled for “physical inactivity” (= 1 if the respondent is never or almost never engaged in physical activities; = 0 otherwise), “smoking” (= 1 if the respondent is a smoker), and “drinking” (= 1 if the respondent consumed alcohol almost daily in the past three months).

#### **4.5 Endogeneity issues and the instrumental variable approach**

When estimating the effect of grandparenting on grandparents’ cognitive functioning, it is important to note that grandparents who provide childcare frequently could be different from other grandparents in

unobservable ways. An ordinary least squares (OLS) regression may therefore produce biased estimates.

One option for dealing with this endogeneity problem is to exploit the panel dimension of SHARE and use a fixed-effect approach. As we already mentioned, we decided to avoid this approach and consider only one observation for each respondent. We did this for two reasons. First, the learning effects from repeated exposure to the same tests may bias analyses on cognitive functioning (Mazzonna and Peracchi 2012). Second, selective attrition is a serious issue in panel surveys of the elderly (in SHARE about one-third of the original sample is lost). Zamarro et al. (2008) found that people in poor health and with poor cognitive abilities are more likely to drop out of the panel. Moreover, a fixed-effect approach would not resolve endogeneity due to time-varying factors and reverse causality.

We deal with the endogeneity issues by implementing an instrumental variable approach. Our instrument is the availability of grandchildren (a binary variable with a value of one if the interviewee has at least one grandchild, and of zero otherwise). An instrumental variable must satisfy two conditions: relevance and validity. The first condition requires a strong association between having at least one grandchild (the instrument) and the provision of grandparental childcare (the endogenous variable). As expected, our instrument easily passed the test of relevance in all the analyses<sup>5</sup>.

The second condition is satisfied if having grandchildren does not affect cognitive functioning directly, but only through the provision of grandparental childcare. The exogeneity of the instrument would be violated if, for example, the respondents' adult children had decided to have children based on the cognitive status of their parents. However, this should not be a

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<sup>5</sup> The Cragg-Donald Wald F-test statistic (required because we allow for heteroskedasticity of any kind and therefore errors to be not i.i.d) in all of the implemented analyses overcame the threshold of 10 usually considered acceptable (Staiger and Stock 1997), as 421 is the minimum value it takes.

problem in our analysis because we excluded respondents who ever had serious health problems linked to cognitive impairment. It is also important to note that we excluded childless respondents from our sample. The childlessness of some respondents would not be exogenous, as it might be the result of past health problems or be associated with cognitive functioning. By contrast, events that affect respondents' children (like their own fertility) are not likely to have a direct impact on respondents' cognitive functioning.

As we had only one instrumental variable (just identified model), we could not implement a test of over-identifying restrictions. However, we implemented a simple falsification test that compared respondents with grandchildren who did not provide childcare to respondents with no grandchildren. We did not find significant differences in any of the four cognitive measures considered. This provides some evidence that having grandchildren does not affect cognitive functioning per se.

## 5 RESULTS

### 5.1 Descriptive findings

A comparison of the average cognitive scores of respondents who provided care for grandchildren on a regular basis and those who did not showed that the first group performed significantly worse. In fact, as shown in Figure 2, grandparents who provided care on a daily<sup>6</sup> basis for grandchildren had lower cognitive performance than those who did not, either because they had no grandchildren ("no gc") or because they looked after their grandchildren less frequently.

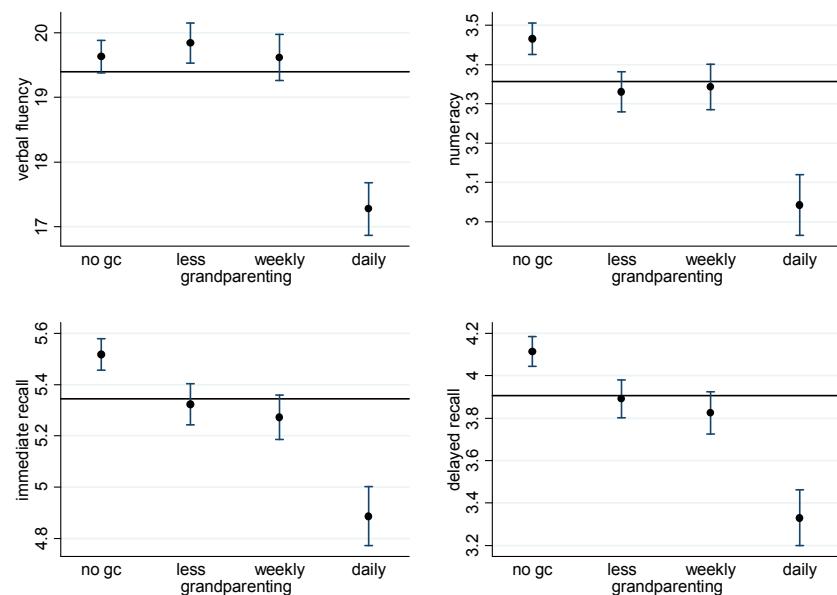
However, this negative evidence, which contradicts our hypotheses 1 and 2, could be due to an adverse self-selection mechanism into regular grandparenting. Comparing the characteristics of respondents who provided

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<sup>6</sup> For simplicity, we refer to "daily" childcare instead of "almost daily," which would be more accurate given the question formulation in SHARE, as reported in section 4.3.

grandparental childcare on a daily basis with the characteristics of the other respondents confirms this hypothesis. Table 2 shows that the “daily” grandparents were, on average, older, less educated, in worse health, more likely to be retired, and less involved in social and physical activities than the rest of the respondents. As was noted in the previously discussed literature, and as our regression models will also confirm, these factors are associated with worse cognitive functioning.

**Figure 2** Cognitive scores (means and 95% confidence intervals) by frequency of grandparenting Note: The horizontal line represents the overall mean; “daily” = daily grandparenting; “weekly” = almost weekly grandparenting; “less” = less frequent grandparenting (including never); “no gc” = no grandchildren



## 5.2 Multivariate results

Tables 3 to 6 present the results from the regression analyses, with each of the tables considering one of the four previously described cognitive measures as an outcome. Each table reports results from Ordinary Least Squares (OLS) regressions in which different blocks of covariates (described in section 4.4) are progressively entered<sup>7</sup>, and from the second stage of a Two-Stage Least Squares (2SLS) regression. To assess whether the effect of grandparenting depends on its frequency (hypothesis 2), we present for each outcome two sets of regressions that differ in the definition of regular grandparental childcare: daily versus other in the first case, and at least weekly versus other in the second case.

Looking at the OLS regression models, when only country effects were controlled for (“OLS 1”), we found that daily grandparental childcare was negatively and significantly associated with all measures of cognitive functioning, which confirmed the descriptive evidence shown in Figure 2. This was also the case for at least weekly childcare, although the magnitude of the effects was lower. However, we have already pointed out that the negative effect of regular childcare might be due to “unfavourable” background characteristics. As control variables were added, the negative coefficient of regular grandparental childcare tended to become smaller in absolute value and statistically insignificant. In many of the analyses, just adding controls for socio-demographic characteristics (age, education and partnership status) made the effect statistically insignificant or only marginally significant. In the case of verbal fluency (Table 3), when control

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<sup>7</sup> The control variables were entered as follows. Apart from the grandparenting dummy variable, “OLS 1” only included controls for country fixed effects. We then added socio-demographic characteristics (age, education, partnership status; “OLS 2”), activity status and social activities (“OLS 3”), health indicators (depression, self-reported health, limitations with daily activities; “OLS 4”) and risk factors (being physically inactive, smoking, drinking; “OLS 5”). The 2SLS model included all of the control variables. For brevity, estimated coefficients for the country dummy variables were not reported, but are available from the authors upon request.

variables were added to the model using at least weekly grandparenting, the effect of regular grandparenting turned out to be positive and marginally significant.

As we noted in section 4.5, an OLS regression gives biased estimates in the presence of unobserved confounders and/or reverse causality. For this reason, we used an Instrumental Variable (IV) approach and estimated a 2SLS regression. For all of the outcomes except for verbal fluency, the results of the 2SLS regression were very similar to those of the OLS in which all of the control variables were included (“OLS 5”): the estimated effect of regular grandparental childcare was not statistically significant with either of the two employed definitions. For verbal fluency, the signs of the “OLS 5” and 2SLS models were the same but the magnitude of the effect increased when we controlled for unobserved factors, and became statistically significant. The instrumental variable model showed that grandmothers providing childcare on a daily basis were able to list almost three animals more than the others. Looking at the distribution of the verbal fluency variable (Table 1), we can see that a gain of three points is quite substantial, as it roughly corresponds to the gap between individuals in the first and second quartiles, or to the jump from the median to the third quartile. The pay off of grandparenting was found to be reduced when the less stringent definition of regular grandparenting was used (there was a difference of one animal between grandmothers who provided childcare “at least weekly” and the others). Therefore, our hypotheses 1 and 2 are confirmed with respect to one dimension of cognitive functioning: when supplementary childcare is considered, as we do in this paper, greater involvement in childcare is found to be associated with better cognitive functioning among grandparents.

To test hypotheses 3 and 4, we decided to take advantage of the relatively large sample size, dividing it according to the age and activity status of the respondents. Table 7 displays the 2SLS estimates of the effect

of grandparental childcare on the four cognitive measures using both definitions of regular care as before for different subsamples<sup>8</sup>.

We found mixed evidence for the hypothesis that supplementary childcare is detrimental for grandmothers' cognitive function when they also have a paid job (hypothesis 3). For verbal fluency, we found a significant and positive effect, similarly to what it is found on the whole sample, while a significant negative effect was found for numeracy. The finding that grandparental childcare had a negative effect on numeracy and not on the other dimensions of cognitive abilities could be explained by the fact that the numeracy test was the most demanding. Thus, a stressed and fatigued respondent might have found it more difficult to perform well on the numeracy test. This result is consistent with the evidence on the effect of fatigue on cognitive performance. For example, Poffenberger (1928) found that test length had a negative effect for arithmetic tests, but not for other types of tests.

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<sup>8</sup> For brevity, estimates of the OLS regressions and the coefficients for the control variables were not reported but are available upon request. For each sub-group analysis, we used the same control variables as before, apart, of course, from the variable used for creating the groups.

**Table 3** Results of OLS and second stage of a 2SLS regression predicting “verbal fluency” using two alternative definitions of regular grandparental childcare (N = 6,274)

Independent variables	Almost daily grandparenting					At least weekly grandparenting					2SLS
	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5	
grandparenting	-0.95 *** -0.04 (0.23)	0.05 (0.22)	0.10 (0.22)	0.12 (0.22)	2.83 *** -0.62 *** (0.75) (0.16)	0.22 (0.16)	0.25 (0.16)	0.27 + (0.15)	0.27 + (0.15)	1.03 *** (0.27)	
<i>Education (ref: low)</i>											
medium education	2.20 *** 2.05 *** 1.88 *** 1.87 *** 1.97 *** (0.17) (0.17) (0.17) (0.17) (0.17)					2.22 *** 2.07 *** 1.90 *** 1.88 *** 1.92 *** (0.17) (0.17) (0.17) (0.17) (0.17)					
high education	4.46 *** 4.16 *** 3.87 *** 3.84 *** 4.03 *** (0.20) (0.21) (0.21) (0.21) (0.23)					4.49 *** 4.19 *** 3.90 *** 3.86 *** 3.96 *** (0.20) (0.21) (0.21) (0.21) (0.22)					
<i>Age (ref: 50-55)</i>											
age 56-60	-0.75 *** -0.51 *** -0.48 * -0.48 * -0.60 ** (0.18) (0.19) (0.19) (0.19) (0.19)					-0.79 *** -0.54 *** -0.52 ** -0.51 ** -0.62 ** (0.18) (0.19) (0.19) (0.19) (0.19)					
age 61-65	-0.97 *** -0.51 * -0.43 + -0.43 + -0.63 ** (0.21) (0.23) (0.23) (0.23) (0.24)					-1.02 *** -0.56 * -0.48 * -0.48 * -0.63 ** (0.21) (0.23) (0.23) (0.23) (0.24)					
age 66-70	-2.07 *** -1.48 *** -1.42 *** -1.40 *** -1.63 *** (0.24) (0.28) (0.28) (0.28) (0.29)					-2.13 *** -1.54 *** -1.47 *** -1.45 *** -1.63 *** (0.24) (0.28) (0.28) (0.28) (0.28)					
age 71-75	-2.55 *** -1.95 *** -1.72 *** -1.66 *** -1.76 *** (0.29) (0.33) (0.33) (0.33) (0.31)					-2.60 *** -1.99 *** -1.76 *** -1.70 *** -1.83 *** (0.30) (0.33) (0.33) (0.33) (0.31)					
age 76-80	-3.46 *** -2.80 *** -2.45 *** -2.40 *** -2.43 *** (0.40) (0.43) (0.43) (0.43) (0.41)					-3.49 *** -2.83 *** -2.49 *** -2.44 *** -2.54 *** (0.40) (0.43) (0.43) (0.43) (0.40)					
living with partner	0.22 (0.18)	0.27 (0.18)	0.23 (0.18)	0.23 (0.18)	0.19 (0.18)	0.21 (0.18)	0.26 (0.18)	0.22 (0.18)	0.23 (0.18)	0.21 (0.18)	

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Table 3 (continued)

Independent variables	Almost daily grandparenting					At least weekly grandparenting					
	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5	2SLS	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5
<i>Activity status (ref: employed)</i>											
other	-1.02 ***	-0.90 ***	-0.89 ***	-1.02 ***			-1.03 ***	-0.91 ***	-0.90 ***	-0.93 ***	
	(0.20)	(0.20)	(0.20)	(0.20)			(0.20)	(0.20)	(0.20)	(0.20)	
retired	-0.97 ***	-0.79 ***	-0.80 ***	-0.91 ***			-0.98 ***	-0.79 ***	-0.80 ***	-0.82 ***	
	(0.22)	(0.22)	(0.22)	(0.23)			(0.22)	(0.22)	(0.22)	(0.22)	
social activities	1.08 ***	1.01 ***	0.98 ***	1.04 ***			1.08 ***	1.01 ***	0.98 ***	0.98 ***	
	(0.23)	(0.23)	(0.23)	(0.23)			(0.23)	(0.23)	(0.23)	(0.23)	
depression (EURO-D)	-0.03	-0.03	-0.03				-0.03	-0.03	-0.03	-0.03	
	(0.04)	(0.04)	(0.04)				(0.04)	(0.04)	(0.04)	(0.04)	
self-reported health	-0.61 ***	-0.59 ***	-0.61 ***				-0.61 ***	-0.59 ***	-0.59 ***	-0.59 ***	
	(0.08)	(0.08)	(0.08)				(0.08)	(0.08)	(0.08)	(0.08)	
ADL limitations	-0.28	-0.23	-0.21				-0.28	-0.22	-0.21		
	(0.17)	(0.17)	(0.14)				(0.17)	(0.17)	(0.17)	(0.14)	
physically inactive	-0.73 *	-0.72 *					-0.73 *	-0.71 *			
	(0.29)	(0.30)					(0.29)	(0.30)			
smoking	0.15	0.19					0.15	0.15			
	(0.18)	(0.18)					(0.18)	(0.18)			
drinking	0.53 *	0.59 *					0.54 *	0.57 *			
	(0.22)	(0.23)					(0.22)	(0.23)			
constant	16.30 ***	14.90 ***	15.17 ***	16.68 ***	16.59 ***	16.43 ***	16.38 ***	14.84 ***	15.12 ***	16.63 ***	16.55 ***
	(0.33)	(0.38)	(0.39)	(0.43)	(0.43)	(0.33)	(0.33)	(0.38)	(0.40)	(0.43)	(0.43)

Note: \*\*\* = p-value < 0.001; \*\* = p-value < 0.01; \* = p-value < 0.05; + = p-value < 0.10. Country fixed effects are included in all the models. Robust standard errors are in parentheses

**Table 4** Results of OLS and second stage of a 2SLS regression predicting “numeracy” using two alternative definitions of regular grandparental childcare (N = 6,274)

Independent variables	Almost daily grandparenting					At least weekly grandparenting					
	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5	2SLS	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5
grandparenting	-0.25 *** (0.04)	-0.11 ** (0.04)	-0.10 * (0.04)	-0.09 * (0.04)	-0.09 * (0.04)	-0.13 (0.13)	-0.16 *** (0.03)	-0.04 (0.03)	-0.04 (0.03)	-0.03 (0.03)	-0.05 (0.05)
Education (ref: low)											
medium education	0.55 *** (0.03)	0.53 *** (0.03)	0.49 *** (0.03)	0.49 *** (0.03)	0.49 *** (0.03)	0.56 *** (0.03)	0.53 *** (0.03)	0.50 *** (0.03)	0.49 *** (0.03)	0.49 *** (0.03)	
high education	0.81 *** (0.04)	0.77 *** (0.04)	0.71 *** (0.04)	0.71 *** (0.04)	0.70 *** (0.04)	0.81 *** (0.04)	0.77 *** (0.04)	0.71 *** (0.04)	0.71 *** (0.04)	0.71 *** (0.04)	
Age (ref: 50-55)											
age 56-60	-0.03 (0.03)	-0.01 (0.03)	-0.01 (0.03)	-0.01 (0.03)	-0.01 (0.03)	-0.03 (0.03)	-0.01 (0.03)	-0.01 (0.03)	-0.01 (0.03)	-0.01 (0.03)	-0.01 (0.03)
age 61-65	-0.06 (0.04)	-0.02 (0.04)	-0.01 (0.04)	-0.01 (0.04)	-0.01 (0.04)	-0.06 (0.04)	-0.02 (0.04)	-0.02 (0.04)	-0.02 (0.04)	-0.01 (0.04)	-0.01 (0.04)
age 66-70	-0.15 *** (0.04)	-0.10 * (0.04)	-0.10 * (0.04)	-0.11 * (0.04)	-0.10 * (0.04)	-0.15 *** (0.04)	-0.10 * (0.04)	-0.10 * (0.04)	-0.11 * (0.04)	-0.11 * (0.04)	-0.10 * (0.04)
age 71-75	-0.18 *** (0.05)	-0.12 * (0.06)	-0.10 + (0.06)	-0.10 + (0.06)	-0.09 (0.06)	-0.18 *** (0.05)	-0.12 * (0.05)	-0.12 * (0.05)	-0.10 + (0.05)	-0.10 + (0.05)	-0.09 (0.05)
age 76-80	-0.30 *** (0.07)	-0.25 *** (0.07)	-0.20 ** (0.07)	-0.20 ** (0.07)	-0.20 * (0.07)	-0.30 *** (0.07)	-0.24 ** (0.07)	-0.20 ** (0.07)	-0.19 ** (0.07)	-0.19 ** (0.07)	-0.19 * (0.07)
living with											
	0.04 (0.03)	0.05 (0.03)	0.02 (0.03)	0.02 (0.03)	0.02 (0.03)	0.04 (0.03)	0.05 (0.03)	0.02 (0.03)	0.02 (0.03)	0.02 (0.03)	0.02 (0.03)

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Table 4 (continued)

Independent variables	Almost daily grandparenting					At least weekly grandparenting					
	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5	2SLS	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5
Activity status (ref: employed other)	-0.15 *** (0.03)	-0.12 *** (0.03)	-0.12 *** (0.03)	-0.11 ** (0.03)			-0.15 *** (0.03)	-0.12 *** (0.03)	-0.12 *** (0.03)	-0.12 *** (0.03)	
retired	-0.09 * (0.04)	-0.05 (0.04)	-0.05 (0.04)	-0.05 (0.04)			-0.09 * (0.04)	-0.06 (0.04)	-0.06 (0.04)	-0.06 (0.04)	
social activities	0.07 + (0.04)	0.06 (0.04)	0.06 (0.04)	0.06 (0.04)			0.07 + (0.04)	0.06 + (0.04)	0.06 + (0.04)	0.06 + (0.04)	
depression (EURO-D)		-0.05 *** (0.01)	-0.05 *** (0.01)	-0.05 *** (0.01)			-0.05 *** (0.01)	-0.05 *** (0.01)	-0.05 *** (0.01)	-0.05 *** (0.01)	
self-reported health		-0.08 *** (0.01)	-0.08 *** (0.01)	-0.08 *** (0.01)			-0.09 *** (0.01)	-0.09 *** (0.01)	-0.09 *** (0.01)	-0.09 *** (0.01)	
ADL limitations		-0.01 (0.03)	-0.01 (0.03)	-0.01 (0.03)			-0.01 (0.03)	-0.01 (0.03)	-0.01 (0.03)	-0.01 (0.03)	
physically inactive		-0.00 (0.05)	-0.00 (0.05)	-0.00 (0.05)			-0.00 (0.05)	-0.00 (0.05)	-0.00 (0.05)	-0.00 (0.05)	
smoking		0.00 (0.03)	0.00 (0.03)	0.00 (0.03)			0.01 (0.03)	0.01 (0.03)	0.01 (0.03)	0.01 (0.03)	
drinking		(0.04) 0.00	(0.04) 0.00	(0.04) 0.00			(0.04) 0.01	(0.04) 0.01	(0.04) 0.01	(0.04) 0.01	
constant	3.37 *** (0.06)	2.95 *** (0.07)	3.01 *** (0.07)	3.32 *** (0.07)	3.32 *** (0.07)	3.39 *** (0.06)	2.95 *** (0.07)	3.01 *** (0.07)	3.32 *** (0.07)	3.32 *** (0.07)	3.32 *** (0.07)

Note: \*\*\* = p-value < 0.001; \*\* = p-value < 0.01; \* = p-value < 0.05; + = p-value < 0.10. Country fixed effects are included in all the models. Robust standard errors are in parenthesis

**Table 5** Results of OLS and second stage of a 2SLS regression predicting “immediate recall” using two alternative definitions of regular grandparental childcare (N = 6,274)

Independent variables	Almost daily grandparenting					At least weekly grandparenting						
	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5	2SLS	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5	
grandparenting	-0.28 *** (0.06)	-0.08 (0.06)	-0.07 (0.06)	-0.05 (0.06)	-0.05 (0.06)	-0.15 (0.20)	-0.25 *** (0.04)	-0.07 (0.04)	-0.06 (0.04)	-0.05 (0.04)	-0.06 (0.07)	
<i>Education (ref: low)</i>												
medium education	0.64 *** (0.04)	0.61 *** (0.04)	0.57 *** (0.04)	0.57 *** (0.04)	0.56 *** (0.04)	0.64 *** (0.04)	0.61 *** (0.04)	0.57 *** (0.04)	0.56 *** (0.04)	0.56 *** (0.04)	0.56 *** (0.04)	
high education	0.97 *** (0.05)	0.91 *** (0.06)	0.84 *** (0.06)	0.84 *** (0.06)	0.83 *** (0.06)	0.96 *** (0.05)	0.91 *** (0.05)	0.84 *** (0.05)	0.84 *** (0.05)	0.84 *** (0.05)	0.84 *** (0.05)	
<i>Age (ref: 50-55)</i>												
age 56-60	-0.06 (0.05)	-0.02 (0.05)	-0.02 (0.05)	-0.02 (0.05)	-0.02 (0.05)	-0.06 (0.05)	-0.06 (0.05)	-0.01 (0.05)	-0.02 (0.05)	-0.01 (0.05)	-0.01 (0.05)	
age 61-65	-0.17 ** (0.05)	-0.08 (0.06)	-0.08 (0.06)	-0.07 (0.06)	-0.07 (0.06)	-0.16 ** (0.05)	-0.07 (0.05)	-0.07 (0.05)	-0.07 (0.05)	-0.07 (0.05)	-0.07 (0.05)	
age 66-70	-0.47 *** (0.06)	-0.36 *** (0.07)	-0.36 *** (0.07)	-0.35 *** (0.07)	-0.34 *** (0.08)	-0.46 *** (0.06)	-0.35 *** (0.06)	-0.35 *** (0.06)	-0.34 *** (0.06)	-0.34 *** (0.06)	-0.34 *** (0.06)	
age 71-75	-0.66 *** (0.08)	-0.55 *** (0.09)	-0.52 *** (0.09)	-0.50 *** (0.09)	-0.50 *** (0.09)	-0.66 *** (0.08)	-0.55 *** (0.08)	-0.51 *** (0.08)	-0.50 *** (0.08)	-0.50 *** (0.08)	-0.50 *** (0.08)	
age 76-80	-1.11 *** (0.11)	-0.93 *** (0.11)	-0.92 *** (0.11)	-0.91 *** (0.12)	-0.91 *** (0.12)	-1.10 *** (0.11)	-0.98 *** (0.11)	-0.93 *** (0.11)	-0.91 *** (0.11)	-0.91 *** (0.11)	-0.91 *** (0.12)	
living with partner	0.21 *** (0.05)	0.22 *** (0.05)	0.20 *** (0.05)	0.21 *** (0.05)	0.21 *** (0.05)	0.22 *** (0.05)	0.22 *** (0.05)	0.20 *** (0.05)	0.21 *** (0.05)	0.21 *** (0.05)	0.21 *** (0.05)	

*Table continued on the next page*

Table 5 (continued)

Independent variables	Almost daily grandparenting					At least weekly grandparenting					
	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5	2SLS	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5
Activity status ( <i>ref: employed</i> )											
other	-0.20 ***	-0.16 ***	-0.16 ***	-0.16 ***	-0.16 ***		-0.20 ***	-0.16 ***	-0.16 ***	-0.16 ***	-0.16 ***
(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)		(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
retired	-0.18 ***	-0.14 *	-0.14 *	-0.13 *	-0.13 *		-0.18 **	-0.14 *	-0.14 *	-0.14 *	-0.14 *
(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)		(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
social activities	0.17 ***	0.16 ***	0.16 ***	0.16 *	0.16 *		0.17 **	0.16 ***	0.16 ***	0.16 ***	0.16 ***
(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)		(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
depression (EURO-D)	-0.05 ***	-0.05 ***	-0.05 ***	-0.05 ***	-0.05 ***		-0.05 ***	-0.05 ***	-0.05 ***	-0.05 ***	-0.05 ***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
self-reported health	-0.11 ***	-0.11 ***	-0.11 ***	-0.11 ***	-0.11 ***		-0.11 ***	-0.11 ***	-0.11 ***	-0.11 ***	-0.11 ***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
ADL limitations	0.02	0.02	0.02	0.02	0.02		0.02	0.02	0.02	0.02	0.02
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)		(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
physically inactive	-0.07	-0.07	-0.07	-0.07	-0.07		-0.07	-0.07	-0.07	-0.07	-0.07
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)		(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
smoking	0.07	0.07	0.07	0.07	0.07		0.07	0.07	0.07	0.07	0.07
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)		(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
drinking	0.02	0.02	0.02	0.02	0.02		0.02	0.02	0.02	0.02	0.02
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)		(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
constant	5.71 ***	5.23 ***	5.28 ***	5.65 ***	5.62 ***	5.63 ***	5.75 ***	5.23 ***	5.29 ***	5.65 ***	5.63 ***
	(0.09)	(0.10)	(0.10)	(0.11)	(0.11)	(0.11)	(0.12)	(0.09)	(0.10)	(0.10)	(0.11)

Note: \*\*\* = p-value < 0.001; \*\* = p-value < 0.01; \* = p-value < 0.05; + = p-value < 0.10. Country fixed effects are included in all the models. Robust standard errors are in parentheses.

**Table 6** Results of OLS and second stage of a 2SLS regression predicting “delayed recall” using two alternative definitions of regular grandparental childcare (N = 6,274)

Independent variables	Almost daily grandparenting					At least weekly grandparenting						
	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5	2SLS	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5	2SLS
grandparenting	-0.37 *** (0.07)	-0.15 * (0.07)	-0.14 * (0.07)	-0.12 + (0.07)	-0.12 + (0.07)	-0.19 (0.23)	-0.29 *** (0.05)	-0.08 + (0.05)	-0.07 (0.05)	-0.07 (0.05)	-0.07 (0.08)	-0.07
<i>Education (ref: low)</i>												
medium education	0.56 *** (0.05)	0.53 *** (0.05)	0.48 *** (0.05)	0.48 *** (0.05)	0.48 *** (0.05)		0.56 *** (0.05)	0.53 *** (0.05)	0.48 *** (0.05)	0.48 *** (0.05)	0.48 *** (0.05)	
high education	0.88 *** (0.06)	0.83 *** (0.06)	0.74 *** (0.07)	0.74 *** (0.07)	0.74 *** (0.07)		0.88 *** (0.06)	0.83 *** (0.07)	0.74 *** (0.07)	0.74 *** (0.07)	0.74 *** (0.07)	
<i>Age (ref: 50-55)</i>												
age 56-60	-0.23 *** (0.06)	-0.20 *** (0.06)	-0.21 *** (0.06)	-0.20 *** (0.06)	-0.20 *** (0.06)		-0.22 *** (0.06)	-0.20 *** (0.06)	-0.20 *** (0.06)	-0.20 *** (0.06)	-0.20 *** (0.06)	
age 61-65	-0.34 *** (0.06)	-0.31 *** (0.07)	-0.31 *** (0.07)	-0.31 *** (0.07)	-0.30 *** (0.07)		-0.34 *** (0.06)	-0.31 *** (0.07)	-0.31 *** (0.07)	-0.30 *** (0.07)	-0.30 *** (0.07)	
age 66-70	-0.61 *** (0.07)	-0.58 *** (0.09)	-0.58 *** (0.09)	-0.58 *** (0.09)	-0.57 *** (0.09)		-0.61 *** (0.07)	-0.57 *** (0.09)	-0.58 *** (0.09)	-0.57 *** (0.09)	-0.57 *** (0.09)	
age 71-75	-0.92 *** (0.09)	-0.88 *** (0.10)	-0.84 *** (0.10)	-0.83 *** (0.10)	-0.83 *** (0.10)		-0.92 *** (0.09)	-0.88 *** (0.10)	-0.84 *** (0.10)	-0.82 *** (0.10)	-0.82 *** (0.10)	
age 76-80	-1.32 *** (0.12)	-1.27 *** (0.13)	-1.21 *** (0.13)	-1.20 *** (0.13)	-1.19 *** (0.13)		-1.32 *** (0.12)	-1.27 *** (0.13)	-1.20 *** (0.13)	-1.19 *** (0.13)	-1.19 *** (0.13)	
living with partner	0.21 *** (0.05)	0.22 *** (0.05)	0.19 *** (0.05)	0.19 *** (0.05)	0.20 *** (0.05)		0.20 *** (0.05)	0.22 *** (0.05)	0.19 *** (0.05)	0.19 *** (0.05)	0.19 *** (0.05)	

Table continued on the next page

Table 6 (continued)

Independent variables	Almost daily grandparenting						At least weekly grandparenting				
	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5	2SLS	OLS 1	OLS 2	OLS 3	OLS 4	OLS 5
Activity status ( <i>ref: employed</i> )											
other	-0.16 *	-0.12 +	-0.11 +	-0.11 +			-0.16 **	-0.12 +	-0.12 +	-0.12 +	-0.12 +
	(0.06)	(0.06)	(0.06)	(0.06)			(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
retired	-0.07	-0.02	-0.02	-0.02			-0.07	-0.02	-0.03	-0.03	-0.03
	(0.07)	(0.07)	(0.07)	(0.07)			(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
social activities	0.22 **	0.21 **	0.21 **	0.21 **			0.22 **	0.21 **	0.21 **	0.21 **	0.21 **
	(0.07)	(0.07)	(0.07)	(0.07)			(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
depression (EURO-D)					-0.06 *** -0.06 *** -0.06 ***						
					(0.01) (0.01) (0.01)						
self-reported health					-0.13 *** -0.12 *** -0.12 ***						
					(0.02) (0.02) (0.02)						
ADL limitations					0.02 0.02 0.02						
					(0.05) (0.05) (0.05)						
physically inactive					-0.02 -0.02 -0.02						
					(0.09) (0.09) (0.09)						
smoking					0.07 0.07 0.07						
					(0.05) (0.06) (0.06)						
drinking					0.06 0.05 0.05						
					(0.07) (0.07) (0.07)						
constant	4.51 ***	4.23 ***	4.27 ***	4.70 ***	4.68 *** 4.68 *** 4.56 ***		4.23 *** 4.27 *** 4.70 ***	4.27 *** 4.70 *** 4.68 ***	4.27 *** 4.70 *** 4.68 ***	4.27 *** 4.70 *** 4.68 ***	4.27 *** 4.70 *** 4.68 ***
	(0.10)	(0.12)	(0.12)	(0.13)	(0.13) (0.13) (0.13)		(0.10)	(0.12)	(0.12)	(0.13)	(0.13)

**Note:** \*\*\* = p-value < 0.001; \*\* = p-value < 0.01; \* = p-value < 0.05; + = p-value < 0.10. Country fixed effects are included in all the models. Robust standard errors are in parentheses.

**Table 7** 2SLS estimates for different subsamples of the effect of grandparental childcare on different measures of cognitive functioning using two alternative definitions of regular childcare

Subsample	Almost daily grandparenting				At least weekly grandparenting			
	verbal fluency	Nu-meracy	Im-mediate recall	delayed recall	verbal fluency	Nu-meracy	Im-mediate recall	delayed recall
Aged 50-64 (N = 4,885)	2.23** (0.86)	-0.24 (0.15)	-0.29 (0.23)	-0.37 (0.27)	0.79** (0.30)	-0.08 (0.05)	-0.10 (0.08)	-0.13 (0.09)
Aged 65-80 (N = 1,389)	5.35*** (1.61)	0.35 (0.30)	0.66 (0.43)	0.81 (0.47)	2.16*** (0.63)	0.14 (0.12)	0.26 (0.17)	0.33 (0.19)
Retired (N = 2,074)	4.07*** (1.17)	0.07 (0.21)	0.24 (0.30)	0.28 (0.35)	1.78*** (0.51)	0.03 (0.09)	0.10 (0.13)	0.12 (0.15)
Employed (N = 2,365)	4.38* (2.13)	-0.81* (0.35)	-0.95 (0.54)	-0.75 (0.63)	1.02* (0.49)	-0.19* (0.08)	-0.22 (0.12)	-0.17 (0.15)

**Note:** \*\*\* = p-value < 0.001; \*\* = p-value < 0.01; \* = p-value < 0.05; + = p-value < 0.10. All control variables, as shown in Tables 3-6, are included but coefficients are not reported. Robust standard errors are in parentheses.

Finally, hypothesis 4, which states that the effect of grandparental childcare is more beneficial for those who are more subject to cognitive decline (i.e., older and retired grandmothers), was partially confirmed. The positive and significant effect found for the verbal fluency measure on the whole sample became even stronger for the oldest group of grandmothers. For retired grandmothers, we also found a sizeable effect on verbal fluency, although it was not substantially stronger than the effect found for working grandmothers.

## 6 SUMMARY AND CONCLUDING REMARKS

As societies age, it becomes increasingly important to focus on the factors that may help elderly people maintain good cognitive functioning. Grandparenting is a social activity that gives grandparents a sense of

responsibility and involves them in tasks based on intergenerational exchanges. Although caring for grandchildren is a widespread activity among US and European seniors, previous studies on grandparents' outcomes have mainly investigated its effect on grandparents' levels of depression and physical health. We add to this existing literature an analysis of a more objective measure of age-related outcomes that covers health conditions more broadly: namely, cognitive functioning.

Descriptive analyses of the SHARE data can create the impression that grandparenting is an activity that negatively affects grandparents' cognitive performance. According to these analyses, grandmothers who look after their grandchildren on a regular basis (especially with daily frequency) appear to have lower cognitive functioning than their counterparts without grandchildren or than those who look after their grandchildren less often.

This conclusion was, however, either not supported or reversed by our multivariate analyses. The observed and unobserved characteristics of the grandparents who provided regular childcare were shown to be different from those of grandparents who did not provide care, and could be associated with cognitive functioning. In particular, we found evidence of an adverse selection mechanism into regular grandparenting: the grandmothers who provided regular childcare were, on average, older, less educated, more likely to be retired, and not involved in social activities. In other words, they had characteristics that are negatively associated with cognitive functioning. When the endogeneity of grandparental childcare was taken into account, our findings (partly) supported our main hypothesis that grandparenting has a positive effect on cognitive functioning: none of the cognitive tests considered was negatively affected by grandparenting; on the contrary, our instrumental variable approach showed that verbal fluency was measurably higher among grandmothers who provided regular childcare, and that the effect was stronger when the provision of childcare was more frequent (i.e., daily rather than at least weekly).

Our findings suggest that the health disadvantages for grandparents found in previous studies might arise from grandparents' prior

characteristics, not as a consequence of providing care. This is consistent with the study by Hughes et al. (2007), which showed that, controlling for (observable) background characteristics, health decline as a consequence of grandparental childcare is the exception rather than the rule. We add to this isolated evidence our conclusion that, after controlling also for unobservables, no negative effect of grandparenting on cognitive functioning can be found. Given the widespread reliance on grandparents for childcare in modern ageing societies, the outcome of this study is of considerable relevance.

The only exception to the positive or non-significant effect of grandparental childcare on older adults' cognition was found for the numeracy performance among grandmothers who had responsibilities that potentially conflicted with childcare (i.e., a paid job). This result suggests that, when the burden on grandparents is excessive, this activity can become more stressful and tiring than beneficial.

We acknowledge that our study is limited by a lack of information on what grandparents do when they are with their grandchildren. This information could help in explaining the different effects found for different measures of cognition.

An interesting area of future research would be to use data that allow us to identify custodial grandparents. With these data, it could be possible to analyse the effects on cognitive functioning of the most challenging type of grandparenting relative to the effects of providing supplementary childcare.

The evidence produced by our study contributes not only to the discussion on cognitive functioning in later life, but also to the debate on the intergenerational transfer balance, which often focuses on the prevalence of downward intergenerational support flows (see, e.g., Attias-Donfut et al. 2005). However, as Kahana and Young (1990; p.79) have argued, "the care giving relationship need not always be as one-sided as it might appear on the surface". This literature should therefore consider both the "costs" of providing childcare (and other transfers) and the benefits that grandparents can derive from it. For example, Powdthavee (2011) found that having

grandchildren is positively associated with life satisfaction, and argued that, even though the literature on the relationship between fertility and happiness has produced conflicting evidence, considering also the long-term effects of fertility through having grandchildren might posit for a positive balance of having children across the life-course. Along this line, our findings point to the need of considering the potential benefits of grandparenting also in terms of cognitive functioning.

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