# Does grandparental care pay off? The effect of childcare on grandparents´ cognitive functioning

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**Abstract**

Extensive literature shows the positive effects grandparental childcare has on younger generations. However, little evidence exists on the effects of grandparental childcare on grandparents. In this paper, we explore to what extent grandparental childcare influences cognitive ageing, by considering four dimensions of cognitive functioning. In particular, we focus on grandmothers, as they are the most engaged. Descriptive evidence suggests that grandmothers looking after grandchildren with a daily frequency have lower cognitive scores than those counterparts involved less often. However, we show that such a negative effect of grandparental childcare results from background characteristics of grandparents. In order to address the endogeneity of grandparental childcare, we implement an instrumental variable approach. Our regression analyses do not show evidence that grandparental childcare has a negative effect on grandparents' cognitive functioning. On the contrary, for one of the considered dimensions, verbal fluency, we find a substantial positive effect.

**Keywords:** grandparents; cognitive functioning; intergenerational relationships; active ageing; Instrumental Variable approach.

## 1. Introduction

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

Viewing grandparental childcare as an altruistic act, this type of intergenerational exchange has been studied mainly with a focus on its effect on younger generations. Its effect have been considered not only in terms of 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 with respect to mothers' labour force participation (Aassve et al. 2012a; Arpino et al. 2010; Dimowa and Wolff 2008; 2011; Gray 2005) and fertility decisions of the middle generation (Aassve et al. 2012b; Del Boca 2002; Hank and Kreyenfeld 2003).

Economic models have hypothesized that inter-vivos transfers from grandparents to grandchildren might also have an egoistic component that explains 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 need in the future and the hope that the younger generations will then be more altruistic toward those who gave them more in the past (e.g., Laferre`re and Wolff 2006). According to this strand of literature, grandparental childcare could be view as sort of investment for the future.

However, grandparental childcare might also be beneficial for grandparents in a more short-run perspective. Little and discordant evidence exists on the effect of grandparental childcare on grandparents' outcomes.

The majority of this literature has found negative effects of grandparental childcare on grandparents´ outcomes such as risk of isolation (Fergusson et al. 2008; Giarrusso et al. 2001; Jendrek 1993) and depression (Minkler et al., 1997; Silverstein, 2007). Few studies, on the contrary, find evidence in favour of a beneficial effect for grandparents of proving childcare (see Giarrusso et al., 2000) on stresses and rewards; Hughes et al. (2007) on health status and behaviors; Powdthavee (2011) on happiness).

The prevalence of evidence for a negative effect of grandparental childcare may be due to the context of childcare provision and to methodological issues. Indeed, there has been the tendency of focusing on problematic situations (e.g. grandparents who are primary caregivers, see Baker and Silverstein 2008; Goodman and Silverstein 2002; Minkler and Fuller-Thomson 2005).

From a methodological point of view, past evidence might be affected by an inadequate treatment of the endogeneity of grandparenting: the negative effect of grandparental childcare might be the resultant of background (observed and unobserved) characteristics of grandparents and not the consequence of childcare *per se*. Hughes et al. (2007) show that when the disadvantages due to background characteristics are adequately taken into account, no negative effect of caregiving is found and supplemental care even turns to have a positive effect on grandparents' health.

Closely linked to health, the process of cognitive ageing is challenging modern societies that are confronted with the need to identify ways to halt or slow down the decline of cognitive functioning in later life. Adding knowledge on cognitive functioning of older adults becomes

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extremely important as it not only predicts health outcomes (Batty et al., 2007; Gottfredson, 2004; Whalley and Deary, 2001) as well as mortality (e.g. Deary, 2005) , but it also fundamental for decision making (e.g. Christelis et al. 2010).

We therefore focus on cognitive functioning and ask if proving supplemental childcare has any impact on it. For the best of our knowledge, no previous study has analyzed the effect of grandparental childcare on grandparents' cognitive functioning.

## 2. Background

In an increased diversity of family forms, norms and behaviours, the horizontal ties within generations tend to decrease; while the duration of family ties crossing generations has been greatly increasing (Bengtson and Martin 2001).

Although in most developed countries there has been a decline in three or more generation households, grandparents hold 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 recent 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 towards children and grandchildren. For example, Aassve et al (2012a), Arpino et al (2010), Dimowa and Wolff (2008; 2011) and Gray 2005 show that grandparenting has an important role in helping mothers to balance working carrier and family in several European countries. It has also been 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; Hank and Kreyenfeld 2003; Del Boca 2002).

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 a particular focus on children raised solely by grandparents (i.e. caregiving grandparents), some research from the UK (e.g. Attar-Schwartz et al. 2009; Lussier et al. 2002) indicates that grandparental childcare when is complementary to parental care (i.e., supplemental childcare) is linked to better emotional adjustment and fewer behavioural problems among adolescents. Similarly, US research shows that grandchildren with close and supportive relationships with grandparents have reduced depressive symptoms than those with weak grandparent relationships (e.g. Ruiz and Silverstein 2007).

Finally, 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 the public provision is scarce. In some countries, the important role of grandparents as providers of childcare has been officially recognized. In the U.K., for example, grandparents who give up paid work to provide childcare can claim credits which 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 the whole society. But, is grandparenting beneficial for grandparents?

*2.2. The effect of grandparenting on grandparents*

Grandparental childcare can be considered both a downward and an upward transfer: on the one side, grandparents invest time and resources on their grandchildren; on the other side, grandchildren are an important (emotional) resource for grandparents (e.g., Bass and Caro 1996; Brandon 2000; 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, such as caring for grandchildren, can have beneficial consequences for the altruist in terms of own physical and mental health (McClellan et al. 1993), including a reduced risk of morbidity and mortality (Brown et al. 2005).

Yet, the effects of grandparenting on grandparents have received only little attention and mixed evidence exists.

Both small scale studies (see Grinstead et al. 2003 for a review) and research based on nationally representative U.S. surveys (e.g. Baker and Silverstein 2008; Minkler and Fuller-Thomson 2005), such as the Health and Retirement Study (HRS), have found poorer health and well-being outcomes associated with grandparenting. However, most of this literature has drawn the attention to problematic situations, such as full care in case of a skipped generation. Heavily-committed grandparents 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; Jendrek 1993), depression (Baker and Silverstein 2008; Minkler et al.,, 1997), emotional drain (Jendrek 1993) and exacerbation of health problems resulting from caregiving stress (Waldrop and Weber 2001). Despite the fact that some grandparents report feeling healthier after assuming the caregiving role because of a more active lifestyle (Waldrop and Weber 2001) and four out of five caregiving parents find the experience of raising a grandchild "extremely rewarding"

(Giarrusso et al., 2000), it is not surprising that grandparents raising grandchildren are more likely to suffer negative health-related outcomes than grandparents who are not raising their grandchildren.

Compared primary caregiving, providing childcare on a supplemental basis may have a completely different effect on older individuals' outcomes. As argued by Muller and Litwin (2011), it is surprising that only a few studies focus on grandparental childcare as complementary to parental childcare, even though it occurs far more commonly.

Proving supplemental childcare may enhance grandparents' sense of purpose in life and help in maintaining their family identity (Giarrusso et al. 2001; Jendrek 1993) and it may therefore have positive effects on grandparents' wellbeing. Indeed, to the best of our knowledge, the only study analysing both primary and supplementary caregivers (Hughes et al., 2007) finds evidence that grandmothers raising grandchildren in skipped-generation households show worse health and depression, while grandmothers acting as supplemental carers report better health. The effect holds even after adjusting for the health status measured before starting providing childcare.

The amount of care provided to the grandchildren and the responsibility burden associated with it may be the key to interpret the contrasting evidence on the effect of grandparental childcare on grandparent's outcomes. As illustrated in Figure 1, Coall and Hertwig (2011) hypothesize a nonlinear relationship between grandparental childcare and grandparents' wellbeing that, in their review, encompasses various positive emotions, such as satisfaction and contentment, and positive activities, such as spending time in company.

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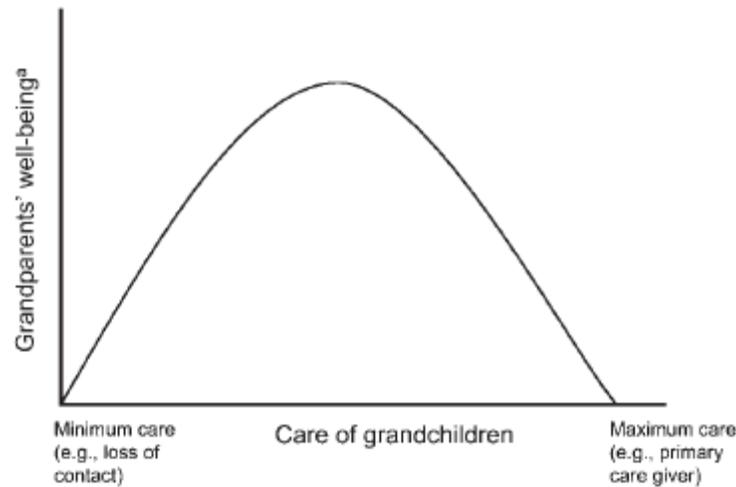


Source: Coall and Herwig (2011)

More study is needed to disentangle how much of the effect of grandparental childcare found in previous research may be based on selection effects (Umberson et al. 2010). Moreover, as recently suggested by Muller and Litwin (2011), rather than on grandparent caregiving, more attention is needed on studying the effect of supplemental grandparenting

Being the grandparent role directly linked to the distribution of responsibility between the family and the welfare system in caring for the young generation, it is important to increase attention on mental abilities and health in ageing societies (Batty et al. 2007; Deary et al. 2005; Gottfredson 2004; Whalley and Deary 2001). This paper aims to add knowledge on the effect of the grandparent-grandchild relationship focussing on cognitive functioning at mid- and late-life.

It is widely recognised that cognitive functioning in later life predicts mental (Martin et al. 2007) and functional status (Gottfredson, 2004) as well as mortality (Batty, Deary, Gottfredson 2007; Deary 2005; Whalley and Deary, 2001). 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). Moreover, cognitive abilities are strongly associated with the propensity to invest in stocks (Christelis et al. 2010). Recent demographic studies have additionally stressed that modern societies, shifting more of the responsibility associated with planning and managing the retirement years (financially and health-related) toward individuals, implicitly raise the importance that the capacity of the individual is maintained in later life (e.g. Hauser and Weir 2010). Preventing or halting cognitive ageing is therefore a goal of both growing old individuals and ageing societies.

Despite its importance in late life and the extensive literature on grandparental care, no previous study has so far focused on the effect of looking after grandchildren on cognitive functioning of the grandparent.


*2.3. Cognitive functioning in later life*

The natural decline of cognitive functioning with age is a characteristic trait of the aging process, in particular after the fifth decade of life (Schaie 1989). Starting with the (debated) conceptual framework proposed by Cattell and colleagues (Cattell, 1943; Horn and Cattell 1967), differentiating fluid and crystallised abilities, scholars have recognised different cognitive dimensions. General consensus has gained the distinction between two patterns of age-cognition relations (Schaie and Hofer, 2001). On the one hand, measures representing efficiency, or effectiveness of processing information at the time of assessment, are subject to a nearly linear decline from early adulthood on as they are closely related to biological and physical factors. On the other hand, measures representing products of processing carried out in the past (e.g.

knowledge acquired during life, with education and other life experiences) tend to decline later in life.

In order to study the effect of grandparenting on grandparents' cognitive functioning, we follow the line of research based on the simple motto "use-it-or-lose-it" (Rohwedder and Willis 2010): an undemanding environment may even accelerate the process of cognitive decline; on the contrary, engaging in stimulating activities may halt the process of ageing.

Several empirical studies highlight that not only genetic differences, but also education (Le Carret et al. 2003), being active in the labour market (Bonsang et al. 2012; Mazzonna and Peracchi 2012) or being involved in leisure and social activities (Engelhardt et al. 2010; Scarmeas and Stern 2003) may (positively) affect the cognitive endowment and (negatively) the rate of cognitive decline over age.

Within this framework, we may think of grandparenting as a stimulating activity for the brain: it provides grandparents with responsibilities and makes them interacting with younger generations (e.g., help in doing homework). This in turn, would result in an increase of elder's vitality. Grandparental childcare tends also to favour healthy behaviours, such as active lifestyle, or a reduction in smoking (Hughes et al., 2007): all activities that have been shown to positively affect cognitive functioning in middle and old age (e.g. Kalmijn et al. 2002).

However, the effect of grandparental childcare on grandparents' cognitive functioning may be a double edge sword: grandparents who actively contribute to grandchild care may feel physically tired and emotionally drained by childcare demands (e.g. Jendrek 1993); also, grandparenting may subtract time from self-care (Roe et al. 1996) or hobbies and other types of social engagement (Pruchno 1999).

Based on the previous discussion, we do not know a priori weather the negative or positive effect of grandparenting on grandmothers' cognitive skills will prevail.

The theoretical framework proposed by Coall and Hertwig (2011) suggests that this effect may depend on the level of grandparental involvement in childcare. Indeed, both incidence and frequency of grandparental childcare hugely vary across countries. For example, Bordone et al. (2012) show that in the 12 European considered countries, less than 30% of young parents did not recur at all to the grandparents to care for the own children in the year before the survey; while, huge differences across countries appear when looking at daily grandparenting. Reflecting the theoretical framework of a dichotomy between grandparents helping on a daily base and those acting as a reserve army (Hagestad, 2006), a clear European North-South divide emerges, with daily grandparenting occurring more often the more we move along the North-South line. Therefore, in order to assess weather the effect of grandparental childcare depends on its frequency, we consider different frequency of the grandparental childcare provision.

In this paper, similarly to several studies cited above, we focus on grandmothers. The literature has shown that, especially among regular carers, grandmothers are more strongly involved than grandfathers (Hank and Buber 2009). There is fairly unison agreement in the literature on grandparenting that the most active, complex grandparent-grandchild ties are found between grandmothers and grandchildren, "with the maternal grandmother as the star actor" (Hagestad 2006, p. 323). Coall and Hertwig (2011: p. 5) note that "one of the most robust findings across the grandparental investment literature 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". Despite the apparent high engagement of a considerable share of (maternal) grandfathers (Attias-Donfut et al

2005; Gutzman 2004; Hank and Buber 2009), the involvement of men as supplemental caregivers is likely to be mediated through grandmothers' engagement in childcare. Hank and Buber (2009) show no significant correlation between partnership status and grandmothers' probability to look after grandchildren, while lone grandfathers were found to be less likely to care than those living with a partner. Hughes et al. (2007), examining both grandmothers and grandfathers, found no significant differences among grandfathers who started, continued, or stopped providing grandchildcare. This finding points to stronger effects of grandparental childcare for grandmothers than for grandfathers due to the different responsibilities.

## 3. Methods

### 3.1. 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 population aged 50 and over (Börsch-Supan et al. 2005; 2008). All persons aged at least 50 in the households were interviewed. 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 are answered by the so-called family respondents. These are selected as the first interviewed person in each couple. The order of interview within couple is random but this selection decreases the size of our working sample. For details on the sampling procedure, questionnaire contents and fieldwork methodology, readers should refer to Börsch-Supan and Jürges (2005; 2008).

We use 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)[1]. We also use the second wave for the countries that joined SHARE in 2006 (i.e., Czech Republic, Ireland and Poland). In this way, we only consider the first observation for each respondent and do not take a panel approach for reasons that we discuss in section 3.5.

We restrict our sample to women aged 50-80 who are in "healthy" condition, excluding respondents who declared to be permanently sick or disabled. We can expect that illness decreases the probability to look after grandchildren: ill grandparents are less able (from a physical point of view) to take care of grandchildren and parents might prefer to leave their children with fit grandparents. For similar reasons, and following Engelhardt et al. (2010), we exclude respondents who reported to have ever been diagnosed with stroke, Parkinson or cancer. It is well-known that stroke, Parkinson, as well as anti-cancer drugs negatively impact on cognitive abilities (see Engelhardt et al. 2010 for a review).

We exclude from our sample grandparents who co-reside with grandchildren, because in this case their role, and their burden in terms of responsibility and time, might be completely different as compared to the case of grandparents who look after their grandchildren, more or less frequently. According to the discussion in section 2.2, it would be interesting to treat caregiving,

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[1] For Israel there is no refresher sample because this country only participated in the first wave. Also for Austria, which participated in both waves, no refresher sample is available.

co-residing and supplemental caregiving grandparents separately, instead of excluding the first two categories, but there are not enough cases in our data set to do so[2].

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[3]) and missing values in each of the variables used in the statistical analyses were other criteria of exclusion of cases. The final sample is composed of 6,274 women aged 50-80.

*3.2. Dependent variables*

Five cognitive functions are measured in SHARE: 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 due to its small variability and, as a consequence, its more appropriate use for detecting really severe cognitive deficits.

Table 1 provides some descriptive statistics on the 4 cognitive measures we consider as outcome variables in our analyses (the higher are their values, the better the cognitive functioning).

The test of verbal fluency in SHARE consists of naming as many animals as possible within in 1 minute. As Table 1 shows, once 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 listed no more than 15 animals and 50% no more than 19.

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[2]In the sample we consider, there are only 246 women co-residing with at least one grandchild. Of these, only in 41 cases none of the parents of the grandchild/ren is living in the household. On top of that, the latter group would not be necessarily composed by custodial grandparents that cannot be directly identified in SHARE.

[3]The regression analyses have been carried out using both dependent variables with and without the outliers and results were not substantially different. We have therefore retained the models using variables cleaned from the outliers.

The test of numeracy consists of a few simple arithmetical calculations assessing how people use numbers in everyday life. The resulting total score ranges from 1 to 5.

As for the test of memory, the interviewer first reads a list of ten common words to the respondent, and then asks the respondent to recall as many words as possible from the list in any order (immediate recall). The test is repeated at the end of the cognitive function module, without reading again the words (delayed recall). As Table 1 shows, 50% of respondents were not able to remember more that 5 words immediately after listening to them and 75% were not able to remember more than 5 words after some time has 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.

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.

We did not combine the four different measures of cognitive abilities into one single index because they refer to different dimensions of cognitive functioning. Moreover, from an empirical point of view, the correlations among the several items are rather low as showed in the bottom part of Table 1: immediate and delayed recall show a relatively high (0.65), while the correlations between all other items range from 0.32 to 0.39[4].

### 3.3. Independent variable

The independent variable of our interest refers to the provision of grandparental childcare on a regular basis. For each child with own children, grandparents were asked whether they 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 build a binary variable equal to 1 if the respondent reported to have provided childcare "almost daily" for the children of at least one child and 0 otherwise (labelled as "almost daily grandparenting" in tables 3-7). According to the discussion in sections 2.2 and 2.3, it is of interest to assess if the effect of grandparenting depends on its frequency. Therefore, in our analyses we also consider a different definition of regular 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 almost on a daily basis, 20% almost weekly, 25% less often (which includes never) and about 43% are grandchildless.

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[4] The summary index we calculated showed low internal consistency (Cronbach's alpha). We tried to combine immediate and delayed recall (as done, for example, by Mazzonna and Peracchi, 2010) but the results are similar to those presented here with the two separate items.

Table 2 – Descriptive statistics on the control variables and the frequency of grandparenting

| Control variables | Frequency of grandparenting | | | | All |
| --- | --- | --- | --- | --- | --- |
| | no grandchildren | less often | almost weekly | almost daily | |
| Age | 56.85 | 62.59 | 61.51 | 61.97 | 59.81 |
| medium education (%) | 0.40 | 0.35 | 0.37 | 0.34 | 0.38 |
| high education (%) | 0.26 | 0.17 | 0.16 | 0.07 | 0.20 |
| living with partner (%) | 0.80 | 0.77 | 0.79 | 0.81 | 0.79 |
| employed (%) | 0.50 | 0.31 | 0.32 | 0.16 | 0.38 |
| retired (%) | 0.20 | 0.46 | 0.38 | 0.45 | 0.33 |
| social activities (%) | 0.11 | 0.10 | 0.11 | 0.09 | 0.11 |
| 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 | 0.06 | 0.10 | 0.07 | 0.11 | 0.08 |
| physically inactive (%) | 0.06 | 0.07 | 0.07 | 0.09 | 0.07 |
| smoking (%) | 0.21 | 0.20 | 0.20 | 0.16 | 0.20 |
| drinking (%) | 0.14 | 0.13 | 0.11 | 0.07 | 0.12 |
| N | 2,725 | 1,535 | 1,253 | 761 | 6,274 |
| (%) | 43.43 | 24.47 | 19.97 | 12.13 | 100.00 |

*3.4. Control variables*

The choice of controls is 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. Part of these differences may be due to the different education systems (Dewey and Prince 2005) or reflect language and cultural differences that may produce effects on the measured cognitive scores (Bonsang et al 2012). We include 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).

*Socio-demographic variables*. Given the non linear decline of cognitive functioning with age, we control for age using a set of dummy variables: 50-55 (reference), 56-60, 61-65, 66-70, 71-75,

76-80. Education is known to be strongly related to cognitive skills (Le Carret et al 2003). We use 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). So we include in the regressions the binary variable "partner" (1 = living with a partner; 0 = otherwise).

*Working and social activities.* It has been found 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 is measured by three dummy variables: "employed" (reference), "retired", "other" (i.e. unemployed, homemaker, other). The vast majority of women in the group "other" are housewives. Regular involvement in voluntary work, religious, political or community-related organizations, educational courses and other social activities is measured by the dummy variable "social activities" (=1 if involved almost daily in at least one of the listed activities; =0 otherwise).

*Health.* We control for the number of limitations with activities of daily living ("ADL"), "self-reported health" (it ranges from 1 to 5; the higher, the worse), and "depression". The latter is measured using the EURO-D scale (it ranges from 1 to 12; the higher, the more depressed), which considers depressive symptoms. Depressive symptoms are found to exacerbate cognitive problems in older adults (Cronin-Stubbs et al. 2000) and functional impairment may be an independent risk factor for cognitive decline (Gill et al 1995).

*Risk factors.* Physical inactivity, smoking, and excessive alcohol consumption negatively influence cognition (Kalmijn et al. 2002) and may also be associated with grandparenting. For

example, grandparents may feel the pressure to reduce smoking when caring for a grandchild (Hughes et al. 2007). We therefore control 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).

*3.5. Endogeneity issues and the Instrumental Variable approach*

When estimating the effect of grandparenting on grandparents' cognitive functioning, it is possible that those providing regular childcare are different from the others in unobservable ways. An ordinary least squares (OLS) regression may then give biased estimates.

One possibility to deal with this endogeneity problem is to exploit the panel dimension of SHARE and use a fixed-effect approach. As we already anticipated, we decided to avoid this approach and consider only one observation for each respondent. The reasons are twofold. First, learning effects from repeated exposure to the same tests may bias analyses on cognitive functioning (Mazzonna and Peracchi 2012). Second, attrition is a serious issue in panel surveys on elderly (in SHARE about one third of the original sample is lost). Zamarro et al. (2008) find 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 taking value 1 if the interviewee has at least one grandchild and 0 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. As it can be expected, our instrument easily passed the test of relevance in all the analyses[5].

The second condition is respected if having grandchildren does not impact on cognitive functioning directly, but only through the provision of grandparental childcare[6]. The exogeneity of the instrument is violated if, for example, respondents' children have decided to have their own children accordingly to the health status of their parents. However, this should not be a problem in our analysis because we exclude respondents who ever had serious health problems. Moreover, we exclude from our sample childless respondents: childlessness of some respondents might derive from past health problems and have therefore an impact on cognitive functioning. On the contrary, events that affect respondents' children (i.e. having or not an own child) are less likely to have a direct impact on respondents' cognitive functioning.

## 4. Results

### 4.1. Descriptive findings

A comparison of the average cognitive functioning between those who take care of grandchildren on a regular basis and those who do not, shows the first performing significantly worse. In fact, as shown in Figure 2, grandparents who care on a daily basis for grandchildren have lower

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[5] The Cragg-Donald Wald F-test statistic (required because we are allowing heteroskedasticity of any kind and so errors to be not i.i.d) in all the implemented analyses overcomes the threshold of 10 usually considered acceptable (Staiger and Stock, 1997), the minimum value it takes being 421.

[6] Having only one instrumental variable (just identified model) we cannot implement a test of over-identifying restrictions. However, we implemented a simple falsification test comparing those with grandchildren but not providing childcare to the grandchildless and we did not find significant differences in any of the four considered cognitive measures. This provides some evidence that having grandchildren does not affect *per se* cognitive functioning.

cognitive abilities than those who do not, either because they have no grandchildren ("no gc") or because they take care of their grandchildren less frequently.

Figure 2 – Cognitive scores (means and 95% confidence intervals) by frequency of grandparenting
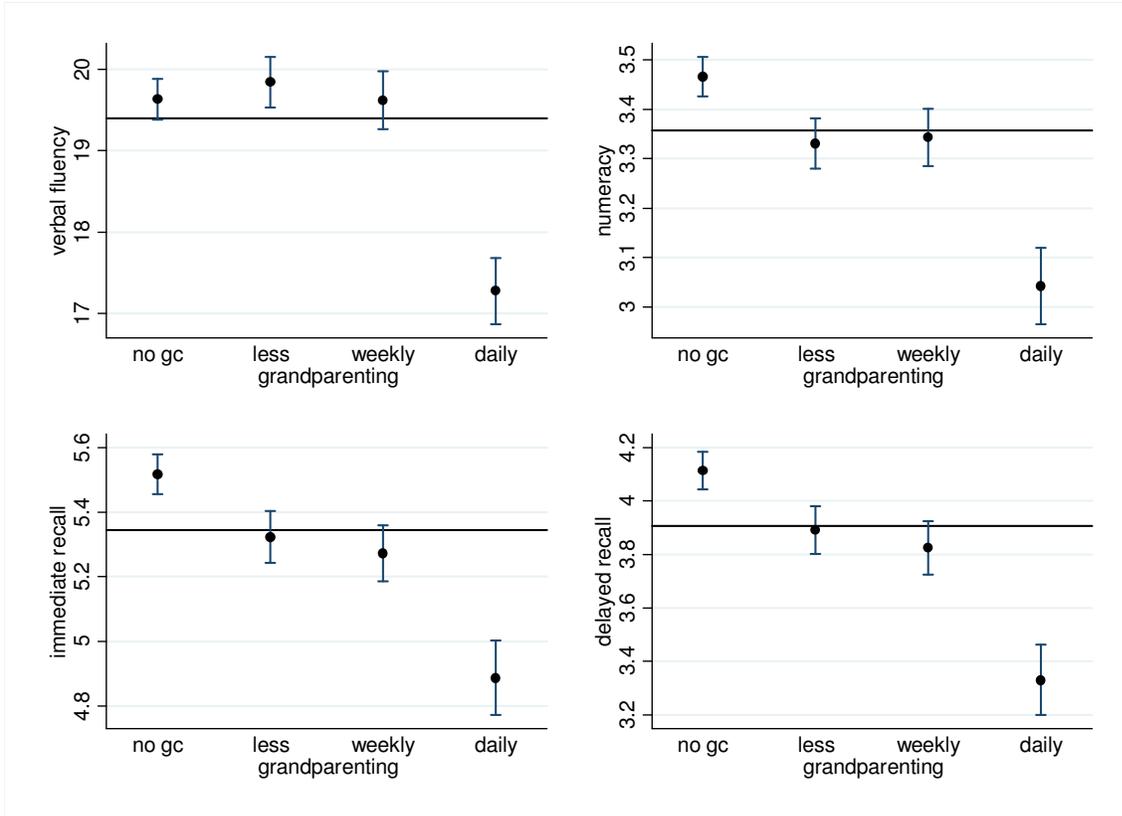


However, this negative evidence could be due to an adverse self-selection mechanism into regular grandparenting. Comparing the characteristics of respondents providing grandparental childcare on a daily basis and those of the others confirms this hypothesis. Table 2, in fact, shows that "daily" grandparents are, on average, older, less educated, in worse health conditions, more likely to be retired, and involved in social and physical activities than the rest of respondents. As

highlighted by the previously discussed literature, and as our regression models will also confirm, these factors are associated with worse cognitive functioning.

*4.2. Regression results*

Tables 3 to 6 present the results from the regression analyses, each considering one of the four previously described cognitive measures as outcome. Each table reports results from Ordinary Least Squares (OLS) regressions where different blocks of covariates (described in section 3.4) are progressively entered[7] and from the second stage of a Two-Stage Least Squares (2SLS) regression. To assess if the effect of grandparenting depends on its frequency, for each outcome we present two sets of regressions that differ for the definition of regular grandparental childcare: daily versus other, in the first case; at least weekly versus other, in the second case.

When only country effects are controlled for ("OLS 1"), we find daily grandparental childcare, to be negatively and significantly associated with all measures of cognitive skills, confirming the evidence shown by Figure 2. This is also the case for at least weekly childcare even though the magnitudes of the effects are lower. However, we already argued that the negative effect of regular childcare might be due "unfavourable" background characteristics. As control variables are added, the negative coefficient of regularly grandparental childcare tends to became smaller and statistically insignificant. In many analyses, already adding controls for socio-demographic characteristics (age, education and partnership status) makes the effects not

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[7] The control variables are entered as follows: Apart from the grandparenting dummy variable, "OLS 1" only includes controls for country fixed effects. Then we add 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 includes all the control variables. For brevity, estimated coefficients for the country dummy variables are not reported but available from the authors upon request.)

statistically significant or only marginally significant. In the case of verbal fluency (Table 3), when adding control variables, the effect of regular grandparenting turns to be positive and marginally significant when at least weekly grandparenting is considered.

As argued in section 3.5, an OLS regression gives biased estimates in the presence of unobserved confounders and/or reverse causality. That is why we use an Instrumental Variable (IV) approach and estimate a 2SLS regression. For all outcomes but verbal fluency the results of the 2SLS regression are very similar to those of the OLS where all the control variables are included ("OLS 5"): the estimated effect of regular grandparental childcare is not statistically significant with neither of the two employed definitions. As verbal fluency is concerned, the signs of the "OLS 5" and 2SLS models are the same but the magnitude of the effect increases when we control for unobserved factors and becomes statistically significant. The instrumental variable model shows that grandmothers providing childcare on a daily basis are able to list almost three animals more than the others. Looking at the distribution of the verbal fluency variable (Table 1), we can notice that a gain of 3 points is quite substantial as it roughly corresponds to the gap between individuals at the first and second quartile or to the jump from the median to the third quartile. The pay off of grandparenting is reduced when the less stringent definition of regular grandparenting is used (one animal is the difference between "at least weekly" grandchild carers and the others).

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 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OLS 1 | OLS 2 | OLS 3 | OLS 4 | OLS 5 | IV | OLS 1 | OLS 2 | OLS 3 | OLS 4 | OLS 5 | IV |
| grandparenting | -0.95 *** (0.23) | -0.04 (0.22) | 0.05 (0.22) | 0.10 (0.22) | 0.12 (0.22) | 2.83 *** (0.75) | -0.62 *** (0.16) | 0.22 (0.16) | 0.25 (0.16) | 0.27 + (0.16) | 0.27 + (0.15) | 1.03 *** (0.27) |
| *Education (ref: low)* | | | | | | | | | | | | |
| medium education | | 2.20 *** (0.17) | 2.05 *** (0.17) | 1.88 *** (0.17) | 1.87 *** (0.17) | 1.97 *** (0.17) | | 2.22 *** (0.17) | 2.07 *** (0.17) | 1.90 *** (0.17) | 1.88 *** (0.17) | 1.92 *** (0.17) |
| high education | | 4.46 *** (0.20) | 4.16 *** (0.21) | 3.87 *** (0.21) | 3.84 *** (0.21) | 4.03 *** (0.23) | | 4.49 *** (0.20) | 4.19 *** (0.21) | 3.90 *** (0.21) | 3.86 *** (0.21) | 3.96 *** (0.22) |
| *Age (ref: 50-55)* | | | | | | | | | | | | |
| age 56-60 | | -0.75 *** (0.18) | -0.51 ** (0.19) | -0.48 * (0.19) | -0.48 * (0.19) | -0.60 ** (0.19) | | -0.79 *** (0.18) | -0.54 ** (0.19) | -0.52 ** (0.19) | -0.51 ** (0.19) | -0.62 ** (0.19) |
| age 61-65 | | -0.97 *** (0.21) | -0.51 * (0.23) | -0.43 + (0.23) | -0.43 + (0.24) | -0.63 ** (0.24) | | -1.02 *** (0.21) | -0.56 * (0.23) | -0.48 * (0.23) | -0.48 * (0.23) | -0.63 ** (0.24) |
| age 66-70 | | -2.07 *** (0.24) | -1.48 *** (0.28) | -1.42 *** (0.28) | -1.40 *** (0.28) | -1.63 *** (0.29) | | -2.13 *** (0.24) | -1.54 *** (0.28) | -1.47 *** (0.28) | -1.45 *** (0.28) | -1.63 *** (0.28) |
| age 71-75 | | -2.55 *** (0.29) | -1.95 *** (0.33) | -1.72 *** (0.33) | -1.66 *** (0.33) | -1.76 *** (0.31) | | -2.60 *** (0.30) | -1.99 *** (0.33) | -1.76 *** (0.33) | -1.70 *** (0.33) | -1.83 *** (0.31) |
| age 76-80 | | -3.46 *** (0.40) | -2.80 *** (0.43) | -2.45 *** (0.43) | -2.40 *** (0.43) | -2.43 *** (0.41) | | -3.49 *** (0.40) | -2.83 *** (0.43) | -2.49 *** (0.43) | -2.44 *** (0.43) | -2.54 *** (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) |
| *Activity status (ref: employed)* | | | | | | | | | | | | |
| other | | | -1.02 *** (0.20) | -0.90 *** (0.20) | -0.89 *** (0.20) | -1.02 *** (0.20) | | | -1.03 *** (0.20) | -0.91 *** (0.20) | -0.90 *** (0.20) | -0.93 *** (0.20) |
| retired | | | -0.97 *** (0.22) | -0.79 *** (0.22) | -0.80 *** (0.22) | -0.91 *** (0.23) | | | -0.98 *** (0.22) | -0.79 *** (0.22) | -0.80 *** (0.22) | -0.82 *** (0.22) |
| social activities | | | 1.08 *** (0.23) | 1.01 *** (0.23) | 0.98 *** (0.23) | 1.04 *** (0.23) | | | 1.08 *** (0.23) | 1.01 *** (0.23) | 0.98 *** (0.23) | 0.98 *** (0.23) |
| depression (EURO-D) | | | | -0.03 (0.04) | -0.03 (0.04) | -0.03 (0.04) | | | | -0.03 (0.04) | -0.03 (0.04) | -0.03 (0.04) |
| self-reported health | | | | -0.61 *** (0.08) | -0.59 *** (0.08) | -0.61 *** (0.08) | | | | -0.61 *** (0.08) | -0.59 *** (0.08) | -0.59 *** (0.08) |
| ADL | | | | -0.28 (0.17) | -0.23 (0.17) | -0.21 (0.14) | | | | -0.28 (0.17) | -0.22 (0.17) | -0.21 (0.14) |
| physically inactive | | | | | -0.73 * (0.29) | -0.72 * (0.30) | | | | | -0.73 * (0.29) | -0.71 * (0.30) |
| smoking | | | | | 0.15 (0.18) | 0.19 (0.18) | | | | | 0.15 (0.18) | 0.15 (0.18) |
| drinking | | | | | 0.53 * (0.22) | 0.59 * (0.23) | | | | | 0.54 * (0.22) | 0.57 * (0.23) |
| constant | 16.30 *** (0.33) | 14.90 *** (0.38) | 15.17 *** (0.39) | 16.68 *** (0.43) | 16.59 *** (0.43) | 16.43 *** (0.44) | 16.38 *** (0.33) | 14.84 *** (0.38) | 15.12 *** (0.40) | 16.63 *** (0.43) | 16.55 *** (0.43) | 16.41 *** (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 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 | IV | OLS 1 | OLS 2 | OLS 3 | OLS 4 | OLS 5 | IV |
| grandparenting | -0.25 *** | -0.11 ** | -0.10 * | -0.09 * | -0.09 * | -0.13 | -0.16 *** | -0.04 | -0.04 | -0.03 | -0.03 | -0.05 |
| | (0.04) | (0.04) | (0.04) | (0.04) | (0.04) | (0.13) | (0.03) | (0.03) | (0.03) | (0.03) | (0.03) | (0.05) |
| *Education (ref: low)* | | | | | | | | | | | | |
| medium education | | 0.55 *** | 0.53 *** | 0.49 *** | 0.49 *** | 0.49 *** | | 0.56 *** | 0.53 *** | 0.50 *** | 0.49 *** | 0.49 *** |
| | | (0.03) | (0.03) | (0.03) | (0.03) | (0.03) | | (0.03) | (0.03) | (0.03) | (0.03) | (0.03) |
| high education | | 0.81 *** | 0.77 *** | 0.71 *** | 0.71 *** | 0.70 *** | | 0.81 *** | 0.77 *** | 0.71 *** | 0.71 *** | 0.71 *** |
| | | (0.04) | (0.04) | (0.04) | (0.04) | (0.04) | | (0.04) | (0.04) | (0.04) | (0.04) | (0.04) |
| *Age (ref: 50-55)* | | | | | | | | | | | | |
| age 56-60 | | -0.03 | -0.01 | -0.01 | -0.01 | -0.01 | | -0.03 | -0.01 | -0.01 | -0.01 | -0.01 |
| | | (0.03) | (0.03) | (0.03) | (0.03) | (0.03) | | (0.03) | (0.03) | (0.03) | (0.03) | (0.03) |
| age 61-65 | | -0.06 | -0.02 | -0.01 | -0.01 | -0.01 | | -0.06 | -0.02 | -0.01 | -0.01 | -0.01 |
| | | (0.04) | (0.04) | (0.04) | (0.04) | (0.04) | | (0.04) | (0.04) | (0.04) | (0.04) | (0.04) |
| age 66-70 | | -0.15 *** | -0.10 * | -0.11 * | -0.11 * | -0.10 * | | -0.15 *** | -0.10 * | -0.11 * | -0.11 * | -0.10 * |
| | | (0.04) | (0.05) | (0.05) | (0.05) | (0.05) | | (0.04) | (0.05) | (0.05) | (0.05) | (0.05) |
| age 71-75 | | -0.18 *** | -0.12 * | -0.10 + | -0.10 + | -0.09 | | -0.18 *** | -0.12 * | -0.10 + | -0.09 | -0.09 |
| | | (0.05) | (0.06) | (0.06) | (0.06) | (0.06) | | (0.05) | (0.06) | (0.06) | (0.06) | (0.06) |
| age 76-80 | | -0.30 *** | -0.25 *** | -0.20 ** | -0.20 ** | -0.20 * | | -0.30 *** | -0.24 ** | -0.20 ** | -0.19 ** | -0.19 * |
| | | (0.07) | (0.07) | (0.07) | (0.07) | (0.08) | | (0.07) | (0.07) | (0.07) | (0.07) | (0.08) |
| living with partner | | 0.04 | 0.05 | 0.02 | 0.02 | 0.02 | | 0.04 | 0.05 | 0.02 | 0.02 | 0.02 |
| | | (0.03) | (0.03) | (0.03) | (0.03) | (0.03) | | (0.03) | (0.03) | (0.03) | (0.03) | (0.03) |
| *Activity status (ref: employed)* | | | | | | | | | | | | |
| other | | | -0.15 *** | -0.12 *** | -0.12 *** | -0.11 ** | | | -0.15 *** | -0.12 *** | -0.12 *** | -0.12 *** |
| | | | (0.03) | (0.03) | (0.03) | (0.03) | | | (0.03) | (0.03) | (0.03) | (0.03) |
| retired | | | -0.09 * | -0.05 | -0.05 | -0.05 | | | -0.09 * | -0.06 | -0.06 | -0.06 |
| | | | (0.04) | (0.04) | (0.04) | (0.04) | | | (0.04) | (0.04) | (0.04) | (0.04) |
| social activities | | | 0.07 + | 0.06 | 0.06 | 0.06 | | | 0.07 + | 0.06 + | 0.06 + | 0.06 + |
| | | | (0.04) | (0.04) | (0.04) | (0.04) | | | (0.04) | (0.04) | (0.04) | (0.04) |
| depression (EURO-D) | | | | -0.05 *** | -0.05 *** | -0.05 *** | | | | -0.05 *** | -0.05 *** | -0.05 *** |
| | | | | (0.01) | (0.01) | (0.01) | | | | (0.01) | (0.01) | (0.01) |
| self-reported health | | | | -0.08 *** | -0.08 *** | -0.08 *** | | | | -0.09 *** | -0.09 *** | -0.09 *** |
| | | | | (0.01) | (0.01) | (0.01) | | | | (0.01) | (0.01) | (0.01) |
| ADL | | | | -0.01 | -0.01 | -0.01 | | | | -0.01 | -0.01 | -0.01 |
| | | | | (0.03) | (0.03) | (0.03) | | | | (0.03) | (0.03) | (0.03) |
| physically inactive | | | | | -0.00 | -0.00 | | | | | -0.00 | -0.00 |
| | | | | | (0.05) | (0.05) | | | | | (0.05) | (0.05) |
| smoking | | | | | 0.00 | 0.00 | | | | | 0.01 | 0.01 |
| | | | | | (0.03) | (0.03) | | | | | (0.03) | (0.03) |
| drinking | | | | | 0.00 | 0.00 | | | | | 0.01 | 0.00 |
| | | | | | (0.04) | (0.04) | | | | | (0.04) | (0.04) |
| constant | 3.37 *** | 2.95 *** | 3.01 *** | 3.32 *** | 3.32 *** | 3.32 *** | 3.39 *** | 2.95 *** | 3.01 *** | 3.32 *** | 3.32 *** | 3.32 *** |
| | (0.06) | (0.07) | (0.07) | (0.07) | (0.07) | (0.07) | (0.06) | (0.07) | (0.07) | (0.07) | (0.07) | (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 in parentheses.

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 | IV | OLS 1 | OLS 2 | OLS 3 | OLS 4 | OLS 5 | IV |
| grandparenting | -0.28 *** | -0.08 | -0.07 | -0.05 | -0.05 | -0.15 | -0.25 *** | -0.07 | -0.06 | -0.05 | -0.05 | -0.06 |
| | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) | (0.20) | (0.04) | (0.04) | (0.04) | (0.04) | (0.04) | (0.07) |
| *Education (ref: low)* | | | | | | | | | | | | |
| medium education | | 0.64 *** | 0.61 *** | 0.57 *** | 0.57 *** | 0.56 *** | | 0.64 *** | 0.61 *** | 0.57 *** | 0.56 *** | 0.56 *** |
| | | (0.04) | (0.04) | (0.04) | (0.04) | (0.04) | | (0.04) | (0.04) | (0.04) | (0.04) | (0.04) |
| high education | | 0.97 *** | 0.91 *** | 0.84 *** | 0.84 *** | 0.83 *** | | 0.96 *** | 0.91 *** | 0.84 *** | 0.84 *** | 0.84 *** |
| | | (0.05) | (0.06) | (0.06) | (0.06) | (0.06) | | (0.05) | (0.06) | (0.06) | (0.06) | (0.06) |
| *Age (ref: 50-55)* | | | | | | | | | | | | |
| age 56-60 | | -0.06 | -0.02 | -0.02 | -0.02 | -0.02 | | -0.06 | -0.01 | -0.02 | -0.01 | -0.01 |
| | | (0.05) | (0.05) | (0.05) | (0.05) | (0.05) | | (0.05) | (0.05) | (0.05) | (0.05) | (0.05) |
| age 61-65 | | -0.17 ** | -0.08 | -0.08 | -0.07 | -0.07 | | -0.16 ** | -0.07 | -0.07 | -0.07 | -0.07 |
| | | (0.05) | (0.06) | (0.06) | (0.06) | (0.06) | | (0.05) | (0.06) | (0.06) | (0.06) | (0.06) |
| age 66-70 | | -0.47 *** | -0.36 *** | -0.36 *** | -0.35 *** | -0.34 *** | | -0.46 *** | -0.35 *** | -0.35 *** | -0.34 *** | -0.34 *** |
| | | (0.06) | (0.07) | (0.07) | (0.07) | (0.08) | | (0.06) | (0.07) | (0.07) | (0.07) | (0.08) |
| age 71-75 | | -0.66 *** | -0.55 *** | -0.52 *** | -0.50 *** | -0.50 *** | | -0.66 *** | -0.55 *** | -0.51 *** | -0.50 *** | -0.50 *** |
| | | (0.08) | (0.09) | (0.09) | (0.09) | (0.09) | | (0.08) | (0.09) | (0.09) | (0.09) | (0.09) |
| age 76-80 | | -1.11 *** | -0.99 *** | -0.93 *** | -0.92 *** | -0.91 *** | | -1.10 *** | -0.98 *** | -0.93 *** | -0.91 *** | -0.91 *** |
| | | (0.11) | (0.11) | (0.11) | (0.11) | (0.12) | | (0.11) | (0.11) | (0.11) | (0.11) | (0.12) |
| living with partner | | 0.21 *** | 0.22 *** | 0.20 *** | 0.21 *** | 0.21 *** | | 0.22 *** | 0.22 *** | 0.20 *** | 0.21 *** | 0.21 *** |
| | | (0.05) | (0.05) | (0.05) | (0.05) | (0.05) | | (0.05) | (0.05) | (0.05) | (0.05) | (0.05) |
| *Activity status (ref: employed)* | | | | | | | | | | | | |
| other | | | -0.20 *** | -0.16 ** | -0.16 ** | -0.16 ** | | | -0.20 *** | -0.16 ** | -0.16 ** | -0.16 ** |
| | | | (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 * | | | -0.18 ** | -0.14 * | -0.14 * | -0.14 * |
| | | | (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 * | | | 0.17 ** | 0.16 ** | 0.16 ** | 0.16 ** |
| | | | (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 *** |
| | | | | (0.01) | (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 *** |
| | | | | (0.02) | (0.02) | (0.02) | | | | (0.02) | (0.02) | (0.02) |
| ADL | | | | 0.02 | 0.02 | 0.02 | | | | 0.02 | 0.02 | 0.02 |
| | | | | (0.05) | (0.05) | (0.05) | | | | (0.05) | (0.05) | (0.05) |
| physically inactive | | | | | -0.07 | -0.07 | | | | | -0.07 | -0.07 |
| | | | | | (0.08) | (0.08) | | | | | (0.08) | (0.08) |
| smoking | | | | | 0.07 | 0.07 | | | | | 0.07 | 0.07 |
| | | | | | (0.05) | (0.05) | | | | | (0.05) | (0.05) |
| drinking | | | | | 0.02 | 0.02 | | | | | 0.02 | 0.02 |
| | | | | | (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 *** | 5.63 *** |
| | (0.09) | (0.10) | (0.10) | (0.11) | (0.11) | (0.12) | (0.09) | (0.10) | (0.10) | (0.11) | (0.11) | (0.12) |

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 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 | IV | OLS 1 | OLS 2 | OLS 3 | OLS 4 | OLS 5 | IV |
| grandparenting | -0.37 *** | -0.15 * | -0.14 * | -0.12 + | -0.12 + | -0.19 | -0.29 *** | -0.08 + | -0.07 | -0.07 | -0.07 | -0.07 |
| | (0.07) | (0.07) | (0.07) | (0.07) | (0.07) | (0.23) | (0.05) | (0.05) | (0.05) | (0.05) | (0.05) | (0.08) |
| *Education (ref: low)* | | | | | | | | | | | | |
| medium education | | 0.56 *** | 0.53 *** | 0.48 *** | 0.48 *** | 0.48 *** | | 0.56 *** | 0.53 *** | 0.48 *** | 0.48 *** | 0.48 *** |
| | | (0.05) | (0.05) | (0.05) | (0.05) | (0.05) | | (0.05) | (0.05) | (0.05) | (0.05) | (0.05) |
| high education | | 0.88 *** | 0.83 *** | 0.74 *** | 0.74 *** | 0.74 *** | | 0.88 *** | 0.83 *** | 0.74 *** | 0.74 *** | 0.74 *** |
| | | (0.06) | (0.06) | (0.07) | (0.07) | (0.07) | | (0.06) | (0.06) | (0.07) | (0.07) | (0.07) |
| *Age (ref: 50-55)* | | | | | | | | | | | | |
| age 56-60 | | -0.23 *** | -0.20 *** | -0.21 *** | -0.20 *** | -0.20 *** | | -0.22 *** | -0.20 *** | -0.20 *** | -0.20 *** | -0.20 *** |
| | | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) | | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) |
| age 61-65 | | -0.34 *** | -0.31 *** | -0.31 *** | -0.31 *** | -0.30 *** | | -0.34 *** | -0.31 *** | -0.31 *** | -0.30 *** | -0.30 *** |
| | | (0.06) | (0.07) | (0.07) | (0.07) | (0.07) | | (0.06) | (0.07) | (0.07) | (0.07) | (0.07) |
| age 66-70 | | -0.61 *** | -0.58 *** | -0.58 *** | -0.57 *** | -0.57 *** | | -0.61 *** | -0.57 *** | -0.58 *** | -0.57 *** | -0.57 *** |
| | | (0.07) | (0.09) | (0.09) | (0.09) | (0.08) | | (0.07) | (0.09) | (0.09) | (0.09) | (0.08) |
| age 71-75 | | -0.92 *** | -0.88 *** | -0.84 *** | -0.83 *** | -0.83 *** | | -0.92 *** | -0.88 *** | -0.84 *** | -0.82 *** | -0.82 *** |
| | | (0.09) | (0.10) | (0.10) | (0.10) | (0.10) | | (0.09) | (0.10) | (0.10) | (0.10) | (0.10) |
| age 76-80 | | -1.32 *** | -1.27 *** | -1.21 *** | -1.20 *** | -1.19 *** | | -1.32 *** | -1.27 *** | -1.20 *** | -1.19 *** | -1.19 *** |
| | | (0.12) | (0.13) | (0.13) | (0.13) | (0.13) | | (0.12) | (0.13) | (0.13) | (0.13) | (0.13) |
| living with partner | | 0.21 *** | 0.22 *** | 0.19 *** | 0.19 *** | 0.20 *** | | 0.20 *** | 0.22 *** | 0.19 *** | 0.19 *** | 0.19 *** |
| | | (0.05) | (0.05) | (0.05) | (0.05) | (0.05) | | (0.05) | (0.05) | (0.05) | (0.05) | (0.05) |
| *Activity status (ref: employed)* | | | | | | | | | | | | |
| other | | | -0.16 * | -0.12 + | -0.11 + | -0.11 + | | | -0.16 ** | -0.12 + | -0.12 + | -0.12 + |
| | | | (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 |
| | | | (0.07) | (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 ** |
| | | | (0.07) | (0.07) | (0.07) | (0.07) | | | (0.07) | (0.07) | (0.07) | (0.07) |
| depression (EURO-D) | | | | -0.06 *** | -0.06 *** | -0.06 *** | | | | -0.06 *** | -0.06 *** | -0.06 *** |
| | | | | (0.01) | (0.01) | (0.01) | | | | (0.01) | (0.01) | (0.01) |
| self-reported health | | | | -0.13 *** | -0.12 *** | -0.12 *** | | | | -0.13 *** | -0.13 *** | -0.13 *** |
| | | | | (0.02) | (0.02) | (0.02) | | | | (0.02) | (0.02) | (0.02) |
| ADL | | | | 0.02 | 0.02 | 0.02 | | | | 0.01 | 0.02 | 0.02 |
| | | | | (0.05) | (0.05) | (0.05) | | | | (0.05) | (0.05) | (0.05) |
| physically inactive | | | | | -0.02 | -0.02 | | | | | -0.02 | -0.02 |
| | | | | | (0.09) | (0.09) | | | | | (0.09) | (0.09) |
| smoking | | | | | 0.07 | 0.07 | | | | | 0.07 | 0.07 |
| | | | | | (0.05) | (0.06) | | | | | (0.05) | (0.06) |
| drinking | | | | | 0.06 | 0.05 | | | | | 0.06 | 0.05 |
| | | | | | (0.07) | (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 *** | 4.68 *** | 4.68 *** |
| | (0.10) | (0.12) | (0.12) | (0.13) | (0.13) | (0.15) | (0.10) | (0.12) | (0.12) | (0.13) | (0.13) | (0.15) |

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 in parentheses.

*4.3. Heterogeneity of the grandparental childcare effect*

The effect of grandparenting can depend on the context of the childcare provision (e.g., Minkler et al., 1999). In this section we address the possibility that grandparental childcare has a different effect for different subgroups of individuals. Exploiting the relatively large sample size, we divide it, in turn, according to the age, level of education, activity and partnership 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[8].

Overall, results are similar to the ones discussed before on the whole sample: for almost all subsamples the effect of grandparental childcare is significant and positive only for verbal fluency and stronger if daily childcare is considered. The only exception is the subgroup of respondents that fall in the activity status "other", the vast majority of them being housewives. For this group we find no significant effect of providing childcare for all the four measures of cognitive skills.

Interestingly, it can be noticed that the effect of grandparental childcare is highly heterogeneous. The positive and significant effect found for the verbal fluency measure on the whole sample becomes even stronger for some subgroups of respondents: the oldest and not living with a partner. This might signal that those who need more stimuli to preserve cognitive functioning benefit more from contacts with grandchildren. The fact that the positive effect of childcare is only found for higher educated people could be related to the

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

content of childcare: i.e., it is more likely that higher educated grandmothers are involved in more intellectual activities, such as reading books to their grandchildren, helping them to doing homework and so on.

Another interesting result is the negative effect of grandparental childcare on numeracy found for the employed. As noticed by Pruchno (1999) "combining caregiving with other roles, such as paid employment, may increase time pressure and exhaustion". For grandmothers who also have a paid job providing regular childcare could be a too heavy burden. The fact, that this has a negative effect on numeracy and not on the other dimensions of cognitive abilities can be explained because the numeracy tests are the most demanding and a stressed and fatigued respondent could find it more difficult to perform well on them.

## 5. Summary and discussion

In a context of ageing societies, it becomes more and more important to focus on the factors that may help elderly people maintaining good cognitive functioning despite its natural decline. Grandparenting is a voluntary social activity that gives the grandparents a sense of responsibility and involves them in tasks based on intergenerational exchanges. Although it is a widespread activity among USA and European seniors, no previous study has, to our knowledge, investigated its effect on grandparents' cognitive functioning.

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 | numeracy | immediate recall | delayed recall | verbal fluency | numeracy | immediate recall | delayed recall |
| *Age:* | | | | | | | | |
| 50-64 (N = 4,885) | 2.23** | -0.24 | -0.29 | -0.37 | 0.79** | -0.08 | -0.10 | -0.13 |
| | (0.86) | (0.15) | (0.23) | (0.27) | (0.30) | (0.05) | (0.08) | (0.09) |
| 65-80 (N = 1,389) | 5.35*** | 0.35 | 0.66 | 0.81 | 2.16*** | 0.14 | 0.26 | 0.33 |
| | (1.61) | (0.30) | (0.43) | (0.47) | (0.63) | (0.12) | (0.17) | (0.19) |
| *Education:* | | | | | | | | |
| Low (N = 2,683) | 1.55 | 0.01 | -0.21 | 0.01 | 0.68 | 0.00 | -0.09 | 0.00 |
| | (0.86) | (0.16) | (0.24) | (0.28) | (0.37) | (0.07) | (0.10) | (0.12) |
| Medium or high  (N = 3,591) | 4.53*** | -0.02 | -0.29 | -0.49 | 1.52*** | -0.01 | -0.10 | -0.16 |
| | (1.30) | (0.22) | (0.33) | (0.40) | (0.43) | (0.07) | (0.11) | (0.13) |
| *Activity status:* | | | | | | | | |
| retired (N = 2,074) | 4.07*** | 0.07 | 0.24 | 0.28 | 1.78*** | 0.03 | 0.10 | 0.12 |
| | (1.17) | (0.21) | (0.30) | (0.35) | (0.51) | (0.09) | (0.13) | (0.15) |
| other (N = 1,835) | 0.91 | 0.07 | 0.01 | -0.19 | 0.40 | 0.03 | 0.01 | -0.08 |
| | (0.94) | (0.18) | (0.27) | (0.31) | (0.41) | (0.08) | (0.12) | (0.14) |
| employed (N = 2,365) | 4.38* | -0.81* | -0.95 | -0.75 | 1.02* | -0.19* | -0.22 | -0.17 |
| | (2.13) | (0.35) | (0.54) | (0.63) | (0.49) | (0.08) | (0.12) | (0.15) |
| *Living with partner:* | | | | | | | | |
| yes (N = 4,971) | 2.28** | -0.15 | -0.06 | -0.34 | 0.84** | -0.05 | -0.02 | -0.13 |
| | (0.82) | (0.14) | (0.22) | (0.26) | (0.30) | (0.05) | (0.08) | (0.09) |
| no (N = 1,303) | 5.07** | -0.11 | -0.60 | 0.40 | 1.65** | -0.03 | -0.20 | 0.13 |
| | (1.89) | (0.34) | (0.47) | (0.54) | (0.60) | (0.11) | (0.15) | (0.18) |

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 in parentheses.

Descriptive analyses on the SHARE data make us thinking of grandparenting as a negative activity for grandparents' cognitive abilities: elderly people taking care on a regular basis of their grandchildren (either with a daily or weekly frequency) appear to have lower cognitive abilities than the others. This conclusion is however not supported and even reversed by our multivariate analyses. Observed and unobserved characteristics of grandparents providing regular childcare and those of the others might be different and can

be associated with cognitive abilities. In particular, we find evidence of an adverse selection mechanism into regular grandparenting: individuals providing regular childcare are on average older, less educated, more likely to be retired and not involved in social activities. In other words, they have characteristics that are negatively associated with cognitive functioning. While endogeneity of grandparental childcare is taken into account, our findings do not support the hypothesis of a negative effect of grandparenting on cognitive functioning: none of the cognitive dimensions considered is negatively affected by grandparenting. On the contrary, our instrumental variable approach shows that verbal fluency is sensibly higher for grandmothers providing regular childcare.

An explanation of the stronger impact of grandparenting on verbal fluency rather than on the other measures of cognitive abilities used in this study, refers to the distinction between the various types of cognitive domains discussed in the background section. Indeed, crystallized abilities, to which fluency belongs, are recognized to be more amenable to change as they rely on specific acquired knowledge. On the contrary, memory (i.e. immediate and delayed recall) involves a timing aspect and a processing speed component which shows a more pronounced decline with age and leaves less room to changes. Although numeracy is often classified as a crystallized ability, together with fluency, as it is measured in SHARE is more an assessment of fluid than crystallized intelligence, as it partly involves processing of new information.

Our findings suggest that the health disadvantages found previously among grandparent caregivers arise from grandparents' prior characteristics, not as a consequence of providing care. This is consistent with the study by Hughes et al. (2007) showing that,

controlling for (observables) background characteristics, health decline as a consequence of grandchild care is the exception rather than the rule. We add to this isolated evidence that also controlling for unobservables, no general negative effect of grandparenting is found on the health-related dimensions of cognitive functioning. We also find that the effect of grandparenting is heterogeneous and not all grandparents benefits at the same way. In particular, it is important to stress the fact that when the burden for grandparents is excessive, this activity can become stressful and tiring more than beneficial. This is confirmed by the negative impact of regular childcare on numeracy skills for women that have to combine grandmotherhood and a paid job.

An interesting avenue for future research is to use data that allow to study both custodial and supplemental grandparents, as to allow testing if our results hold also in the case of the most challenging role for grandparents.

The evidence produced by our study contributes not only to the discussion on age-related cognitive decline, but also on the debate on the intergenerational transfers balance (e.g., de Jong Gierveld 2011). This literature should consider not only the "costs" of providing childcare (and other transfers) but also the benefits that grandparents can derive from it, for example, in terms of cognitive functioning as showed here. Related to this aspect, Powdthavee (2011) finds that having grandchildren is positively associated with life satisfaction, arguing that, even though the literature on the relationship between fertility and happiness has found contrasting evidence, considering also the long-term effects of fertility trough having grandchildren might posit for a positive balance of having children across the life-course.

Given the vast reliance on grandparents for childcare in modern ageing societies, it is of high relevance the outcome of this study.

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