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# Determinants of grandparent–grandchild digital contact in Italy

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## Abstract

The broad definition of intergenerational contact includes not only meeting face-to-face, but also the important element of communication at a distance, such as via telephone. With the pervasion of the Internet and electronic devices, digital contact has become another increasingly important option. We examined digital contact between grandparents and grandchildren in comparison with traditional forms of contact (i.e. face-to-face and by telephone) using Italian data from the 2016 *Families, Social Subjects and life cycle (FSS)* survey. We found that grandparents belonging to younger cohorts, those with higher education, those who lived in urban areas and those in better health were more likely to maintain digital contact with their grandchildren. Results also show that digital contact tends to compensate for a lack of (frequent) face-to-face contact, and to cumulate with telephone contact. Our results have significant implications for the current and future development of intergenerational relationships as they suggest an increasing role of digital contact for distant geographical situations. Against the background of persisting inequalities in the access and the use of the Internet, our findings emphasise the need to improve digital network connectivity and user skills, particularly among specific sub-groups of the population.

**Keywords:** Digital contact, Intergenerational relationships, Italy, Grandparenting, Grandparent–grandchild contact

## Introduction

The relationship between grandparents and their grandchildren is receiving greater attention due to its importance in the lives of many individuals. Most studies have focused on care provided by grandparents to their grandchildren (e.g. Bordone et al., 2017; Di Gessa et al., 2016; Hank & Buber, 2009; Zamberletti et al., 2018), on its consequences on grandparental health and well-being (e.g. Arpino & Bellani, 2022; Arpino & Bordone, 2014; Ates, 2017), and on outcomes of other generations, including children's fertility (e.g. Rutigliano, 2020), labour force participation (e.g. Arpino et al., 2014), and grandchild education attainment (Lehti et al., 2019). However, the relationships between grandparents and their grandchildren are not confined to the provision and receipt of care (Pasqualini et al., 2021). For example, grandparents and grandchildren can exchange emotional and practical support independently of whether formal caregiving activity is

involved. Apart from caregiving, other forms of intergenerational relationships do not even require physical co-presence (Arpino et al., 2021a; Peng et al., 2018).

In this paper, we focus on contact between grandparents and grandchildren. More specifically, we investigate the correlates of digital contact between grandparents and grandchildren. We also compare the correlates of digital and traditional forms of contact. Thus, rather than focusing on the content of and reasons for these types of contact, we examine the means through which they are maintained. It could be argued that what really matters is that intergenerational relationships are kept up, and that intergenerational solidarity is fostered, independently of the means by which these goals are attained. However, examining the means of contact is also significant. First, it has been shown that social contact at a distance might provide some of the same benefits of face-to-face contact, although it cannot replace it perfectly, for example in terms of the level of emotional support that is exchanged (Pecino et al., 2012). While in this study we are not dealing with the emotional content attached to each form of grandparent–grandchild contact by examining the prevalence and determinants of digital contact with grandchildren, our analyses will provide significant information, constituting a useful background for future studies on other related aspects. Second, individual characteristics (e.g. education) and contextual factors (e.g. access to the Internet in the area of residence) that may influence the use of digital tools for social contact and create inequalities among older people. Third, other factors, such as geographical distance from kin, may impede or reduce face-to-face contact, necessitating family members to use other forms of contact. Fourth, digital contact may induce positive consequences for the well-being of older adults. This aspect has been particularly salient in the context of the COVID-19 pandemic with its restrictions to movement that have reduced face-to-face contact. In fact, research has demonstrated that digital intergenerational contact contributed to a reduction in the negative effects of the pandemic on the psychological well-being of older adults (Arpino et al., 2021b). Fifth, despite the persisting digital divide, the use of digital technologies by older adults has been growing in recent years (Barbosa Neves & Vetere, 2019). This has favoured and will continue to favour the development of digital family relationships more and more.

Therefore, in this paper we aim to contribute to the literature on grandparent–grandchild relationships by focusing on digital contact between them. A broad definition of digital technologies includes both the software and the hardware that work together using digital coding, as well as the infrastructures that support them (Lupton, 2015; Stafford & Hillyer, 2012). Of particular interest for this study is the use of the Internet and digital technologies for communication purposes, including devices (e.g. smartphones), Social Networking Sites (SNS; e.g. Facebook/Meta), applications for instant messaging (e.g. WhatsApp) and video calls (e.g. Skype). More specifically, adapting Peng et al. (2018)'s approach to contact between grandparents and grandchildren, we investigate which of the key characteristics of grandparents and grandchildren commonly analysed in the literature are associated with the digital contact between them and, to what extent digital contact substitutes (rather than adds to) “traditional” forms of contact (i.e. face-to-face and (landline telephone contact). In the concluding section, we discuss those associations that are found to have opposite signs for digital contact as compared to “traditional” contact. To gain further insight, we implement two additional analyses.

The first consists of splitting the sample according to geographical distance to grandchildren in order to test whether a compensatory effect of digital contact arising from lack of frequent face-to-face contact only applies to grandparents with grandchildren living geographically far away. The second additional analysis implements separate models according to grandchild characteristics to test whether determinants of grandparent–grandchild digital contact is very different depending on the age of the grandchildren. As for all types of contact, we do not focus on who initiates the communication/contact. Clearly, for younger grandchildren the mediating role of parents is stronger; but still, grandchild and grandparent characteristics may matter.

## **Background**

### **Theoretical considerations**

To reflect upon the potential role of digitalisation in intergenerational relationships, it is useful to refer to one of the most widespread theoretical models that have been formulated in the literature on intergenerational relationships: the “intergenerational solidarity model”. This model elaborates a typology of bonds across family members, based on the concept of solidarity. Research within this framework typically assumes that personal feelings, such as affection, attraction and warmth, serve to maintain cohesion in the family system (Sprey, 1991). The model, initially developed with regard to relationships between adult children and their parents (Bengtson, 1975), was later expanded to include other types of ties (e.g. those between grandparents and grandchildren, see Silverstein et al., 1998). The intergenerational solidarity model has been found to be useful for investigating how intergenerational relationships are developed during the life course and over time. Within this model, it has been highlighted that multigenerational bonds become increasingly important over time, particularly for instrumental support and resources sharing (Bengtson, 2001).

Bengtson and colleagues (Bengtson & Roberts, 1991; Bengtson & Schrader, 1982; Roberts et al., 1991; Silverstein & Bengtson, 1991) conceptualise intergenerational family solidarity as a multidimensional construct based on six interrelated dimensions of solidarity: structural (e.g. number of children and grandchildren, geographic proximity); associational (e.g. social contact, shared activities); affectual (e.g. feelings, affection); consensual (e.g. agreement); functional (e.g. instrumental support and transfers of resources); and normative (e.g. sense of mutual obligation). The first dimension refers to the “opportunity structure” for intergenerational interactions. For example, geographical proximity determines the ability to provide some forms of instrumental support (e.g. help in cooking), but not others (such as financial transfers). Similarly, social contact can be “physical” (face-to-face) or not (e.g. via traditional telephone or digital tools).

Since the earliest formulations of the model, intergenerational contact has been broadly defined to include not only face-to-face relations as an important element of associational solidarity but also, for example, telephone contact (e.g. Bengtson & Roberts, 1991). Recently, the model has been further extended to also include digital intergenerational relationships, and the concept of “digital solidarity” has been proposed as a new element of both associational solidarity and functional solidarity (Peng et al., 2018). By focusing on the associational solidarity dimension, Peng et al. (2018) argue that digital tools enhance intergenerational cohesion in ways that both complement and supplement

more traditional forms of communication that require greater investments of time and efforts of coordination. Instead, digital contact, once the initial skills and cost barriers have been overcome, allows for the easy establishment of frequent, non-invasive and inexpensive contact. Peng and colleagues (2018) developed their arguments specifically for the relationships between older mothers and their adult children. However, as historically the intergenerational solidarity model was extended from parent–child relationships to other types of intergenerational ties, most of the arguments in Peng et al. (2018) can be applied to relationships between grandparents and their grandchildren. Importantly, the authors review the most important determinants of intergenerational relationships and argue that the directions of association found for traditional forms of contact do not necessarily apply to digital contact as well. As an example, while older people's intergenerational contact generally increases with age, digital contact may actually follow an opposite pattern given that the use of digital tools decreases with age.

Different forms of contact can be used in a compensatory or cumulative way. Cherlin and Furstenberg (1986) found that telephone calls were not used to compensate face-to-face contact with grandchildren. Thus, grandparents who frequently met with their grandchildren, also tended to call them frequently on the telephone. However, the cumulation observed among traditional forms of contact between grandparents and grandchildren may not apply to digital contact which, instead, may substitute traditional contact. Generally speaking, the use of new media reduces the time spent with older media (Dimmick et al., 2004), suggesting that communication channels in competition with each other show a compensatory pattern. Thus, we would expect competition between telephone calls and digital contact. For example, for grandparents living far away from their grandchildren, video calls could be a better option than traditional calls, allowing them to function in a way that resembles physical contact. In fact, studies have shown that video chats bring feelings of “being there” and of feeling closer to others more than other technologies (Ames et al., 2010; Nedelcu, 2012; Neustaedter & Greenberg, 2012).

Treas and Gubernskaya (2012) argued that technological development in communication (e.g. the diffusion of cell phones and the Internet) makes non-face-to-face contact more convenient and less expensive. Thus, the diffusion of these technologies implies that, independent of geographical distance, contact that does not require physical co-presence can increase. They also confirmed their hypothesis with respect to contact with mothers, but their data did not distinguish digital contact from more traditional non-face-to-face contact (e.g. letters). However, these arguments suggest that digital contact can compensate for the difficulty of being able to have (frequent) face-to-face contact with grandparents who live far away from their grandchildren.

#### **What do we know about digital grandparent–grandchild contact?**

As noticed by Pasqualini et al. (2021), the grandparenting literature in Europe has mostly focused on childcare and few studies on contact between grandchildren and grandparents exist in general. Although several scholars (e.g. Fingerman, 2017; Furstenberg, 2020) share the idea that digital devices may favour intergenerational relations, there are even fewer studies that have examined digital grandparent–grandchild contact.

Based on semi-structured interviews of non-representative samples of individuals aged 60 years and over from 6 locations in Europe, Ivan et al. (2017) found that the motivation to communicate and share daily life routines with children and grandchildren who lived at a distance was a significant factor in encouraging older people to learn how to use digital technologies. When younger family members were back home, older people were less motivated to use them. These findings suggest that intergenerational solidarity (e.g. availability of grandchildren, their distance and presumably quality of relation with them) stimulates older people to learn or keep using digital tools.

Other studies have more directly considered the use of digital technologies by older people to maintain intergenerational relations. Quadrello et al. (2005) collected data from small non-representative samples of grandparents in the UK, Spain, Estonia and Finland. They found a moderate use of mobile phones, while a minority of grandparents used text messages and emails. Based on simple bivariate correlations, they also found evidence in favour of the accumulation hypothesis, i.e. digital contact was not used to substitute traditional connection tools. The Finnish data collected in Quadrello et al. (2005) were reanalysed by Hurme et al. (2010) who found a significant relation between the proximity among the generations (measured in terms of time of travelling) and all forms of contact frequency, digital and not.

Several studies on transnational families indicate that digital tools (e.g. mobile phones, Skype and social networking sites) are widely used in intergenerational relationships at a distance (Bacigalupe & Lambe, 2011; Madianou & Miller, 2013; Vildaite, 2018). Similar to Quadrello et al. (2005), these studies were also based on small non-representative samples. For example, Vildaite (2018)'s research is based on a qualitative study of 25 children of Lithuanian immigrants aged 14–18 living with their families in Ireland and 10 of their grandmothers residing in Lithuania.

Other studies have examined the use of digital technologies to keep in contact with grandchildren, as well as other family and non-family ties during the COVID-19 pandemic. Using an on-line survey, for example, Arpino and colleagues (2021a) found that the reductions in physical contact occurred during the pandemic (as a consequence of “physical distancing” measures) were compensated by a higher frequency of digital contact.

As demonstrated above, the existing studies that specifically examine digital contact between grandparents and grandchildren are few and based on non-representative (and often very small) samples. A recent Finnish study (Danielsbacka et al., 2021) examined several dyads of kin, including grandparents–grandchildren, finding evidence of positive association among digital and other forms of contact. To the best of our knowledge, our paper and Danielsbacka et al.'s study are the first quantitative studies based on nationally representative samples.

### Research questions

We aim at answering two research questions. Firstly, we investigate the socio-demographic characteristics of grandparents and grandchildren associated with (frequent) digital contact and whether these associations are different from those found for traditional contact (RQ1). Secondly, we explore whether digital grandparent–grandchild

contact substitutes or cumulates with traditional contact and whether a substitution effect exists only among grandparents who live far away from their grandchildren (RQ2).

### Data and methods

Data are drawn from the *Families, Social Subjects and life cycle (FSS)* survey carried out by the Italian National Institute of Statistics (ISTAT) in 2016. This is a nationally representative cross-sectional study based on Italian private households selected from the Register of Population, which collects information on a range of demographic and socio-economic characteristics. The response rate is about 80% (ISTAT, 2016).

The analytic sample is restricted to respondents aged 50+ who are grandparents and have at least one grandchild living outside the household. The characteristics of grandchildren (described below) are only available for up to three grandchildren. Therefore, we only selected grandparents with up to three grandchildren (67.6% of all grandparents) to make sure that the information about contact refers to the same set of grandchildren. After dropping 194 individuals from the analysis who had missing information in at least one of the variables of interest, the working sample includes 3,763 grandparents. Additional data sources have been used to provide a contextual picture of the use of digital devices in Italy. More specifically, we used the survey *Multiscopo—Aspects of Daily Life* (hereafter AVQ) collecting information on almost 25,000 Italian households in 2016.

### Contact variables

The dependent variables measure the frequency of contact between grandparents and grandchildren. Specifically, grandparents are asked about the frequency of face-to-face and telephone contact with up to three non-coresidential grandchildren (once a day, more than once a week, once a week, less than four times a month, few times a year and never). With regard to digital contact, respondents were asked about the frequency with which they keep connected with their non-coresidential grandchildren, respectively, via the internet (i.e. Skype, FaceTime, etc.) or via messages (i.e. SMS, WhatsApp, email, social network). We distinguished between high-frequency contact (i.e. at least once a week) and less frequent contact. Each dependent variable is equal to one when at least one of the three grandchildren is (frequently) contacted using a specific means. Robustness checks (available upon request) have been conducted by using different thresholds for the outcome variables, and by distinguishing for each communication tool considered, those who do have some contact with grandchildren from the others.

### Independent variables

In the multivariable models we control for a set of socio-economic and demographic characteristics. Specifically, as for grandparents' characteristics we include independent variables measuring gender, birth cohort (*pre-1939; 1940–1949; post-1950*), marital status (*married; separated/divorced/never married; widowed*), the macro-region of residence (*North; Centre; South and Islands*) and the degree of urbanisation of the municipality or residence according to the EUROSTAT (DEGURBA) classification (*high; middle and low*). As an indicator of socio-economic condition, we account for educational attainment at the time of the interview (At least a university degree (*high*); secondary

school diploma (*medium*); lower-secondary school diploma or lower (*low*)), and working status (*in paid work*; *unemployed/retired/other*). As indicators of financial well-being, we include a dichotomous variable indicating whether the main source of income was from own work/pension/assets or not (i.e. it was from private/public transfers). Also, we control for respondents' functional limitations (*severe limitations*; *light limitations*; *no limitations*).<sup>1</sup> In order to consider the extended social network, we use information on whether or not at least one friend or neighbour that they can rely on is available to the respondent. Finally, we include information about some characteristics of grandchildren such as the number of grandchildren (*1*; *2 or 3*), the gender (*all men*; *all women* and *mixed*), the age of the grandchildren (*all 0–13*; *all 14+* and *mixed*) and proximity to the grandchildren (*within 16 km*; *more than 16 km* and *mixed*).

### Statistical model

To investigate the association between individual characteristics of both grandparents and grandchildren and the frequency of contact between them, we ran three separate logistic regression models for each type of contact: face-to-face, telephone and digital contact (Model 1; RQ1). Then, we looked at digital contact only to test whether the probability of having frequent digital contact with grandchildren substitutes or cumulates with face-to-face and telephone contact (Model 2; RQ2). In particular, we added the variables related to face-to-face and telephone contact to Model 1 as additional independent variables. As mentioned in the introduction, to gain further insight, we replicated the analyses on the two subsamples consisting of grandparents with all their grandchildren living nearby (within 16 km) or far away (minimum distance greater than 16 km). Then we repeated the analysis on the two subsamples of grandparents with all grandchildren aged 0–13 and 14+, respectively. To ease the interpretation of findings we computed Average Marginal Effects (AMEs) which express how the probability of observing the outcome changes for a unitary increase of a specific independent variable. All the analyses were performed using Stata 16.

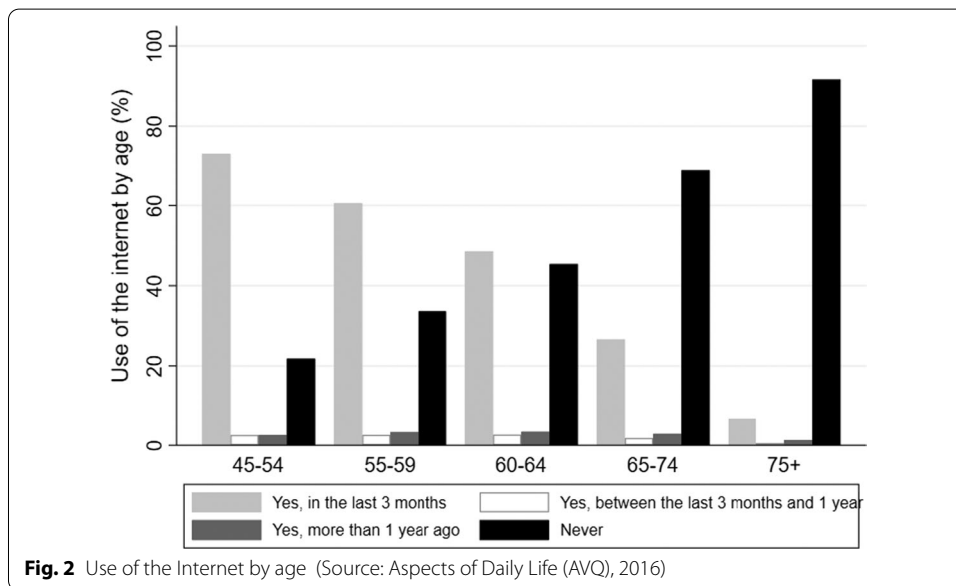
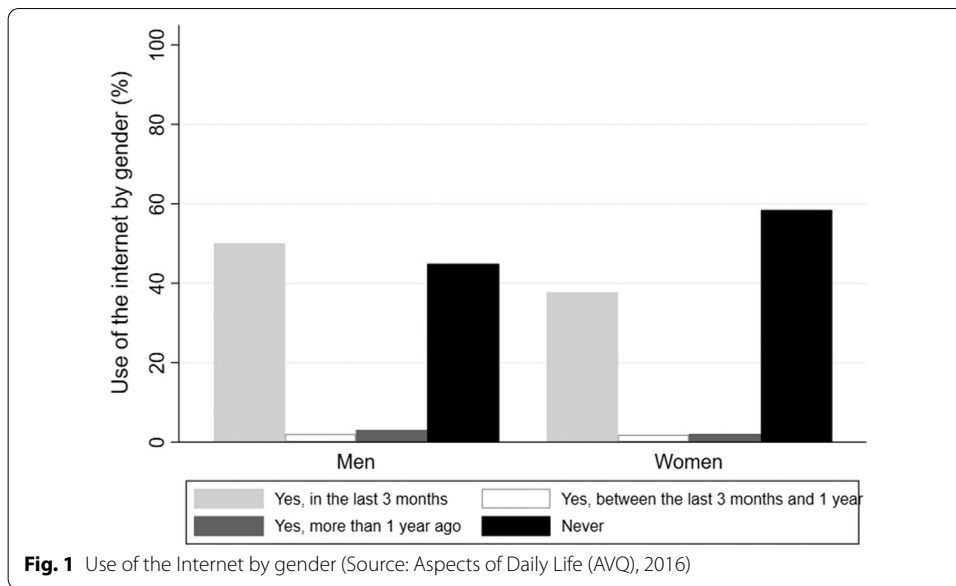
## Results

### Descriptives

Figures 1 and 2 provide a description of the prevalence of internet use according to gender and age in Italy. Note that, consistent with data used in the analyses, this information refers to 2016. However, given that AVQ does not allow the identification of grandparents, the data refers to the whole population aged 45 and higher. Overall, we noticed that among those aged 45+, 50% of men and 38% of women reported frequent use of the Internet (in the last 3 months; Fig. 1). Moreover, our descriptive statistics showed a clear age digital divide with a strong decline in the prevalence of internet use by age. While more than 75% of respondents aged 45–54 reported using the Internet in the last three months, this percentage decreased to only 7% for those aged 75+ (Fig. 2).

Table 1 reports weighted descriptive statistics. The prevalence of grandparents reporting frequent face-to-face contact was 69%. About 57% of grandparents reported calling

<sup>1</sup> Health limitation variable has about 5% of missing answers. To avoid reducing the sample, we did not drop these observations from the analyses and created a category for missing values, instead.



grandchildren by telephone at least a few times per week and 11% of them use chat and video calls to keep connected with at least one grandchild (this amounted to 873,000 grandparents of a total of 7.6 million). Close to 57% of the grandparents in the Italian population were women, and the cohort of grandparents born after 1950 was the most represented (39.5%), while the oldest (pre-1939) was about 27.2%. About 75% of grandparents reported having low educational attainment while only 5% of them had a bachelor’s degree or higher education. About 70% of the population were married and the proportion of never married/separated or divorced was about 8%. As to socio-economic conditions, 87% of grandparents were out of the job market and about 85% reported having their own work-related income. Half of grandparents lived in Northern Italy and



**Table 1** Grandparent socio-demographic characteristics: weighted data, total sample

	%
Dependent variables	
Face-to-face contact	
At least few times a week	69.0
Telephone contact	
At least few times a week	57.2
Digital contact	
At least few times a week	11.4
Independent variables	
Grandparent characteristics	
Gender	
Women	57.2
Birth cohort	
Pre-1939	27.2
1940–1949	33.3
Post-1950	39.5
Educational level	
High	4.6
Middle	20.5
Low	74.8
Marital status	
Separated/divorced/never married	7.8
Married	69.0
Widowed	23.2
Occupational condition	
In paid work	12.7
Unemployed/retired/other	87.3
Functional limitation	
Severe	10.7
Light	18.2
No Limitations	66.3
No response	4.9
Geographical area of residence	
North	50.7
Centre	20.6
South and Islands	28.8
Degree of urbanisation	
High	30.5
Middle	50.7
Low	18.8
Main source of income	
Own Income	85.2
Network	
At least one friend or one neighbour	59.4
Number of grandchildren	
1	33.6
2	42.0
3	24.4
Grandchild characteristics	%
Gender	

**Table 1** (continued)

	%
All men	31.5
All women	29.4
Mixed (men and women)	39.1
Grandchild age	
All 0–13	57.5
All 14+	28.4
Mixed (0–13 and 14+)	14.1
Living distance from the grandchildren	
Within 16 km	67.4
Further than 16 km	22.6
Mixed (within 16 km and further than 16 km)	10.0

Source: Families, Social Subjects and life cycle (FSS) ISTAT, 2016. Weighted data

about the same percentage reported to live in areas characterised by a middle level of urbanisation. With regard to health conditions, about 30% of grandparents reported having limitations in daily activities and about a third of them described their limitations as severe. About 60% of grandparents reported being able to rely on at least one friend or neighbour. Finally, among grandparents who had at most three grandchildren, about 40% of them had two grandchildren, while only 24% had three.

Concerning the characteristics of grandchildren, gender composition is balanced with about 30% of grandparents who only had females and about 30% who had only male grandchildren. About 57% of grandparents had all grandchildren below the age of 14, about 28% of respondents had older grandchildren (14+) and the remaining 14% had both. Finally, although about 22% of grandparents reported that all their grandchildren lived far away, about 67% of them lived within 16 km of all of their grandchildren. The remaining 10% reported having grandchildren living both near and far from them.

**Grandparent–grandchild face-to-face, telephone and digital contact: determinants, accumulation hypothesis and the relevance of living proximity**

Table 2 reports AMEs and robust standard errors from logistic regression models of grandparent–grandchild contact: face-to-face, telephone and digital interactions (Model 1). With regard to the characteristics of grandparents, we notice that older grandparents were less likely to have any kind of frequent contact with grandchildren. There is a clear cohort-gradient in digital contact. It increases as we move from the oldest (pre-1939) to the youngest (post-1950) cohort. Compared to grandparents born after 1950, those born between 1940 and 1949 and those born before 1939 were about 6 and 14 percentage points less likely to report, respectively, digital contact with grandchildren.

Although never married, separated or divorced grandparents were significantly less likely to report face-to-face meetings (AMEs = -0.087;  $p < 0.01$ ) and phone calling with their grandchildren (AMEs = -0.059;  $p < 0.05$ ), we did not find a statistically significant association between marital status and digital contact ( $p > 0.1$ ). Regarding health condition, we found that grandparents with functional limitations (particularly if these were severe) were less likely to have any frequent contact with grandchildren, but the effects were strongest for telephone and digital contact. In particular, reporting

**Table 2** Average marginal effects and robust standard errors from logistic regression models of grandparent–grandchild contact: face-to-face, telephone and digital interaction

Variables	AMEs (SE)			
	Model 1			Model 2
	Face-to-face	Telephone	Digital	Digital
Grandparent characteristics				
Gender (ref = men)				
Women	0.014 (0.013)	0.038 (0.018)**	− 0.003 (0.010)	− 0.008 (0.010)
Birth cohort (ref = post-1950)				
Pre-1939	− 0.043 (0.022)**	− 0.003 (0.029)	− 0.137 (0.014)***	− 0.138 (0.014)***
1940–1949	− 0.006 (0.016)	0.041 (0.021)*	− 0.064 (0.015)***	− 0.070 (0.014)***
Marital status (ref = married)				
Separated/divorced/never married	− 0.087 (0.024)***	− 0.059 (0.030)**	− 0.004 (0.015)	− 0.001 (0.015)
Widowed	− 0.030 (0.016)*	− 0.030 (0.022)	− 0.001 (0.015)	− 0.003 (0.014)
Functional limitations in daily activities (ref = no limitations)				
No response	− 0.075 (0.029)**	0.007 (0.037)	0.0205 (0.024)	0.015 (0.023)
Severe	− 0.040 (0.020)**	− 0.067 (0.028)**	− 0.052 (0.015)***	− 0.048 (0.015)***
Light	− 0.036 (0.015)**	− 0.059 (0.022)***	− 0.030 (0.013)**	− 0.025 (0.013)*
Educational level (ref = low)				
High	− 0.010 (0.026)	− 0.001 (0.035)	0.076 (0.023)***	0.079 (0.022)***
Middle	− 0.013 (0.014)	0.021 (0.019)	0.054 (0.012)***	0.049 (0.011)***
Occupational condition (ref = unemployed/retired/other)				
In paid work	− 0.015 (0.021)	− 0.038 (0.026)	0.008 (0.013)	0.015 (0.013)
Principal source of income (ref = own income)				
Maintained	0.005 (0.020)	0.012 (0.026)	− 0.013 (0.014)	− 0.014 (0.013)
Network (ref = no friends or neighbours)				
At least one friend or neighbour	0.027 (0.012)**	0.053 (0.016)***	0.034 (0.009)***	0.030 (0.009)***
Geographical area (ref = South and Islands)				
North	− 0.017 (0.013)	− 0.130 (0.018)***	− 0.016 (0.010)	0.001 (0.010)
Centre	− 0.004 (0.016)	− 0.032 (0.022)	0.003 (0.014)	0.010 (0.013)
Degree of urbanisation (ref = low)				
High	− 0.071 (0.016)***	0.090 (0.022)***	0.064 (0.014)***	0.050 (0.013)***
Middle	− 0.015 (0.013)	0.028 (0.019)	0.022 (0.010)**	0.018 (0.010)
Number of grandchildren (ref = 3)				
1	− 0.069 (0.021)***	− 0.079 (0.028)***	− 0.039 (0.018)**	− 0.029 (0.017)*
2	− 0.040 (0.015)***	0.005 (0.021)	− 0.037 (0.015)**	− 0.036 (0.014)**
Grandchild characteristics				
Grandchildren gender (ref = all men)				
Mixed	− 0.009 (0.016)	0.020 (0.022)	− 0.014 (0.013)	− 0.016 (0.012)
All women	0.010 (0.014)	0.046 (0.020)**	0.022 (0.012)*	0.019 (0.012)
Living distance from grandchildren (ref = within 16 km)				
Further than 16 km	− 0.128 (0.018)***	0.010 (0.024)	0.039 (0.017)**	0.033 (0.016)**

**Table 2** (continued)

Variables	AMEs (SE)			
	Model 1			Model 2
	Face-to-face	Telephone	Digital	Digital
Mixed	-0.034 (0.019)*	0.102 (0.026)***	0.052 (0.018)***	0.035 (0.016)**
Age of grandchildren (ref = all 0-13)				
All 14 +	-0.654 (0.014)***	0.023 (0.019)	0.076 (0.012)***	0.042 (0.015)***
Mixed	-0.068 (0.022)***	-0.003 (0.028)	0.047 (0.019)**	0.046 (0.019)**
Face-to-face				
At least few times a week				-0.037 (0.015)**
Telephone				
At least few times a week				0.126 (0.008)***

Source: Families, Social Subjects and life cycle (FSS), ISTAT, 2016. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Number of obs. = 3763

to have severe functional limitations in daily activities was negatively associated with frequent digital contact with grandchildren (AMEs = -0.052;  $p < 0.01$ ). Furthermore, high and middle educated grandparents were significantly more likely to report at least weekly digital contact with grandchildren compared to low educated ones, and having an elective social network was positively associated not only with face-to-face contact (AMEs = 0.027;  $p < 0.05$ ), but also with telephone and digital calls with grandchildren (AMEs = 0.053;  $p < 0.01$  and AMEs = 0.034;  $p < 0.01$ , respectively). In addition, our findings show that living in northern regions was negatively associated with grandparent-grandchild telephone contact (AMEs = -0.130;  $p < 0.01$ ), while living in highly urbanised areas was negatively associated with face-to-face meeting (AMEs = -0.071;  $p < 0.01$ ) but positively associated with both telephone and digital contact (AMEs = 0.090;  $p < 0.01$  and AMEs = 0.064;  $p < 0.01$ , respectively). Grandparents with fewer grandchildren were less likely to report frequent face-to-face, telephone and digital contact with at least one of them ( $p < 0.01$ ).

Concerning the characteristics of grandchildren, our findings show that while their age was negatively associated with face-to-face contact, it was positively associated with digital contact. More specifically, grandparents with all grandchildren aged 14 and over were about 65 percentage points less likely to have frequent face-to-face contact with at least one of them—compared to grandparents with all grandchildren aged 0-13 years old—but they were about 7 percentage points more likely to contact them frequently using digital devices. With regard to the gender composition of grandchildren, we notice that grandparents of girls only were significantly more likely to have frequent contact with them by telephone. Finally, as expected, having all the grandchildren living far away was negatively associated with frequent face-to-face contact but was positively associated with frequent digital contact. In particular, having all grandchildren living far away was associated with about a 4 percentage point increase in the likelihood of frequent digital contact, compared to having all of them living within 16 km.

The last column in Table 2 reports findings for the association between face-to-face and telephone contact with digital contact, controlling for the characteristics of grandparents and grandchildren (Model 2). Findings show that grandparents reporting

frequent face-to-face contact with grandchildren were about 3 percentage points less likely to have frequent digital contact with them ( $p < 0.05$ ). Instead, calling grandchildren by telephone at least a few times a week was positively associated with frequent digital contact (AMEs = 0.126;  $p < 0.001$ ).

As additional analysis, we re-estimated the models by splitting up the sample according to geographical proximity to grandchildren (Table 3) and to grandchild age (Table 4). Overall, most of the findings reported above were confirmed. Analyses in Table 3 were motivated by the idea that a potential compensatory effect of digital contact for the lack of (frequent) face-to-face contact depends on living proximity to grandchildren. This was confirmed. In fact, a negative association between face-to-face and digital contact (Model 2) was found only among grandparents with all grandchildren living far away (Table 3B). For both samples we confirmed the cumulation between telephone and digital contact (Table 3AB, Model 2).

As for the analyses by grandchild age, the most striking result is that among grandparents who only have older grandchildren (aged 14+) most characteristics of grandparents lose their statistical significance (Table 4B). In addition, while the positive association between telephone and digital contact is found independently of grandchild age, the negative association between digital and face-to-face contact is found only in the case of younger grandchildren (Table 4A, model 2). In this case, the effect of having only far-away grandchildren on the probability of frequent digital contact is stronger than in the whole sample (AME = 0.102,  $p < 0.001$ ).

## Discussion and conclusions

This study examined the patterns of contact among grandparents with up to three grandchildren through different tools, with a focus on digital contact and the factors associated with such exchanges by using a large, nationally representative Italian survey. Drawing from the literature on intergenerational relations, we considered the role of the characteristics of grandparents and grandchildren in shaping the use of digital tools for grandparent–grandchild contact (RQ1). Exploring the socio-economic characteristics associated with frequent digital contact has revealed that communication through digital means was different from other traditional forms of contact for selected independent variables. For example, digital contact was influenced by grandparent birth cohorts and education level, with younger and better educated grandparents being more likely to keep in contact with their grandchildren with digital tools, while results were not significant for more traditional forms of contact, proving a marked age and education divide consistent with the timing of the introduction of popular smartphones and tablets. Frequent digital communications were not associated with the marital status of grandparents, while a disadvantage among separated, divorced or single grandparents persisted in traditional forms of contact. This was an interesting result since being separated/divorced at older ages has been traditionally considered detrimental for intergenerational exchanges (Albertini & Tosi, 2018; Pasqualini et al., 2021; Tomassini et al., 2004), but not for newer means of contact, which tend to be less dependent on the role of children as bridges in grandparent–grandchild relationships. In contrast, the poor health of grandparents was confirmed as a roadblock to grandparent–grandchild contact, whether traditional or digital. Living

**Table 3** Average marginal effects and robust standard errors from logistic regression models of grandparent–grandchild contact, for grandparents stratified by grandchildren’s living proximity: face-to-face, telephone and digital interactions

A Variables	All grandchildren living within 16 km, AMEs (SE)			
	Model 1			Model 2
	Face-to-face	Telephone	Digital	Digital
Grandparent characteristics				
Gender (ref = men)				
Women	0.017 (0.016)	0.030 (0.022)	− 0.001 (0.012)	− 0.006 (0.011)
Birth cohort (ref = post-1950)				
Pre-1939	− 0.033 (0.026)	− 0.002 (0.037)	− 0.114 (0.017)***	− 0.115 (0.017)***
1940–1949	− 0.011 (0.019)	0.0257 (0.026)	− 0.068 (0.017)***	− 0.071 (0.016)***
Marital status (ref = married)				
Separated/divorced/never married	− 0.130 (0.035)***	− 0.071 (0.041)*	− 0.004 (0.019)	0.003 (0.020)
Widowed	− 0.014 (0.018)	− 0.001 (0.028)	− 0.006 (0.016)	− 0.008 (0.015)
Functional limitations in daily activities (ref = no limitations)				
No response	− 0.049 (0.036)	0.071 (0.045)	0.043 (0.032)	0.030 (0.028)
Severe	− 0.040 (0.024)*	− 0.027 (0.035)	− 0.037 (0.017)**	− 0.037 (0.016)**
Light	− 0.023 (0.018)	− 0.059 (0.027)**	− 0.021 (0.014)	− 0.015 (0.014)
Educational level (ref = low)				
High	0.021 (0.031)	0.008 (0.046)	0.017 (0.023)	0.025 (0.024)
Middle	0.009 (0.017)	0.013 (0.024)	0.035 (0.014)**	0.035 (0.013)***
Occupational condition (ref = unemployed/retired/other)				
In paid work	0.003 (0.025)	− 0.007 (0.032)	− 0.004 (0.014)	− 0.002 (0.014)
Principal source of income (ref = own income)				
Maintained	− 0.006 (0.024)	0.026 (0.032)	− 0.027 (0.014)*	− 0.030 (0.013)**
Network (ref = no friends or neighbours)				
At least one friend or neighbour	0.013 (0.014)	0.047 (0.020)**	0.021 (0.010)*	0.017 (0.010)
Geographical area (ref = South and Islands)				
North	− 0.040 (0.015)**	− 0.093 (0.022)***	− 0.004 (0.012)	0.006 (0.011)
Centre	− 0.016 (0.019)	− 0.002 (0.028)	0.014 (0.016)	0.016 (0.015)
Degree of urbanisation (ref = low)				
High	− 0.082 (0.020)***	0.128 (0.028)***	0.078 (0.015)***	0.061 (0.014)***
Middle	− 0.018 (0.016)	0.051 (0.024)**	0.033 (0.011)***	0.030 (0.011)***
Number of grandchildren (ref = 3)				
1	− 0.052 (0.022)**	− 0.069 (0.035)**	− 0.026 (0.020)	− 0.014 (0.020)
2	− 0.040 (0.016)**	0.028 (0.027)	− 0.027 (0.017)	− 0.028 (0.015)*
Grandchild characteristics				
Grandchildren gender (ref = all men)				
Mixed	0.005 (0.019)	0.021 (0.027)	0.000 (0.014)	− 0.002 (0.014)
All women	0.026 (0.016)	0.049 (0.024)**	0.021 (0.014)	0.016 (0.013)
Age of grandchildren (ref = all 0–13)				

**Table 3** (continued)

A	All grandchildren living within 16 km, AMEs (SE)			
	Model 1			Model 2
	Face-to-face	Telephone	Digital	Digital
All 14+	-0.129 (0.024)***	0.050 (0.030)*	0.029 (0.020)	0.023 (0.019)
Mixed	0.000 (0.021)	0.146 (0.032)***	0.061 (0.022)***	0.038 (0.018)**
Face-to-face				
At least few times a week				0.001 (0.018)
Telephone				
At least few times a week				0.115 (0.009)***
B	All grandchildren living far from 16 km, AMEs (SE)			
Variables	Model 1			Model 2
	Face-to-face	Telephone	Digital	Digital
Grandparent characteristics				
Gender (ref=men)				
Women	-0.018 (0.029)	0.052 (0.035)	-0.017 (0.026)	-0.032 (0.025)
Birth cohort (ref=post-1950)				
Pre-1939	-0.068 (0.042)	-0.024 (0.059)	-0.176 (0.033)***	-0.172 (0.033)***
1940-1949	0.009 (0.035)	0.042 (0.044)	-0.064 (0.035)*	-0.068 (0.033)**
Marital status (ref=married)				
Separated/divorced/never married	-0.038 (0.037)	-0.064 (0.048)	-0.005 (0.032)	-0.003 (0.031)
Widowed	-0.032 (0.039)	-0.037 (0.048)	0.049 (0.043)	0.034 (0.039)
Functional limitations in daily activities (ref=no limitations)				
No response	-0.088 (0.050)*	-0.090 (0.071)	0.001 (0.051)	-0.008 (0.048)
Severe	0.008 (0.051)	-0.151 (0.058)**	-0.072 (0.043)*	-0.049 (0.045)
Light	-0.086 (0.033)***	-0.077 (0.045)*	-0.076 (0.032)**	-0.068 (0.031)**
Educational level (ref=low)				
High	-0.089 (0.042)**	-0.078 (0.062)	0.166 (0.051)***	0.166 (0.050)***
Middle	-0.051 (0.029)*	0.027 (0.037)	0.094 (0.028)***	0.078 (0.026)***
Occupational condition (ref=unemployed/retired/other)				
In paid work	-0.040 (0.036)	-0.064 (0.050)	0.050 (0.035)	0.060 (0.034)*
Principal source of income (ref=own income)				
Maintained	0.036 (0.044)	0.000 (0.054)	0.033 (0.041)	0.039 (0.039)
Network (ref=no friends or neighbours)				
At least one friend or neighbour	0.038 (0.026)	0.054 (0.034)	0.063 (0.024)**	0.062 (0.023)***
Geographical area (ref=South and Islands)				
North	0.066 (0.028)**	-0.174 (0.035)***	-0.042 (0.026)	-0.008 (0.025)
Centre	0.053 (0.038)	-0.047 (0.047)	0.008 (0.036)	0.021 (0.033)
Degree of urbanisation (ref=low)				
High	-0.026 (0.035)	0.009 (0.044)	0.023 (0.033)	0.011 (0.031)
Middle	-0.012 (0.030)	0.000 (0.036)	-0.004 (0.026)	-0.010 (0.025)
Number of grandchildren (ref=3)				

**Table 3** (continued)

B Variables	All grandchildren living far from 16 km, AMEs (SE)			
	Model 1			Model 2
	Face-to-face	Telephone	Digital	Digital
1	-0.059 (0.048)	-0.052 (0.058)	-0.063 (0.047)	-0.063 (0.044)
2	-0.029 (0.040)	-0.022 (0.046)	-0.074 (0.040)*	-0.068 (0.037)**
Grandchildren characteristics				
Grandchildren gender (ref = All Men)				
Mixed	-0.001 (0.038)	0.063 (0.048)	-0.036 (0.034)	-0.047 (0.032)
All women	-0.017 (0.032)	0.042 (0.039)	0.016 (0.029)	0.010 (0.028)
Age of grandchildren (ref = all 0-13)				
All 14 +	-0.0097 (0.035)***	-0.072 (0.048)	0.033 (0.041)	0.033 (0.038)
Mixed	-0.064 (0.043)	0.026 (0.060)	0.047 (0.050)	0.025 (0.044)
Face-to-face				
At least few times a week				-0.104 (0.023)***
Telephone				
At least few times a week				0.172 (0.021)***

Source: Families, Social Subjects and life cycle (FSS), ISTAT, 2016. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Number of obs. = 916

in urban areas resulted as a positive predictor of intergenerational digital contact as urban areas are better equipped with broadband coverage. Finally, having a friend or neighbour to rely on is also positively associated with frequent digital contact as well as for the other types of contact.

We also considered several aggregated grandchildren’s variables as potential predictors of frequent use of digital technologies by grandparents with their grandchildren, such as age. Indeed, digital contact is significantly higher for grandparents with older grandchildren. Interestingly, when all grandchildren lived far away, grandparents not only maintained more frequent digital contact, but also the age of grandchildren lost significance. This suggests that distance behaves in a diametrically opposite way in digital intergenerational relations compared to face-to-face, for which distance exhibits a negative correlation.

In addition, we explored the adoption of accumulation versus a compensatory pattern testing if digital interactions between grandparents and grandchildren substitute or cumulate with other traditional forms of contact (RQ2). The study demonstrated that digital contact compensated for the absence of traditional frequent face-to-face contact, while it accumulated with telephone contact. When grandparents usually contact grandchildren via telephone, they also often interact with them via digital means. However, in the absence of traditional frequent face-to-face meetings digital contact was compensatory, but this effect was true only when all grandchildren live far away. A distance-related gratification opportunity factor may explain the results, so that when geographical distance prevents or limits meeting face-to-face, families are pushed to opt for digital contact. It is particularly among older adults who have close family ties living far away that new technologies become more appealing. Thus, given a general preference for face-to-face contact, we observe a negative association. Among those who live geographically close, the preferred type of contact is



**Table 4** Average marginal effects and robust standard errors from logistic regression models of grandparent–grandchild contact, for grandparents stratified by grandchildren’s age: face-to-face, telephone and digital interactions

A Variables	All grandchildren aged 0-13, AMEs (SE)			
	Model 1			Model 2
	Face-to-face	Telephone	Digital	Digital
Grandparent characteristics				
Gender (ref = men)				
Women	0.012 (0.015)	0.059 (0.023)**	− 0.011 (0.015)	− 0.021 (0.014)
Birth cohort (ref = post-1950)				
Pre-1939	− 0.074 (0.031)**	0.041 (0.044)	− 0.133 (0.015)***	− 0.137 (0.014)***
1940–1949	0.001 (0.017)	0.033 (0.025)	− 0.049 (0.016)***	− 0.055 (0.015)***
Marital status (ref = married)				
Separated/divorced/never married	− 0.065 (0.025)***	− 0.014 (0.036)	− 0.007 (0.021)	− 0.009 (0.020)
Widowed	− 0.043 (0.024)*	0.052 (0.035)	− 0.003 (0.024)	− 0.016 (0.021)
Functional limitations in daily activities (ref = no limitations)				
No response	− 0.044 (0.032)	0.045 (0.045)	0.029 (0.032)	0.016 (0.029)
Severe	− 0.055 (0.031)*	− 0.047 (0.045)	− 0.057 (0.025)**	− 0.048 (0.026)*
Light	− 0.065 (0.022)***	− 0.103 (0.032)***	− 0.044 (0.019)**	− 0.038 (0.019)**
Educational level (ref = low)				
High	− 0.027 (0.028)	− 0.055 (0.042)	0.067 (0.029)**	0.074 (0.028)**
Middle	− 0.029 (0.016)*	− 0.013 (0.023)	0.046 (0.015)***	0.043 (0.015)***
Occupational condition (ref = unemployed/retired/other)				
In paid work	− 0.010 (0.020)	− 0.050 (0.029)*	0.003 (0.017)	0.014 (0.017)
Principal source of income (ref = own income)				
Maintained	− 0.013 (0.023)	− 0.041 (0.033)	− 0.012 (0.020)	− 0.006 (0.019)
Network (ref = no friends or neighbours)				
At least one friend or neighbour	0.025 (0.014)*	0.037 (0.021)*	0.021 (0.014)	0.018 (0.013)
Geographical area (ref = South and Islands)				
North	− 0.003 (0.015)	− 0.145 (0.023)***	− 0.038 (0.015)**	− 0.012 (0.014)
Centre	0.018 (0.020)	− 0.038 (0.030)	0.008 (0.021)	0.020 (0.019)
Degree of urbanisation (ref = low)				
High	− 0.058 (0.020)***	0.100 (0.029)***	0.064 (0.019)***	0.048 (0.018)***
Middle	− 0.008 (0.016)	0.057 (0.025)**	0.024 (0.015)	0.017 (0.015)
Number of grandchildren (ref = 3)				
1	− 0.048 (0.026)*	− 0.079 (0.039)**	− 0.021 (0.026)	− 0.009 (0.024)
2	− 0.023 (0.021)	0.004 (0.032)	− 0.017 (0.023)	− 0.015 (0.021)
Grandchildren characteristics				
Grandchildren gender (ref = all men)				
Mixed	0.018 (0.021)	0.030 (0.030)	− 0.019 (0.018)	− 0.023 (0.017)
All women	0.018 (0.016)	0.010 (0.024)	0.014 (0.016)	0.014 (0.016)
Living distance from grandchildren (ref = within 16 km)				
Further than 16 km	− 0.652 (0.019)***	0.079 (0.023)***	0.102 (0.017)***	0.038 (0.020)*

**Table 4** (continued)

Variables	All grandchildren aged 0-13, AMEs (SE)			
	Model 1			Model 2
	Face-to-face	Telephone	Digital	Digital
Mixed	0.015 (0.028)	0.072 (0.048)	0.081 (0.036)**	0.080 (0.035)**
Face-to-face				
At least few times a week				− 0.068 (0.023)
Telephone				
At least few times a week				0.164 (0.012)
Variables	All grandchildren aged 14+, AMEs (SE)			
	Model 1			Model 2
	Face-to-face	Telephone	Digital	Digital
Grandparent characteristics				
Gender (ref = men)				
Women	0.025 (0.032)	0.035 (0.036)	− 0.007 (0.017)	− 0.013 (0.017)
Birth cohort (ref = post-1950)				
Pre-1939	− 0.037 (0.072)	0.004 (0.085)	− 0.076 (0.045)*	− 0.081 (0.046)*
1940–1949	− 0.003 (0.070)	0.034 (0.083)	− 0.026 (0.044)	− 0.031 (0.044)
Marital status (ref = married)				
Separated/divorced/never married	− 0.159 (0.072)**	− .208 (0.066)***	0.010 (0.026)	0.026 (0.030)
Widowed	− 0.034 (0.032)	− 0.103 (0.037)***	0.010 (0.017)	0.016 (0.017)
Functional limitations in daily activities (ref = no limitations)				
No response	− 0.164 (0.072)**	− 0.015 (0.077)	0.030 (0.046)	0.038 (0.046)
Severe	− 0.033 (0.036)	− 0.100 (0.043)**	− 0.029 (0.018)	− 0.028 (0.018)
Light	− 0.022 (0.031)	− 0.037 (0.036)	− 0.009 (0.016)	− 0.009 (0.016)
Educational level (ref = low)				
High	0.053 (0.080)	0.015 (0.098)	0.028 (0.040)	0.041 (0.044)
Middle	− 0.005 (0.039)	0.138 (0.043)***	0.029 (0.021)	0.024 (0.019)
Occupational condition (ref = unemployed/retired/other)				
In paid work	− 0.121 (0.104)	0.118 (0.099)	0.071 (0.051)	0.052 (0.046)
Principal source of income (ref = own income)				
Maintained	0.062 (0.048)	0.132 (0.057)**	− 0.005 (0.026)	− 0.011 (0.023)
Network (ref = no friends or neighbours)				
At least one friend or neighbour	0.029 (0.026)	0.058 (0.030)*	0.067 (0.013)***	0.064 (0.012)***
Geographical area (ref = South and Islands)				
North	− 0.055 (0.031)*	− 0.103 (0.036)***	0.011 (0.016)	0.014 (0.016)
Centre	− 0.035 (0.037)	− 0.013 (0.043)	0.001 (0.019)	0.003 (0.019)
Degree of urbanisation (ref = low)				
High	− 0.132 (0.036)***	0.012 (0.043)	0.041 (0.021)**	0.037 (0.020)*
Middle	− 0.058 (0.030)*	− 0.043 (0.036)	− 0.006 (0.015)	− 0.007 (0.015)
Number of grandchildren (ref = 3)				
1	− 0.052 (0.044)	− 0.028 (0.052)	− 0.047 (0.026)*	− 0.047 (0.026)*

**Table 4** (continued)

B Variables	All grandchildren aged 14+, AMEs (SE)			
	Model 1			Model 2
	Face-to-face	Telephone	Digital	Digital
2	-0.058 (0.032)*	0.043 (0.038)	-0.052 (0.023)**	-0.052 (0.022)**
Grandchildren's characteristics				
Grandchildren gender (ref = all men)				
Mixed	-0.017 (0.038)	0.015 (0.044)	-0.012 (0.018)	-0.016 (0.018)
All women	0.018 (0.034)	0.145 (0.039)***	0.053 (0.021)**	0.043 (0.020)**
Living distance from grandchildren (ref = within 16 km)				
Further than 16 km				
Mixed	-0.620 (0.027)***	-0.075 (0.037)**	0.029 (0.018)	0.043 (0.025)*
Face-to-face				
At least few times a week				
				0.013 (0.017)
Telephone				
At least few times a week				
				0.049 (0.013)***

Source: Families, Social Subjects and life cycle (FSS), ISTAT, 2016. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Number of obs. = 1022

face-to-face contact, while among those living at a distance the only possible form of contact will be non-face-to-face contact. So while traditional phone calls are widespread among older adults and used to keep in frequent contact with people living close by, the use of newer types of digital communication is particularly appealing to those older adults with relatives who live far away.

When implementing separate analyses by grandchild age, we found that among grandparents who only have older grandchildren (aged 14 and over) most characteristics of grandparents lost their statistical significance, pointing to a stronger role of their ability to use digital tools and the characteristics of grandchildren. No compensatory effect between digital and face-to-face contact was found when considering older grandchildren. This is consistent with the less important role of geographical distance for digital contact with older grandchildren. Thus, digital contacts with older grandchildren do not seem to be driven by geographical distance and the need to replace frequent face-to-face contact. For older grandchildren face-to-face contact is generally less frequent, while digital contact is used independently from distance.

The present study has some limitations, mostly related to data restrictions. First, data refer to 2016, but the level of digitalisation in Italy has experienced a constant increase in recent years, particularly evident in the context of the COVID-19 pandemic which limited the chances of face-to-face interaction. Nevertheless, the next FSS survey is scheduled for 2023, so that 2016 is the most recently available large survey allowing statistically robust estimates on intergenerational exchanges at a national representative level for Italy. Second, information on contact with grandchildren and on the characteristics of grandchildren in the FSS survey is available only for up to three non-coresident grandchildren, so that the sample was restricted to grandparents with at most three grandchildren living outside the household (67.6% of all grandparents). By excluding those grandparents having more than three

grandchildren from the sample analysis, we potentially exclude the oldest respondents, who are probably less likely to engage in digital contact with grandchildren. This would lead to a slight overestimation of the relative contribution of digital contact in grandparent–grandchild exchanges. Additionally, data are cross-sectional and do not allow for further examination of cohort effects and causality for some characteristics. For example, we observe a correlation between grandparent–grandchild geographical distance and the propensity to engage in digital contact. However, we cannot statistically establish whether geographical distance is the driving factor for the use of digital technologies. Finally, data are not specific on the digital tools employed and do not allow the use of different apps to be distinguished, such as text or WhatsApp messages. For this reason, different digital technologies have been analysed together. However, Fernández-Ardèvol et al. (2020) highlighted that among digital platforms, older adults define a hierarchy of preferred tools. Thus, future studies could investigate the determinants of grandparent–grandchild digital contact distinguishing the specific technology employed.

Despite these limitations, our research provides the first quantitative study based on nationally representative Italian data and focused on digital grandparent–grandchild contact. Our study also has relevant implications for the broader theme of persisting inequalities in the access to and the use of the Internet. Overall, results suggest that the use of new digital technologies by grandparents is still limited, involving a minority of about one in ten grandparents. The fact that poor health, low levels of education and living in less urbanised areas are factors associated with lower access to or use of digital tools emphasises the need to improve digital network connectivity and skills. Nevertheless, the increasing availability of new digital products, combined with wider familiarity in the use of new communication technologies will mitigate the observed cohort effect as new generations of grandparents emerge. Moreover, findings indicate that digital technologies can potentially compensate for barriers to physical contact due to geographic distance, thus preserving some form of intergenerational solidarity among these families. And last, although FSS data do not provide information on the quality of intergenerational exchanges, previous literature showed that frequent face-to-face interactions may be an indicator of high satisfaction with family relations (Tomassini et al., 2021), and the gender of grandchildren could influence the level of pleasure as evidenced for child gender in parent–child relationships (Grundy & Murphy, 2018). However, possible negative aspects, namely conflicts about the use of digital tools, can also arise (Ivan et al., 2021) and need to be considered in future research.

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#### **Author contributions**

All authors contributed to the design of the work. BA wrote the introduction and background. EM implemented the analyses and, together with MP, wrote the Data and Methods and Results sections. CT and EC wrote the conclusions. All authors worked on the drafted manuscript to substantively revise it. All authors have approved the submitted version and have agreed both to be personally accountable for the author's own contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature. All authors read and approved the final manuscript.

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**Availability of data and materials**

The data that support the findings of this study are available from the Italian National Institute of Statistics' (ISTAT) website. A restricted version of the 2016 survey is publicly available for download from <https://www.istat.it/it/archivio/microdati+ad+uso+pubblico>

**Declarations****Competing interests**

The authors declare that they have no competing interests.

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