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A systematic review of studies considering grandparenting, health, and well-being

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Abstract

***Background and Objectives*:** Whether grandparenting is associated with improved health and well-being among older adults is a salient question in present-day aging societies. This systematic review compiles studies that consider the health and well-being outcomes of grandparenting, concerning (i) custodial grandparent families, where grandparents are raising children without parental presence; (ii) three-generation households, where grandparents are living with adult children and grandchildren; and (iii) non-coresiding grandparents, who are involved in the lives of their grandchildren.

***Research Design and Methods*:** This systematic review was based on literature searches conducted in September 2019 via Web of Science, PubMed, PsycINFO, and Ebsco. We screened 3,868 abstracts across four databases, and by following the PRISMA guidelines, we identified ninety-two relevant articles (117 studies) that were published between 1978 and 2019.

***Results*:** In 68% of cases custodial grandparenting was associated with decreased health and wellbeing of grandparents. The few studies considering the health and well-being of grandparents living in three-generation households provided mixed findings (39% positive; 39% negative). Finally, in 69% of cases involvement of non-coresiding grandparents was associated with improved grandparental outcomes; however, there was only limited support for the prediction that involved grandparenting being causally associated with grandparental health and well-being.

***Discussion and Implications*:** The findings are discussed separately among these three groups of grandparents, including reference to possible causal relations between involved grandparenting and grandparental health and well-being. The article concludes by considering the scope for future studies.

Keywords: custodial grandparents; grandchild care; grandparental health; intergenerational relationships; three-generation households

Background and Objectives

Due to increased life expectancy, the proportion of older adults, including grandparents, has increased on a global scale, and in fact, it has been estimated that there are currently approximately one billion grandparents in the world (Moore & Rosenthal, 2016). Most grandparents play an active role in the lives of their grandchildren. In Europe, for instance, 58% of grandmothers and 49% of grandfathers provide regular grandchild care (Hank & Buber, 2009), while approximately one million grandparents in the US are the primary caregivers for their grandchildren (Dunifon, Ziol-Guest, & Kopko, 2014). Thus, grandparents are often highly involved in their grandchildren's lives and whether grandparenting provides benefits or disadvantages for grandparents in terms of their health and well-being is a salient question.

Many studies that attempt to detect whether grandparenting is associated with improved health and well-being predict that helping others should correlate with the health of the helpers. In other words, it is often hypothesized that grandparents benefit from being involved in their grandchildren's lives (e.g., Mahne & Huxhold, 2015; Tsai, Motamed, & Rougemont, 2013). A counterhypothesis, however, takes the stance that caring for young children is challenging, particularly for older adults with limited reserves of strength (e.g., Baker & Silverstein, 2008; Hughes, Waite, LaPierre, & Luo, 2007). According to this perspective, active grandparenting could overburden older adults and lead to grandparents' decreased health and well-being. For example, Coall and Hertwig (2010, 2011) argue that the association between grandparenting and grandparents' health may result in an inverted U-shaped curve. Based on the Coall-Hertwig hypothesis, moderate grandparental involvement is the most beneficial for grandparents, while negative effects may arise when no

grandparental involvement occurs or when it reaches the highest level of involvement (e.g., when grandparents are the primary caregivers of their grandchildren).

Thus, whether grandparenting improves the health and well-being of grandparents may depend on family circumstances, which is why they are separated into three groups: (i) custodial grandparents, (ii) grandparents living with their children and grandchildren in three-generation households, and (iii) non-coresiding grandparents (i.e., those involved in their grandchildren's lives without living with them). In households where the grandparents are the primary caregivers of their grandchildren or they live with their descendants in a three-generation household, the high level of their involvement is assumed based on the living arrangements. Among non-coresiding grandparents, however, grandparental involvement is most often measured via childcare support but also the frequency of contact, emotional closeness, and other informal assistance.

We excluded studies that explore custodial grandparenting only among custodial grandparents or three-generational grandparenting only among three-generational grandparents i.e., there is no relevant comparison group (e.g., Whitley, Kelley, & Lamis, 2016). These studies could not provide answers to the question of whether custodial grandparenting or living in a three-generational household is associated with grandparental health. We also excluded studies that only explore the association between being/becoming a grandparent and grandparental health and well-being (e.g., Tanskanen et al., 2019).

In this systematic review, which was based on literature searches that were conducted across four databases, we investigated whether grandparental involvement is negatively or positively associated with a grandparent's health and well-being, according to three contextual divisions

(custodial grandparents, grandparents living in a three-generation household, and non-coresiding grandparents). This review makes a novel contribution to the literature by compiling research on all three contexts of grandparenting and revealing how in each context the involved grandparenting is associated with grandparental health. In addition, the review investigates whether previous studies have provided convincing causal evidence for the possible association.

Research Design and Methods

Search strategy

On September 27, 2019, we conducted a systematic literature search in three databases: Web of Science, PubMed, and PsycINFO. Then, on September 30, 2019, we included one more database, Ebsco, in the review process. We limited the search to peer-reviewed articles in English that employed a quantitative method and were published between 1970–2019.

Our search words included the following familial circumstances or terms related to grandparenting: intergeneration*; multigeneration*; "custodial grandparent*"; three-generation*; "skipped generation*"; grandchild*; "extended famil*"; "extended household*"; alloparent*; "co residence"; co-residence, coresidence, grandparent*; grandmother*; grandfather*; grandmaternal*; and grandpaternal*. We also included search words related to grandparental investment or well-being: care; "primary care*"; cognition*; "mental health"; depression, depressive; "physical health"; "self-rated health"; "self-rated health"; "activities of daily living"; ADL; happiness; and "life satisfaction".

Screening eligibility and inclusion criteria

The review's search yielded 19,246 records in total, but we excluded the following articles: duplicates (n=8,189), those that covered other topics based on the article's name (n=7,030), those that were not scientific or peer-reviewed (n=99), and those that were in other languages besides English (n=60). Thus, we included 3,868 abstracts for screening, and afterward, we excluded articles that did not concern grandparenting (n=2,735) or include indicators about grandparental health or well-being (n=465). We also excluded those that were not peer-reviewed (n=217), only employed qualitative methods (n=68), were in other languages besides English (n=60), were reviews (n=15), and those specifically concerned with being/becoming a grandparent (n=8).

We assessed the full text for 300 articles, excluding those that were not based on quantitative research (n=39), did not have grandparental investment as an independent variable (n=38), included no grandparental health or well-being outcomes (n=15), and those that only generally covered caregivers but did not distinguished between grandparents and other types of caregivers (n=7). Finally, we excluded studies that only concerned custodial grandparents (n=99) or only three-generational households (n=9) if they did not include a comparison group of either noncustodial or non-coresiding grandparent populations. The exceptions included studies that compared grandparents' health or well-being before and after they were custodial grandparents or before and after they began living in three-generational households. Finally, one study could not be accessed, and based on the abstract, we were unable to evaluate whether it should have been included in the review (Minkler & Fuller-Thomson, 2001).

Based on these selections, a total of ninety-two *articles* (i.e., peer-reviewed, published research reports) were included in the final sample (PRISMA, Appendix Figure 1). We classified all the *studies* (i.e., part of an article that covers one of the above-mentioned types of familial circumstances) based on whether they concerned custodial grandparents (n=34), three-generational households (n=18), or non-coresiding grandparents (n=65). Some articles covered more than one type of family circumstance; thus, the total number of studies included was higher (n=117) than the number of articles in the final database. In this paper, the term, *result*, refers to a single finding that concerns grandparental involvement and an outcome measure. In this sense, an article can contain a maximum of three studies, while a single study can contain several results.

Aim of the review: to reveal a grandparenting effect

Our main aim is to investigate whether grandparenting, i.e., grandparental involvement, is associated with the health and well-being of grandparents and whether this association is negative or positive. Three contexts of grandparenting (i.e., custodial grandparents, grandparents in three-generation households and non-coresiding grandparents) have been considered, respectively. As we conducted a database of studies included in the review, we marked each study's result as being either positive, negative, or nonsignificant, depending on the association between grandparents' involvement and their health and well-being. Some studies that included more than one context of grandparenting may have been marked as providing nonsignificant results in one context (e.g., custodial grandparents) but positive results in another (e.g., non-coresiding grandparents; Choi & Zhang, 2018). Likewise, some studies may provide negative results in one context and positive results in another (e.g., Hughes et al., 2007).

In several cases, more than one health or well-being outcome was investigated in a single study. We marked the result of a study as being either positive *or* negative, even if there was one positive or negative association revealed, and we marked a study as being both positive *and* negative if it contained both results. The latter was often the case if the results were separated according to gender (e.g., Hughes et al., 2007) or ethnicity (e.g., Goodman & Silverstein, 2002, 2006). Also, a study was marked as nonsignificant if *all* the results in specific grandparent groups showed nonsignificant associations (e.g., Ates, 2017; Hsu & Chang, 2015). Thus, the total number of positive, negative, or negligible results exceeded the number of studies included in the review (see Table 2). However, in the review, we also counted the total number of *all* the results in the studies, which was substantially higher than counting only the positive, negative, and nonsignificant results overall, as one study may have several positive, negative, or nonsignificant results due to multiple outcome measures and separations (see Appendix Table 4).

Results

Descriptive findings

Our descriptive findings showed that there is a growing interest in the associations between grandparental involvement and grandparental health (Fig 1). Although our time frame began in 1970, the first study in our sample is from 1978 (Wood & Robertson, 1978), and the number of relevant studies has only increased since then, especially over the first few decades of the twenty-first century. Since the literature review was conducted in September 2019, some studies that may have been published in late 2019 were not included. Also, since some

articles covered more than one context of grandparenting, the number of articles was somewhat lower (n=92) than the total number of studies indicated (n=117) in Figures 1 and 2 as well as in Table 1.

< Figure 1 somewhere here >

When we examine the number of studies per year by the context of grandparenting, we observe that the increase is mostly due to studies focusing on non-coresiding grandparents (Fig 2), which was especially high at the beginning of the 2010s, concerning grandparents' health and well-being. Since we only collected a limited sample, these figures do not determine the popularity or trends of grandparent studies overall.

< Figure 2 somewhere here >

The populations that were studied are shown in Table 1. Most research was conducted with data from the US (n=48), especially in the custodial grandparent group. Also, many studies, especially in the non-coresiding grandparent group, were conducted with data from European countries (n=21), and of these, a significant number utilized data from the Survey of Health, Ageing and Retirement in Europe (SHARE) (n=12), including the utilization of ten to twenty countries in a single study. However, studies using data from European countries are missing from the custodial grandparent group, which is likely because the number of custodial grandparent households are much lower in Europe (particularly Western Europe) than in the US or Asian countries (Shwalb & Hossain, 2017).

< Table 1 somewhere here >

Custodial grandparents

Custodial grandparents are the primary caregivers for their grandchildren, and recently, the number of these "skipped-generation households," or "grandfamilies," has increased in many Western countries. Currently, this population group is highest in the US, where approximately 2% of children are raised by their grandparents (Dunifon et al., 2014). While grandparents may be responsible for raising their grandchildren for many reasons, among the most common in Western countries include are parental teenage pregnancy, drug addiction, mental/physical health problems, incarceration, distance employment, relationship breakdown, and death (Hayslip, Fruhauf, & Dolbin-MacNab, 2017). In Asian countries, however, grandparents mostly raise their grandchildren due to distance employment, especially in China, where parents often leave their children with their parents due to temporary migration, which refers to working in other locations (Chen & Liu, 2012; Cong & Silverstein, 2008).

In the review, a total of 68% (23/34) of the custodial grandparent studies were conducted with data from the US (Table 1 and Appendix Table 1). According to the research describing custodial grandparents' characteristics in the US, they are more often concerned with women than men, and more often, they focus on the maternal side (Dunifon et al., 2014; Hayslip et al., 2017). In most cases, custodial grandparents in the US are members of lower socioeconomic classes, single women (Fuller-Thomson, Minkler, & Driver, 1997; Heywood, 1999; Minkler & Fuller-Thomson, 2000), African-Americans, and between ages fifty and fifty-nine, whereas only very few are under forty or over eighty (Ellis & Simmons, 2014).

Thus, in the US, custodial grandparent families are predominantly a selected group, which inevitably affects any comparison between custodial grandparents and noncustodial grandparents. According to the studies in this review, grandparents raising grandchildren have a higher risk of various health problems. Among 68% (30/44) of the results, the health or well-being of custodial grandparents was, at least in some grandparent subpopulations, poorer than noncustodial grandparents, their counterparts (Appendix Table 1). For instance, custodial grandparents have a higher risk of being limited in their daily activities as well as having depressive symptoms, elevated stress levels, and poorer self-rated health than their counterparts (e.g., Baker & Silverstein, 2008a; Blustein, Chan, & Guanais, 2004; Minkler & Fuller-Thomson, 1999, 2005; Musil et al., 2011). Many of the detrimental effects on grandparents' health in skipped-generation households are likely due to their characteristics and history rather than their caring responsibilities exclusively. For instance, a US study shows that an association between caring responsibilities and diminishing health among custodial grandmothers (as compared to noncustodial grandmothers) was predominantly due to their medical history (Hughes et al., 2007).

Although many studies on custodial grandparents have been conducted with cross-sectional data and could reveal selection effects, numerous investigations also contain longitudinal data (n=16 studies, n=21 results; Appendix Table 5). In these studies, a negative association is also apparent, as a grandparent who begins raising a grandchild often suffers from a decline in health (e.g., Baker & Silverstein, 2008a, 2008b; Musil et al., 2011). Thus, it might not only be selection that explains the negative association between custodial grandparenting and grandparental health.

Among the results, only 27% (12/44) showed positive outcomes for custodial grandparents (Appendix Table 1). Twelve studies report at least one positive result between being a custodial grandparent and grandparental health, including those from the US (7), South Korea (1), Taiwan (1), Kenya (2), and Thailand (1). Most of these studies, however, also report some negative results regarding an outcome or grandparent group (Appendix Table 1), and importantly, only two studies report solely positive results (Chung & Park, 2008; Ku et al., 2013). In fact, one of these studies with only positive associations was only interpreted as such because the findings indicate that South Korean grandmothers, who had stopped raising grandchildren and belonged to a low-income group, had *more* depressive symptoms than when they were raising their grandchildren (Chung & Park, 2008).

In summary, there are two options for interpreting the results, which showed that, in most cases, custodial grandparents reported poorer health when compared to their noncustodial counterparts. The first option is that a decline in health occurs when one enters the role of a custodial grandparent since it increases the burden of caregiving. However, one study shows that grandmothers, who had been raising and continued to raise their grandchild, were more likely to have preventive health behaviors (Baker & Silverstein, 2008b), meaning that the health decline may not be considered long-lasting. The second option is that these findings are based on selection effects, and custodial grandparents—especially in Western societies—are typically considered part of a disadvantaged group. In Asian countries, however, custodial grandparents do not constitute a disadvantaged group, so the results may differ. In this review, 5/34 studies concerning custodial grandparents were conducted with data from Asian countries, and the results were either nonsignificant (Chen & Liu, 2012; Choi & Zhang, 2018), positive (Chung & Park, 2018; Ku et al., 2013), or both positive and negative (Komonpaisarn & Loichinger, 2019).

Grandparents in three-generation households

The terms, "three-generation" and "multigenerational" families, refer to a living arrangement whereby children, parents, and grandparents live together in the same household. The number of three-generation households varies remarkably between countries. For instance, approximately 25% (or more) of adolescents in Southern European countries live in three-generation households, whereas the number of children living in multigenerational households is less than 5% in Scandinavian countries (Kreidl & Hubatkova, 2014). Meanwhile, by age five, almost a fourth of children in the US live in three-generation families, while 8% and 11% do so in the UK and Australia, respectively (Pilkauskas & Martinson, 2014).

Few investigations examine whether living in three-generation households is associated with improved or impaired outcomes among grandparents, (Dunifon et al., 2014) and, similar to custodial grandparenting, this population group is primarily studied in the US (Dunifon et al., 2016). In our review, 56% (10/18) of the studies were conducted with US data, while 39% (7/18) was data from Asian countries and one study included data from Turkey.

Based on the results, living in a three-generation household is as likely to be beneficial as detrimental for grandparents. Of the results, 39% (9/23) showed a positive association, but 39% (9/23) also showed a negative association. Meanwhile, 22% (5/23) of the results showed a nonsignificant association (Table 2 and Appendix Table 2). Many of the articles examining grandparents' health and well-being while living in three-generational households also consider custodial grandparents, so in these cases, comparisons are often made between these

two groups (e.g., Blustein et al., 2004; Goodman & Silverstein, 2002; 2006). The outcome measures that were utilized include, for instance, the following: depressive symptoms, self-rated health, functional/mobility limitations, different stress factors, happiness, and life satisfaction (e.g., Tsai et al., 2013; Musil & Ahmad, 2002; Ku et al., 2013; Hsu & Chang, 2015; Goodman, 2003).

Like the results concerning custodial grandparents, those involving grandparents in three-generation households may reflect the selection effect, meaning that grandparents living in three-generation households may already have poorer health than those in different living arrangements (Hughes et al. 2007). However, studies with longitudinal data (n=11 studies, n=13 results; Appendix Table 5) indicate that negative (e.g., Chen & Liu, 2012; Hughes et al., 2007; Musil, 2000) and positive (Tsai et al., 2013; Musil et al., 2011; Hughes et al., 2007) associations exist, even when the health or well-being of a grandparent is measured over time.

Positive and negative results were found in studies that were conducted with data from both the US and Asia (e.g., Chen, Mair, Bao, & Yang Claire, 2015; Chen & Liu, 2012; Hughes et al., 2007; Tsai et al., 2013). Thus, the positive/negative results were not solely related to the country of residence; however, the results that were solely positive were more often found in studies with data from Asian countries (Guo, Pickard, & Huang, 2008; Ku et al., 2013; Tsai et al., 2013). Finally, the low number of existing studies that consider the health and well-being of grandparents in three-generation households have provided mixed results.

Grandparents living separately from their grandchildren

The largest group of caregiving grandparents, particularly in Western countries, includes those who do not live with their grandchildren but provide them with different kinds of support relatively frequently. In recent decades, an increasing number of studies have investigated the associations between active grandparenting and the health and well-being of non-coresiding grandparents (Fig 2). Most studies that focus on non-coresiding grandparents are conducted with European data (32%; 21/65), and over half of these (twelve studies) contain SHARE data from multiple European countries. Meanwhile, 26% of the studies (17/65) were conducted with data from Asian countries, 23% (15/65) utilized data from the US, 9% (6/65) utilized data from Australia, and the remaining 9% (6/65) involved data from other countries (e.g., Israel or Turkey) (Table 1 and Appendix Table 3).

Non-coresiding grandparents are involved in the life of their grandchildren in many ways, and the most common measure of their involvement is grandparental childcare assistance (e.g., Ates, 2017; Grundy et al., 2012; Xu et al., 2012). Grandparental involvement measures also include the frequency of contact between grandparent and grandchild (e.g., Bates & Taylor, 2012, 2016; Danielsbacka & Tanskanen, 2016; García-Campos, Aguilar-Zavala, & Malacara, 2010), financial help, and other informal forms of assistance or emotional support (e.g., Fujiwara & Lee, 2008). Also, grandparental well-being has been measured with various variables, such as self-rated health (e.g., Choi & Zhang, 2018; Danielsbacka, Tanskanen, Coall, & Jokela, 2019), longevity and time to death (Hilbrand, Coall, Meyer, Gerstorf, & Hertwig 2017a; Hilbrand, Coall, Gerstorf, & Hertwig, 2017b), cognitive functioning (e.g., Ahn & Choi, 2019; Arpino & Bordone, 2014), depression and mental health (e.g., Lee et al., 2019; Xu, 2019), functional limitations/abilities (e.g., O'Loughlin, Loh, & Kendig, 2017; Ku et al., 2012), happiness and life satisfaction (e.g., Danielsbacka & Tanskanen, 2016; Nimrod, 2008), and in many cases, several measurements are utilized in the same study.

Among non-coresiding grandparents, most of the results were positive (69%; 51/74). Meanwhile, only 19% (14/74) reported a negative association between grandparental involvement and well-being, while 14% (9/74) showed a negligible association (Table 2 and Appendix Table 3). The positive results were found from the data of European countries (e.g., Arpino & Bordone, 2014; Mahne & Huxhold, 2015), Asian countries (e.g., Luo, Pan, & Zhang, 2019; Park, 2018), the US (e.g., Hughes et al., 2007; Xu et al., 2017), and other countries (e.g., Grundy et al., 2012; Thiele & Whelan, 2008). Thus, the positive results were not solely restricted to certain geographic regions. Furthermore, they were found among studies that contained cross-sectional data (e.g., Conde-Sala, Portellano-Ortiz, Calvó-Perxas, Garre-Olmo, & Conde-Sala, 2017), longitudinal data (e.g., Di Gessa, Glaser, & Tinker, 2016a) and methods for detecting causal relations (e.g., the IV approach [Arpino & Bordone, 2014] or panel fixed-effect models [Danielsbacka et al., 2019]). Since most studies utilize grandparental childcare support as an independent variable, this is the most common explanatory variable among the studies with positive results. Grandparental health and well-being were measured with several outcome variables, and thus, the positive associations were not restricted to certain health or well-being outcomes.

The negative results were most commonly accompanied with positive results (n=9), and in these cases, the negative associations only applied to a certain grandparent group or outcome. Results that were solely negative were only found in five studies, which included associations between grandfathers' frequency of contact with a grandchild and decreased life satisfaction (Sener, Oztop, Dogan, & Guven, 2008), a grandparent's centrality role and decreased psychological well-being (Muller & Litwin, 2011), and grandparental childcare and increased depressive symptoms (Brunello & Rocco, 2018). In addition, one study focuses on the

contact frequency with grandchildren and its association with women's postmenopausal symptoms, illustrating that some symptoms increased alongside more contact and caring for their grandchildren (García-Campos et al., 2010). Only a single Thai study shows a negative association between grandchild care and *several* health outcomes among grandparents (self-rated health, functional limitations, and psychological well-being) (Komonpaisarn & Loichinger, 2019). This Thai study utilizes representative data and several instrumental variable approaches to reduce the endogeneity between health status and care provision, meaning that the findings may be considered robust.

Only nonsignificant results were found most likely among the studies that were not specifically focused on associations between grandparental involvement and well-being but considered a wider range of social connections or caregiving roles (i.e., caring for grandchildren was one measurement among others) (Hsu & Chang, 2015; Nimrod, 2008; O'Loughlin et al., 2017; Ward, McGarrigle, & Kenny, 2019; Young & Denson, 2014). For instance, Choi, Stewart, and Dewey (2013) study five types of productive activities (paid work, formal volunteering, caregiving, informal assistance, and caring for grandchildren) and their associations with grandparental depression. They reveal that caring for grandchildren is not associated with grandparental depression. Furthermore, two studies that only show nonsignificant results concerning grandparental involvement and grandparent health/well-being utilize longitudinal data and panel fixed-effect models. These studies find no causal evidence for an association between grandparental childcare and grandparents' self-rated health (Ates, 2017), depression, life satisfaction, or subjective life expectancy (Sheppard & Monden, 2019).

In summary, the evidence mostly indicated positive health and well-being outcomes for involved grandparents who do not co-reside with their grandchildren. However, both negative and negligible effects exist as well. Although investigations have been utilized with methods that can detect causal relationships, these remain a minority in the literature. Thus, the question concerning whether a causal association exists between involved grandparenting and grandparental health and well-being remains under debate.

Discussion and Implications

The present review includes articles that consider the associations between grandparenting and grandparents' health and well-being. In 68% of cases custodial grandparenting was associated with decreased health and wellbeing of grandparents. Studies considering grandparents' health and well-being who live in three-generation households provided mixed results. The involvement of non-coresiding grandparents was associated with improved grandparental outcomes in 69% of the results. Thus, the most negative results were present in the case of custodial grandparents, the most mixed results were among those that involved grandparents living in three-generation households, and most positive results concerned the case of non-coresiding grandparents (Table 2). However, when we consider *all* the results that were included in the studies in this review, the picture appears somewhat different (Appendix Table 4).

< Table 2 somewhere here >

As in many studies, several results were investigated that were either due to a differentiation in the grandparent subgroups (e.g., the grandparents according to gender) or multiple

outcomes, so the same study may include several positive, negative, or negligible results. When all the results were considered (n=452), the most common in every grandparent group was nonsignificant. In the case of custodial grandparents, 44% (67/151) of the results were nonsignificant, 62% (53/85) in the case of three-generation households, and 51% (111/216) for non-coresiding grandparents (Appendix Table 4). Although the number and proportion of nonsignificant results increased after all the results were counted, the proportion of negative results remains the highest among custodial grandparents (43%), while that of the positive results were those of the non-coresiding grandparents (36%). However, it is evident that after counting all the results that address the association between grandparental involvement and grandparental health and well-being, the overall evidence for significant results (either positive or negative) becomes weaker.

Furthermore, as previously discussed, the associations that were found may not be causal in nature, but rather, they may reflect the selection of different caregiving groups. To observe how well the abovementioned studies capture the causal nature of the associations, we have compiled a table of the results that are only based on longitudinal data and/or methods that can detect causality. The ones that are most commonly utilized include panel fixed-effect models and instrumental variable approaches (Appendix Table 5). Overall, approximately 50% (59/117) of studies utilized longitudinal data and/or causal methods, and based on these, the most negative results were still found among custodial grandparents (57%; 12/21) and the positive among non-coresiding grandparents (72%; 26/36). However, a more detailed investigation reveals that only approximately 20% (22/117) of studies' methods can actually address the question of causality (Appendix Table 6). Based on these studies, the negative effects were most commonly found among custodial grandparents (50%; 3/6) and three-

generation households (60%; 3/5), while positive effects were found among non-coresiding grandparents (50%; 6/12).

As was assumed, based on the hypothesis of Coall and Hertwig (2010, 2011), moderate grandparental involvement (e.g., that of non-coresiding grandparents) seems the most beneficial for grandparents, while negative effects were more common when grandparental involvement reached the highest level, like when grandparents became the primary caregivers for their grandchildren. However, as more detailed investigation has revealed, the most common result in all grandparenting contexts was nonsignificant. Also, although approximately half of the studies utilized longitudinal data, only one fifth of the methods that were used could detect causal relations. This reveals two important questions: First, since there was a large number of nonsignificant results, is the interpretation concerning the association of grandparenting with grandparental health and well-being robust? Second, is the association causal? The first question could indicate a publishing bias, meaning that nonsignificant results may remain unpublished unless they are accompanied by at least one significant result.

Overall, the most negative results were found among custodial grandparents and grandparents living in three-generation households, but these may reflect selection effects (concerning poorer health), as previously discussed. However, we also found negative results in the longitudinal data that was conducted with methods able to detect causal associations. At least in some circumstances, therefore, the interpretation that becoming a custodial grandparent or living in a three-generation household is detrimental for grandparental health and well-being seems to be robust.

In the case of three-generation households, it is important to consider the reason behind these living arrangements, as grandparental co-residence could either be a result of their poor health (i.e., they need daily support) or stem from a need to take care of their grandchildren. For the former, grandparents may receive significant support from their adult children, which can improve their health and well-being, but they are in poor health to begin with. Regarding the latter, the grandparents are likely in reasonably satisfactory health to begin with but may become constant "nannies" for their grandchildren, causing extra strain that may have a negative health effect.

Although an extensive and increasing number of studies have investigated whether grandparenting is associated with the health and well-being of grandparents, some gaps still exist in the research. While studies with longitudinal data are well-represented, more studies are needed that analyze the causal nature of the associations. Furthermore, studies using longitudinal data (especially with several follow-ups), and even those with causal methods, cannot disregard that a health decline is inevitable among older adults. Thus, studies should concentrate on the relative health decline rather than health improvement (e.g., Chen & Liu, 2012). Thus, a hypothesis may be that moderately involved grandparents would suffer from a *slower* health decline than their counterparts. Another relevant direction would include studies that use cross-sectional data and causal methods (e.g., instrumental variable approach), as they may capture the causal effect more accurately without involving the aging effect.

In several studies, grandparental outcomes have been separated by gender or ethnicity, so some additional segregation or interactions could be relevant. For instance, it is well-known that socioeconomic status is associated with health (e.g., Kim & Durden, 2007), but few

studies examine the interaction between socioeconomic status and grandparental involvement and its association with grandparental health and well-being (e.g., Chung & Park, 2008; Mahne & Huxhold, 2015). It is also well-known that lineage (i.e., whether a grandparent is from the maternal or paternal side) is strongly associated with grandparental childcare and being a custodial or coresiding grandparent (Coall & Hertwig, 2010). Still, surprisingly few studies consider this while studying the association between involved grandparenting and grandparental health and well-being (e.g., Danielsbacka & Tanskanen, 2016).

Moreover, in the case of non-coresiding grandparents, the most common measure for grandparental involvement is childcare that is provided by grandparents. Looking after grandchildren without a parental presence may not capture all the positive aspects of being an involved grandparent. Thus, contact frequency or emotional closeness with grandchildren could be a more relevant measurement to understand the association between involved grandparenting and grandparental health and well-being.

The question of how to increase the healthy years of one's life is crucial in contemporary aging societies, so whether time spent with grandchildren could promote health remains relevant. Policy implications concerning this review's findings are threefold. First, grandparents in custodial circumstances and three-generational households are the most vulnerable grandparent group, which policymakers should recognize. For them, caring responsibilities are not beneficial (although they are not solely detrimental either). Moreover, based on scant causal evidence, negative associations are not merely due to selection, which means that becoming or continuing a custodial/co-residing role as a grandparent could deteriorate health and well-being. Second, among non-coresiding grandparents, their involvement is associated with improved health and well-being; although, this association is

not unequivocal. Despite the paucity of strong causal evidence, moderate grandparental involvement of non-coresiding grandparents should still be encouraged and enabled in terms of social policy decisions. Third, we need more studies that can detect the causal nature of this association, as the lack of causal evidence concerns all three contexts of grandparenting.

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Appendix Figure 1. Prisma 2009 Flow Diagram.

Appendix Figure 2. Prisma 2009 Checklist

Table 1. Number of studies by study population and family circumstances, total 117

	Grandparent type			
Population	**Custodial**	**Three-generation**	**Non-coresiding**	**Total**
USA	23	10	15	48
Finland	0	0	1	1
Sweden	0	0	1	1
Germany	0	0	4	4
Ireland	0	0	2	2
Spain	0	0	1	1
Europe	0	0	12	12
China	1	2	5	8
South Korea	2	1	6	9
Taiwan	1	4	5	10
Thailand	1	0	1	2
Australia	1	0	6	7
Chile	0	0	1	1
Mexico	0	0	1	1
Israel	0	0	2	2
Kenya	4	0	0	4
Turkey	1	1	2	4
Total	34	18	65	117

Table 2. Summary of associations in grandparent groups: custodial, three-generation households, and non-coresiding. Number of results and (% of total number of results).

	Positive association	Negative association	No association	Total n of studies	Total n of results
Custodial care	12 (27%)	30 (68%)	2 (5%)	34	44
Three-generation	9 (39%)	9 (39%)	5 (22%)	18	23
Non-coresiding	51 (69%)	14 (19%)	9 (14%)	65	74
total	72 (51%)	53 (38%)	16 (11%)	117	141

Figure 1. Number of studies per year (1978–2019), total 117

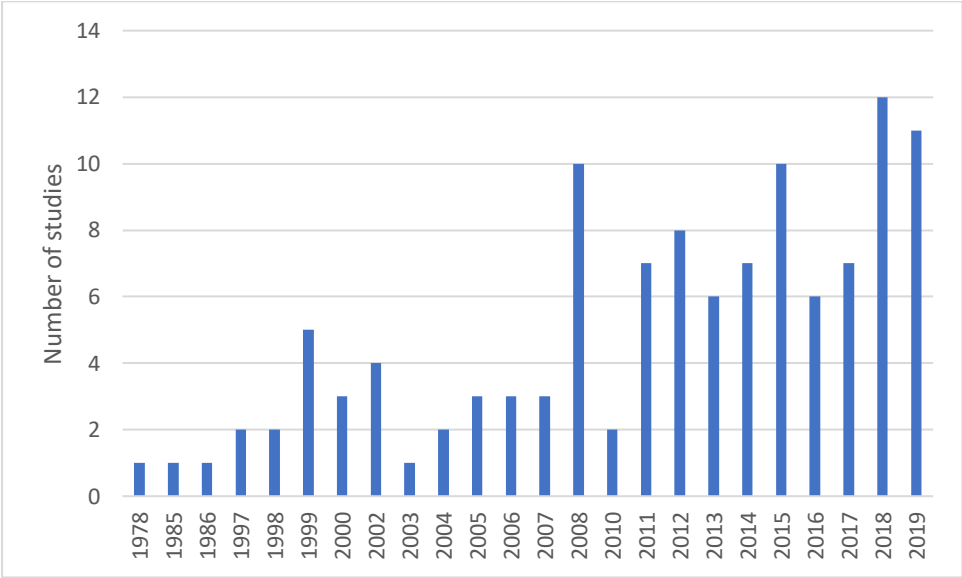
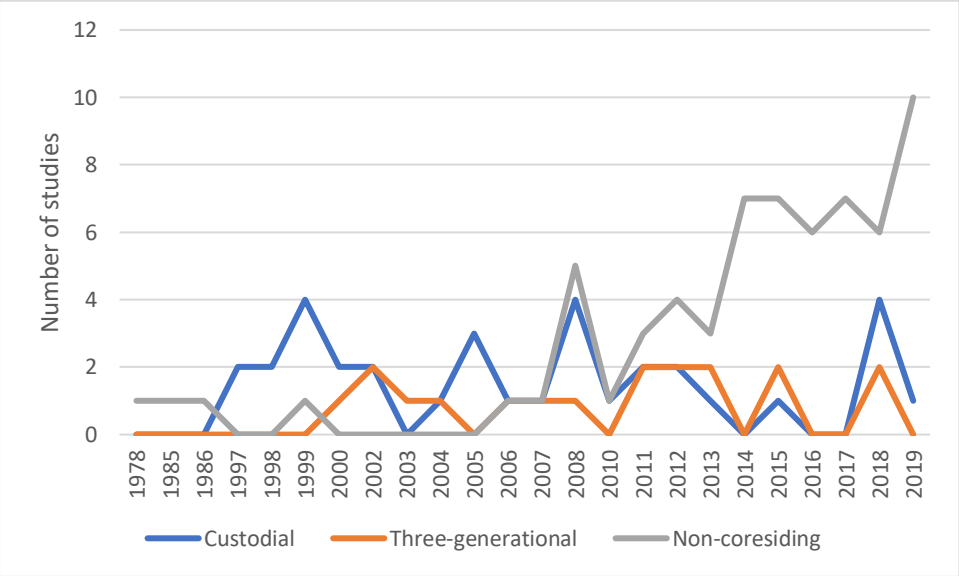


Figure 2. Number of studies per year based on family circumstances (1978–2019), total 117



Appendix Table 1. Custodial care: Studies concerning the association between custodial care arrangement and grandparents' health and well-being (n=34)

Authors	Population	Sample characteristics	Measure of grandparent's health/well-being	Association
Baker & Silverstein, 2008a	USA	8,468; 52-74 years old; representative	depressive symptoms	neg.
Baker & Silverstein, 2008b	USA	5,298 grandmothers; 50-70 years old; representative	preventive health behavior	neg. (gms who recently began raising gc, less likely preventive health behav) & pos. (gms who had been raising and continue to raise gc, more likely preventive health behav)
Bigbee et al., 2011	USA	485 grandmothers (rural-urban); non-representative	physical and mental health	neg. (for rural gms in case of mental health)
Blustein et al., 2004	USA	10,293 grandparents; 53-63 years old; representative	depressive symptoms	neg.
Bowers & Myers, 1999	USA	101 grandmothers (23 custodial, 33 part-time carers, 45 regularly visiting grandchildren); non-representative	burden, parenting stress, grandparenting satisfaction, life satisfaction	neg.
Chen et al., 2015	USA	69,668; 50+ years old; representative	frailty Index (FI)	neg.
Chen & Liu, 2012	China	14,954 person–year records; 55 and above; non-representative	self-rated health (SRH)	ns.
Choi & Zhang, 2018	South Korea	3,092 grandmothers; 45 and above; representative	self-rated health	ns.
Chung & Park, 2018	South Korea	1,948 grandmothers; 50-74 years old (in 2006); representative	developmental trajectories of depressive symptoms and self-rated health over time	pos. (more depressive symptoms if stopped raising gc in low income group)

Dunne & Kettler, 2008	Australia	52 caregiving and 45 non-caregiving grandparents (age-matched sample); non-representative	stress, anxiety and depression scores	neg.
Fuller-Thomson & Minkler, 2000	USA	79 African American grandparents who were raising a grandchild and 485 African American grandparents who had never been primary caregivers for a grandchild; non-representative	depression (CES-D), activities of daily living	neg.
Fuller-Thomson & Minkler, 2005	USA	319 American Indian or Alaska Native grandparent caregivers and 5,956 AI/AN who reported that they were not caregivers to grandchildren; 45 years old and older; representative	limitations in activities of daily living, functional disability, severe vision or hearing problem, poverty line status	neg.
Goodman & Silverstein, 2002	USA	1,058 grandmothers; non-representative	grandmothers' well-being (negative affect, positive affect, life satisfaction, depression, and mental health)	neg. (Latino), pos. (African American), ns. (White)
Goodman & Silverstein, 2006	USA	1,051 grandmothers; non-representative	grandmothers' well-being (negative affect, positive affect, life satisfaction, and depression)	neg. (Latino), pos. (African American), ns. (White)
Hayslip et al., 1998	USA	193 grandparents; non-representative	psychosocial satisfaction and positive grandparental meaning	neg. (psychosocial satisfaction), pos. (positive grandparental meaning, men)
Hughes et al., 2007	USA	12,872 grandparents; 50-80 years old; representative	health behaviors (smoking, problem drinking, excercise, obesity) and mental and physical health (depressive symp., SRH, chronic conditions, functional limitations)	neg. (women: SRH (start), smoking (contin.)), pos. (women SRH (cont.))
Ice et al., 2010	Kenya	287 Luo grandparents; 60+ years old; non-representative	BMI, glucose, hemoglobin, perceived health, mental health, systolic blood pressure (SBP)	neg. (perceived health, mental health; at p<0.1: BMI)
Ice et al., 2012	Kenya	640 Luo elders; 60+ years old; non-representative	perceived and physiological measures of stress (cortisol levels and BP)	neg. (women: perceived stress), pos. (men: perceived stress)

Ice et al., 2008	Kenya	287 Luo grandparents; 60+ years old; non-representative	mental and physical health	pos. (women: vitality, nutritional status; men: mental health), neg. (men: nutritional status)
Komonpaisarn & Loichinger, 2019	Thailand	29,227 older people; 60-80 years old; representative	SRH, functional limitations, psychological wellbeing, happiness	pos. (custodial gp: functional limitations, SRH, psychological wellbeing), neg. (happiness)
Ku et al., 2013	Taiwan	3,711 grandparents; 50+ years old; representative	SRH; depressive symptoms; mobility limitations; life satisfaction	pos. (mobility limitations; recent custodial caregivers only, not long-term)
Minkler et al., 1997	USA	3,111 grandparents; representative	depression levels	neg.
Minkler & Fuller-Thomson, 1999	USA	173 custodial and 3,304 non-custodial grandparents; representative	summary measure of ADL limitations	neg.
Minkler & Fuller-Thomson, 2005	USA	2,362 African American grandparent caregivers with 40,148 noncaregiving peers; 45+ years old; representative	functional limitations, limitations in ADL, income, and poverty	neg. (women: functional limitations, income, porverty)
Musil et al., 2011	USA	485 grandmothers; non-representative	caregiving stress and reward, intrafamily strain, social support, resourcefulness, depressive symptoms, mental and physical health, SRH, and perceived family functioning	neg. (stress, intrafamily strain, perceived family functioning, physical health, SRH, depressive symptoms, reward)
Musil, 1998	USA	90 grandmothers (58 had primary responsibility and 32 did not); 39-82 years old; non-representative	health, depressed mood, anxiety, stress, coping, and social supports	neg. (stress [subscales: parent/child dysfunctional interaction, parenting distress], subjective and instrumental support)
Musil, 2000	USA	74 grandmothers living in the same home as grandchild(ren), 49 primary caregiver grandmothers, and 25 with partial/supplemental responsibility; 39-72 years old; non-representative	self-assessed health, depression, parenting stress, anxiety, coping and social support	neg. (parenting stress [all subscales], instrumental support, depression) (no main effects on depression by caregiver status, but primary caregivers had higher time 2 depression scores)

Musil & Ahmad, 2002	USA	86 primary caregiver grandmothers, 85 partial/supplemental caregiver grandmothers in multigenerational homes, and 112 noncaregiver grandmothers; non-representative	perceived stress, social support, self-assessed health, health problems, health visits, health maintenance, depressed mood	neg. (stress, instrumental support, self-assessed health, health problems, health visits), pos. (at p<0.1: subjective support, depression)
Oburu & Palmerus, 2005	Kenya	241 caregiving grandmothers; non-representative	stress levels	neg.
Solomon & Marx, 1999	USA	11,591 women; 40 years and above; representative	health status	neg.
Strawbridge et al., 1997	USA	42 grandparent, 44 spouse, and 130 adult-child caregivers with 1,669 noncaregivers; 46-75 years old; representative	mental and physical health (surveyd in 1974 and 1994) (symptoms of depression, happiness, self-reported health, and prevalence of chronic conditions or activity limitations)	neg. (happiness, chronic conditions, activity limitations; at p<0.1: depression, SRH)
Szinovacz et al., 1999	USA	1,789 black and white grandparents; representative	grandparents' subjective well-being (depressive symptoms and life satisfaction)	neg. (women: depressive symptoms) & pos. (men: depressive symptoms; gc leaving the househod increase)
Wilmoth et al., 2018	USA	2,503 grandparents; non-representative	well-being	neg.
Yalcin et al., 2018	Turkey	2,563 women; 65+ years old; non-representative	quality of life (SF-12; mental and physical), health status (Visual Analog Scale of EQ-5D, VAS) and symptoms of depression (Beck Depression Inventory, BDI)	neg.

Appendix Table 2. Three-generation families: Studies concerning the association between living in three-generation households and grandparents' health and well-being (n=18)

Authors	Population	Sample characteristics	Measure of grandparent's health/well-being	Association
Bigbee et al., 2011	USA	485 grandmothers (rural-urban); non-representative	physical and mental health	ns.
Blustein et al., 2004	USA	10,293 grandparents; 53-63 years old, representative	depressive symptoms	neg.
Chen et al., 2015	USA	69,668 observations; 50+ years old; representative	frailty index (FI)	neg.
Chen & Liu, 2012	China	14,954 person–year records; 55 and above; non-representative	self-rated health (SRH)	neg.
Choi & Zhang, 2018	South Korea	3,092 grandmothers; 45 and above; representative	self-rated health	ns.
Goodman, 2003	USA	987 grandmothers (512 custodial grandmothers and 475 coparenting grandmothers); non-representative	depression and life satisfaction	ns.
Goodman & Silverstein, 2002	USA	1,058 grandmothers; non-representative	grandmothers' well-being (negative affect, positive affect, life satisfaction, depression, and mental health)	neg. (African American), pos. (Latino), neg. (White)
Goodman & Silverstein, 2006	USA	1,051 grandmothers; non-representative	grandmothers' well-being (negative affect, positive affect, life satisfaction, and depression)	pos. (Latino), neg. (African American)
Guo et al., 2008	China	1,002 individuals; 50 years old and above; non-representative	physical health status and mental health status	pos.

Hsu & Chang, 2015	Taiwan	14,193 observations from 4,731 older persons; 60 years old or above; representative	happiness	ns.
Hughes et al., 2007	USA	12,872 grandparents; 50-80 years old; representative	health behaviors (smoking, problem drinking, excercise, obesity) and mental and physical health (depressive symp., SRH, chronic conditions, functional limitations)	neg. (women: obesity (start + cont.); men: funtional limitations (cont.), pos. (men: exercise)
Ku et al., 2012	Taiwan	4,582 adults; 50-80 years old at first interview; representative	SRH; depressive symptoms; mobility limitations	ns.
Ku et al., 2013	Taiwan	3,711 grandparents; 50+ years old; representative	SRH; depressive symptoms; mobility limitations; life satisfaction	pos. (srh [both long-term and recent caregivers], mobility limitations [recent caregivers only], depressive symptoms [long-term only])
Musil et al., 2011	USA	485 grandmothers; non-representative	caregiving stress and reward, intrafamily strain, social support, resourcefulness, depressive symptoms, mental and physical health, SRH, and perceived family functioning	neg. (transitions to higher caregiving; physical health, stress, intrafamily strain, perceived family functioning), pos. (subjective support, instrumental support)
Musil, 2000	USA	74 grandmothers living in the same home as grandchild(ren), 49 primary caregiver grandmothers, and 25 with partial/supplemental responsibility; 39-72 years old; non-representative	self-assessed health, depression, parenting stress, anxiety, coping and social support	neg. (parenting stress)

Musil & Ahmad, 2002	USA	86 primary caregiver grandmothers, 85 partial/supplemental caregiver grandmothers in multigenerational homes, and 112 noncaregiver grandmothers; non-representative	perceived stress, social support, self-assessed health, health problems, health visits, health maintenance, depressed mood	neg. (stress, subjective support; at p≤0.1: depression), pos. (instrumental support)
Tsai et al., 2013	Taiwan	914 elders in 1993, 1792 elders in 1999 and 2292 elders in 2007; 60 years old and above; representative	depressive symptoms	pos. (less symptoms if living with children (&gc))
Yalcin et al., 2018	Turkey	2,563 women; 65+ years old	quality of life (SF-12; mental and physical), health status (Visual Analog Scale of EQ-5D, VAS) and symptoms of depression (Beck Depression Inventory, BDI)	pos.

Appendix Table 3. Non-coresiding care: Studies concerning the association between grandparental involvement and grandparents' health and well-being (n=65)

Authors	Population	Sample characteristics	Type of grandparental involvemet	Measure of grandparent's health/well-being	Association
Ahn & Choi, 2019	South Korea	27,947 observations for 8,469 individuals; 45-84 years old; representative	grandparents' caregiving status	cognitive functioning	pos.
Arpino & Bordone, 2014	12 countries (Austria, Belgium, Denmark, France, Germany, Greece, Israel, Italy, Spain, Sweden, Switzerland, and the Netherlands)	5,610 women and 4,760 men; 50-80 years old; representative	childcare (how often on average they cared for grandchild during last 12 months (5 point scale), hours per day grandparents look after grandchildren)	verbal fluency, numeracy, delayed recall, immediate recall, orientation	pos. (verbal fluency)
Arpino et al., 2018	20 countries (Austria, Belgium, Croatia, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Israel, Italy, Luxemburg, the Netherlands, Poland, Portugal, Slovenia, Spain, Sweden, and Switzerland)	83,427 observations of 42,868 individuals; 50-84 years old; representative	childcare (and being a grandparent, number of grandchildren, how often they engaged in grandchild care)	subjective well-being (SWB)	pos.

Arpino & Gómez-León, 2019	12 countries (Austria, Germany, Sweden, Netherlands, Spain, Italy, France, Denmark, Greece, Switzerland, Belgium, Israel)	5,012 men and 6,784 women; 50-84 years old; representative	combination of grandchild care with other care roles	depressive symptoms	pos. (grandmothers, only gc care - no other care)
Ates, 2017	Germany	1,875 observations of 625 individuals; 40 years and above; representative	childcare	self-rated health (SRH)	ns.
Bates & Taylor, 2012	USA	351 grandfathers; non-representative	grandfather involvement (contact frequency, generative activities, commitment)	mental health	pos.
Bates & Taylor, 2016	USA	351 grandfathers; non-representative	grandfather involvement (contact frequency, generative activities, commitment)	mental health	pos.
Bigbee et al., 2011	USA	485 grandmothers (rural-urban); non-representative	rural/urban effects, caregiver status	physical and mental health	ns.
Bowers & Myers, 1999	USA	101 grandmothers (23 custodial, 33 part-time carers, 45 regularly visiting grandchildren); non-representative	level of caregiving (full-time, part-time, no care)	burden, parenting stress, grandparenting satisfaction, life satisfaction	pos. (gp satisfaction [part-time vs. non-caregiving), neg. (burden, parenting stress [full-time vs part-time], life-satisfaction [full-time vs non-caregiving])

Brunello & Rocco, 2018	12 European countries (Austria, Germany, Sweden, Netherlands, Spain, Italy, France, Denmark, Switzerland, Belgium, the Czech Republic and Poland)	13,091 (7,397 females and 5,694 males); 50 years and above; representative	childcare (hours per month)	depressive symptoms	neg.
Burn et al., 2014	Australia	186 women; 57-68 years old; non-representative	childcare	cognition	neg. (high-level of childcare), pos. (low-level of childcare)
Burn & Szoeke, 2015	Australia	224 women; 65+ years old	childcare	cognitive function	pos.
Chen et al., 2015	USA	69,668 observations; 50+ years old; representative	grandparents' living arrangements and in case of non-coresiding grandparents: amount of childcare	frailty index (FI)	pos.
Choi et al., 2013	14 countries (Denmark, Sweden, Austria, France, Germany, Switzerland,Belgium, the Netherlands, Spain, Italy, Greece, Israel, Czech Republic and Poland)	7,238; 60+ years old; representative	five types of productive activities (paid work, formal volunteering, caregiving, informal helping and caring for grandchildren)	depression	ns.
Choi & Zhang, 2018	South Korea	3,092 grandmothers; 45 and above; representative	grandparenting type and transition and grandparenting intensity	self-rated health	pos. (overall nonresidential grandparenting)

Conde-Sala et al., 2017	15 countries (Denmark, Sweden, The Netherlands, Switzerland, Luxembourg, Austria, Germany, Belgium, France, Slovenia, Czech Republic, Estonia, Spain, Italy and Israel)	33,241; 65+ years old; representative	sociodemographic, socioeconomic factors, physical exercise and activities (including grandparenting), physical health, depressive symptoms, life expectancy and healthy life expectancy, suicide rate, gross domestic product (GDP) per capita based on purchasing power parity (PPP)	perceived quality of life	pos. (all countries combined & Mediterranean country cluster: caring for gc (yes/no) --> better perceived QoL)
Danielsbacka et al., 2019	11 European countries (Austria, Germany, Sweden, Netherlands, Spain, Italy, France, Denmark, Switzerland, Belgium and Czech Republic)	41,713 person-observations from 24,787 persons; 50 and above; representative	grandchild care for < 14-year-old grandchildren	SRH; difficulties with activities of daily living (ADLs); depressive symptoms; life satisfaction; meaning of life	pos. (ADL)
Danielsbacka & Tanskanen, 2016	Finland	2,152; 62-67 years old; representative	contact frequencies with grandchildren	grandparental happiness	pos. (maternal grandmothers, higher contact with gc --> happier)
Di Gessa et al., 2016a	10 European countries (Austria, Belgium, Switzerland, Germany, Denmark, Spain, France, Italy, the Netherlands, and Sweden)	8,485 people; 50 and above; representative	intensive and nonintensive grandparental childcare	subsequent health (self-rated health, depressive symptoms, and disability)	pos.

Di Gessa et al., 2016b	11 European countries (Austria, Belgium, Switzerland, Germany, Denmark, Spain, France, Italy, Greece, the Netherlands, and Sweden)	8,972 grandmothers and 6,567 grandfathers; 50 years and above; representative	intensive and nonintensive grandparental childcare	latent continuous physical health variable based on self- and observer-measured indicators	pos. (grandmothers, both intensive and non-intensive care)
Fujiwara & Lee, 2008	USA	724 adults; 25-74 years old; representative	altruistic behaviors for children and grandchildren (ABC) (informal assistance, emotional support, financial support)	Major Depression (MD)	pos. (men: informal assistance 1–10 h/month, and financial support 1–50 $/month), neg. (women, at p<0.1: financial support 1–50 $/month)
García-Campos et al., 2010	Mexico	386 postmenopausal women; 55–75 years old; non-representative	number of children and grandchildren and frequency of their contact (in addition: age, date of the last menstrual period, age at menarche, previous menstrual history, number of pregnancies and deliveries, height, weight and waist and hip circumferences, BMI, waist/hip ratio, schooling in years, work, hours of exercise per week, alcohol consumption, smoking habit)	women's symptoms at postmenopause - hot flushes, vaginal dryness, depressive mood, anxiety, non-specific symptoms of depression (NSSD; problems with digestion, loss of sexual interest, and weight loss), empty nest syndrome (ENS)	neg. (caring for gc: loss of sexual interest, depression, NSSD and ENS; meeting gc: ENC)
Grundy et al., 2012	Chile	2,000 people; 66-68 years old; representative	hours per week of grandchild care	mental well-being two years later (life satisfation, depression,	pos. (gf life satisfaction), pos. (gm less depression)

				Mental Component Summary (MCS) SF-36	
Guo et al., 2008	China	1,002 individuals; 50 years old and above; non-representative	whether the respondent currently helps with childcare; if the respondent lives with any grandchildren	physical health status and mental health status	pos.
Hilbrand et al., 2017a	Germany	516 older adults; representative	grandparenting and supporting others in the social network	longevity	pos.
Hilbrand et al., 2017b	Germany	516 older adults; representative	frequency of childcare	time to death	pos.
Hsu & Chang, 2015	Taiwan	14,193 observations from 4,731 older persons; 60 years old or above; representative	social connection variables included living arrangements, contacts with children/grandchildren/parents/relatives/friends, telephone contacts, providing instrumental and informational support, receiving instrumental and emotional support, and social participation.	happiness	ns.
Hughes et al., 2007	USA	12,872 grandparents; 50-80 years old; representative	caring for grandchildren	health behaviors and mental and physical health	pos. (grandmothers: exercise & continued care; SRH & started care + continued care), pos. (gf: exercise & started care)
Jun, 2015	South Korea	2,341 female; 45–74 years old at time 2; representative	grandchild care	cognitive functioning	pos. (for higher educated, both

					instantaneous and lagged effect)
Kim et al., 2017	South Korea	5,129 grandparents; 50 years old and above without depression; representative	intensity of grandchild care (hours spent caring for a grandchild per week)	depressive symptoms	pos.
Komonpaisarn & Loichinger, 2019	Thailand	29,227 older people; 60-80 years old; representative	grandchild care for < 10-year-old grandchildren	SRH; functional limitations; psychological wellbeing; happiness	neg. (self-rated health, functional limitations and psychological well-being)
Ku et al., 2012	Taiwan	4,582 adults; 50-80 years old at first interview; representative	grandparental childcare	SRH; depressive symptoms; mobility limitations	pos.(better SRH & less depressive symptoms; only significant for grandparents receiving financial support from adult children)
Ku et al., 2013	Taiwan	3,711 grandparents; 50+ years old; representative	grandparental caregiving status (non-caregivers; three-generational; custodial; non-coresiding caregivers)	SRH; depressive symptoms; mobility limitations; life satisfaction	pos. (better SRH & less mobility limitations for long-term non-coresiding caregivers), BUT ns. in FE-models (for nonresidential gps), ns. (depressive symptoms and life-satisfaction; for recent caregivers, all outcomes)
Lee et al., 2019	South Korea	922 grandparents; 65 years old or above; non-representative	grandparental childcare	depression scores, suicidal ideation	pos. (moderate care and less depression) pos. (moderate and high care and less suicidal ideation)

Luo et al., 2019	China	13,596; 50+ years old; representative	caring for grandchildren	cognitive decline	pos.
Mahne & Huxhold, 2015	Germany	990 grandparents; mean age 74 years; representative	relationship quality with children and grandchildren (measured with 2 variables: contact frequency and emotional closeness)	subjective well-being (SWB), measured with life satisfaction, positive affect, negative affect, loneliness	pos. (life satisfaction, positive affect, negative affect (reduces), loneliness (reduces))
Mansson, 2014	USA	104 grandparents; 60-91 years old; non-representative	grandparents' expressions of affection (4 types: love and esteem, caring, memories and humor, and celebratory)	psychological health (self-reported stress, loneliness, self-reported general mental health)	pos. (stress, mental health)
Markides & Krause, 1985	USA	1,125 Mexican Americans; 65-80 years old; representative	intergenerational solidarity (association and affection)	psychological well-being - Life Satisfaction Index, Center for Epidemiologic Studies Depression (CES-D) scale	pos. (self-perceived affection with gc and gp life satisfaction)
McGarrigle et al., 2018	Ireland	8,504 people; 50+ years old; representative	grandchild care (numbers of hours of grandchild care reported in the past month)	depressive symptoms and quality of life	neg. (those with primary education or lower and no active or social leisure: intensive care, both outcomes) , pos. (tertiary-educated gp with no active or social leisure: intensive care, quality of life) (secondary-educated gp with active and social leisure: low intensity care, quality of life)

Mellqvist et al., 2011	Sweden	80 suicide attempters; 70 years old and above; non-representative	social (e.g., too little time spend with grandchildren) and health variables	sense of coherence (SOC)	pos. (too little time spend with children and grandchildren were both associated positively with lower SOC meaning that more time with them would most likely associate positively)
Monin et al., 2014	USA	2,025 U.S. veterans; 60 years old or above; representative	age, gender, education, marital status, income, combat exposure, care- giving hours, caring for a grandchild or other, and scores on physical health, psychological health, cognitive functioning, the positive psychological factor, and social support factor	physical strain, emotional strain, and reward	pos. (reward), neg. (physical strain) NOTE: comparing only gp caregivers to other types of caregivers
Moore & Rosenthal, 2015	Australian	1,205 grandmothers; 34-92 years old; non-representative	personal resources (age, health, education, being partnered) and grandmother engagement (number of grandchildren, hours/week spent with them, frequency of activities with grandchildren, grandmother satisfaction)	generativity, life satisfaction, grandmother satisfaction	pos. (frequency of activities: generativity, gm satisfaction) (only correlation, ns. in regression: frequency of activities and life satisfaction; hours/week and gm satisfaction) , ns. (hours/week: generativity and life satisfaction)

Muller & Litwin, 2011	11 European countries (Denmark, Sweden, Austria, Germany, France, Switzerland, Netherlands, Belgium, Spain, Italy, and Greece)	3,888 grandparents; 50 years old and above; representative	grandparent role centrality (calculated with standardized frequency of contact, the summary score for beliefs on grandparenting, and the grandparent-focused role occupancy measure and summed)	psychological well-being (depressive symptoms)	neg. (the more gp role centrality the more depressive symptoms)
Neuberger & Haberkern, 2014	14 European Countries (Austria, Belgium, Czech Republic, Denmark, France, Germany, Greece, Ireland, Italy, the Netherlands, Poland, Spain, Sweden and Switzerland)	12,740 grandparents; 50 years and above; representative	grandchild care, grandparent obligations	quality of life	pos. (high gp oblig. & gp care --> better QoL)
Nimrod, 2008	Israel	383 recently retired individuals; 50 years old and above; non-representative	get-togethers (grandchildren as one group)	life satisfaction	ns. (concerning gc)
O'Loughlin et al., 2017	Australia	1,261 men and women; 60-64 years old; representative	caregiving status (giving care to grandchildren or other family memeber/friend, yes/no and hours per week)	mobility difficulties, self-rated health, subjective wellbeing (life satisfaction, quality of life)	ns. (grandchild care, all outcomes)
Park, 2018	South Korea	255 grandparents; non-representative	grandparenting role type, involvement level, mediating effect of care burden (stress)	psychological well-being	pos.

Sener et al., 2008	Turkey	200 persons; 60+ years old; non-representative	socioeconomic, demographic (age, education, marital status, income, perceived healthiness, and physical distance from adult children), and relational - frequency of contact with loved ones (children, grandchildren, siblings, and friends) and relational satisfaction	life satisfaction	neg. (men; frequency of contact with gc)
Sheppard & Monden, 2019	15 countries (Austria, Belgium, Czechia, Denmark, Estonia, France, Germany, Italy, the Netherlands, Portugal, Slovenia, Spain, Sweden, Switzerland, and Israel)	13,506 respondents (3,511 (26%) transitioned to grandparent status); 50 years old and above; representative	caring for grandchildren, (becoming a grandparent)	depression, life satisfaction, subjective life expectancy	ns. (gc care and outcomes)
Sobol & Ben-Shlomo, 2019	Israel	197 first time grandparents; non-representative	age, SES, education, gender, economic stress, work commitment, grandchild care burden, self-mastery, family support	grandparents' mental health, grandparents' personal growth	pos. (gc care burden & personal growth)
Szinovacz & Davey, 2006	USA	1,200 grandfathers and 1,481 grandmothers; 51-60 years old at wave 1	retirement and grandchild care obligations	well-being (depressive symptoms)	neg. & pos. (gms; retired gms & extensive care --> neg; working gms & extensive care --> pos)

Tang et al., 2016	USA	2,365 older adults (818 designated caregivers); 60 years old and above; non-representative (representative only of Chinese-American older adults in a large metropolitan area)	grandparent caregiver status, caregiving time, burden, pressure, and perceived negative effect in caregivers	psychological well-being (depressive symptoms, anxiety, stress, and loneliness)	pos. (being a caregiver: all outcomes)
Thiele & Whelan, 2008	Australia	149 non-custodial grandparents; up to 80 years old; non-representative	weekly childcare contact with grandchildren, grandparental meaning, generativity	grandparent satisfaction	pos. (childcare hours --> valued elder meaning, gp satisfaction [correlation only])
Thomas, 1986	USA	177 grandmothers and 105 grandfathers; 45-90; non-representative	characteristics of grandparents' families (grandchildren's number and proximity, and ages of oldest and youngest grandchildren), grandparent characteristics (age, gender, marital status, and retirement status), and perceived responsibility scores (disciplining, caretaking, helping, and advising)	grandparenting satisfaction	pos. (cg care)
Triado et al., 2014	Spain	312 grandparents; 46-91; non-representative	socio-demographic variables (grandparent and grandchildren genders, ages, and family lines), indicators of intensity of care, the types of care provided, evaluation of behavioral problems in the grandchildren, satisfaction and difficulties with care responsibilities	number of health problems, perceived health, and satisfaction with life	neg. (time since care began --> perceived health), pos. (hours per week --> life satisfaction [ns. after controlling for difficulties with care])

Tsai, 2016	Taiwan	2,930 grandparents; 50 years old and above	elders' changing behaviour in caring for grandchildren from 2003 to 2007, age, gender, educational level, work status and self-reported health status in 2007	changes in depression symptoms from 2003 to 2007	pos. (less depressive symptoms)
Tsai et al., 2013	Taiwan	914 elders in 1993, 1792 elders in 1999 and 2292 elders in 2007; 60 years old and above; representative	providing grandchild care	depressive symptoms	pos. (providing no gc care --> greater risk for depression or feeling lonely)
Ward et al., 2019	Ireland	3,646 respondents; representative	gender, education and whether respondents lived with a partner, self-rated health, social connectedness, household income	quality of life (QoL)	ns. (caring for gc was associated with QoL in baseline but not in longitudinal analysis)
Wood & Robertson, 1978	USA	257 grandparents; mean age 65; non-representative	grandchildren, friendship and organizations involvement	morale (life satisfaction)	pos. (association between gc involvement and life satisfaction)
Xu et al., 2017	USA	2,775 grandparents; 60 years old and above; representative	grandparent caregiving time (hours/week), caregiving burden, and caregiving pressure	psychological well-being (depressive symptoms and quality of life)	pos. (depressive symptoms)
Xu et al., 2012	China	1,704 caregivers; 60 years old and above	grandparent caregiving intensity	life satisfaction	pos.

Xu, 2019	China	2,663 to 3,770; representative	grandparents' self-reported family caregiving in the past year, gender and rural-urban residence	mental health (life satisfaction and depressive symptoms) and physical health (levels of high sensitivity C-reactive protein (CRP; chronic inflammation and acute infection), hypertension, high-risk pulse rate, and diabetes)	pos. (urban grandfathers: depressive symptoms [at p<0.1]; urban grandmothers: life satisfaction and chronic inflammation), neg. (rural grandfathers: high-risk pulse)
Yalcin et al., 2018	Turkey	2,563 women; 65+ years old	study vs. control group, age, education, income, number of children and grandchildren, mean number of grandchildren cared for, mean age of grandchildren receiving care, mean time spent on grandchild car, mean length of care per week, and length of day- and night-time care	quality of life (SF-12; mental and physical), health status (Visual Analog Scale of EQ-5D, VAS) and symptoms of depression (Beck Depression Inventory, BDI)	pos. (mean time spent caring for grandchildren per week --> BDI; mean duration of day-time care & mean duration of night-time care --> SF-12 [mental and physical component], VAS), neg. (time spent caring for grandchildren to date --> BDI, VAS; mean time spent caring for grandchildren per week --> SF-12 [both components], VAS; mean duration of day-time care --> BDI; mean duration of night-time care --> BDI)

Young & Denson, 2014	Australia	148 non-custodial Australian boomer grandparents; non-representative	amount of time spent engaged in, desire to change that time, and satisfaction with four different roles: grandchild care, paid work, other family care, and home duties	psychosocial distress (symptoms of nervousness, agitation, psychological fatigue and depression), self-esteem	ns. (time spent providing care: both outcomes)
Zhang et al., 2015	China	3,418 elderly respondents; representative	social engagement (social activity, productive activity)	SRH, PWB	pos. (whole sample, men, and the "young-old": both outcomes)

Appendix Table 4. Summary of all associations in custodial, three-generation and non-coresiding grandparent groups. Number of results and (% of total number of results)

	Positive association	Negative association	No association	Total n of studies	Total n of results
Custodial care	19 (13%)	65 (43%)	67 (44%)	34	151
Three-generation	15 (18%)	17 (20%)	53 (62%)	18	85
Non-coresiding	77 (36%)	28 (13%)	111 (51%)	65	216
total	111 (25%)	110 (24%)	231 (51%)	117	452

Appendix Table 5. Summary of associations in custodial, three-generation and non-coresiding grandparent groups with longitudinal data and/or causal modelling. Number of results and (% of total number of results)

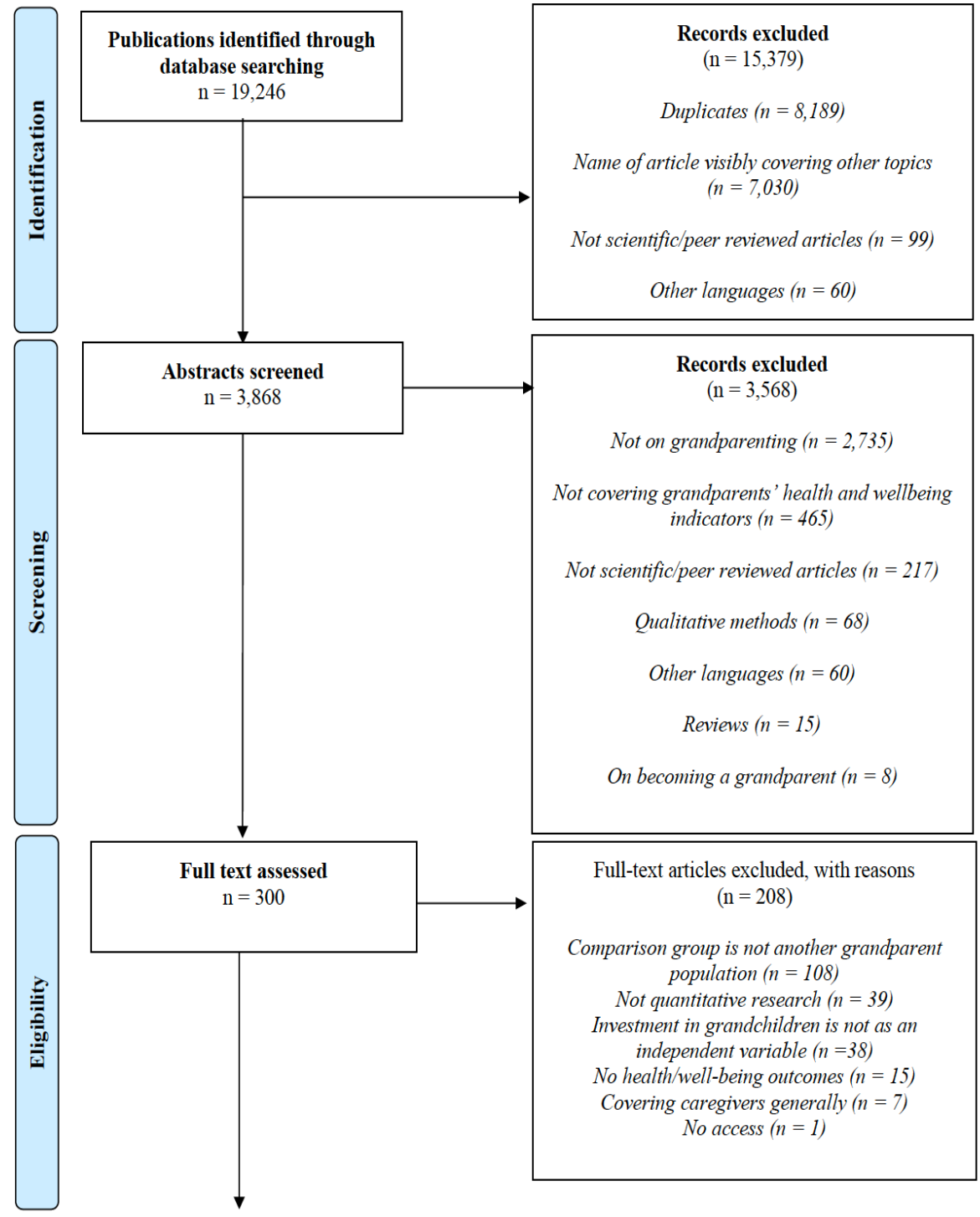
	Positive association	Negative association	No association	Total n of studies	Total n of results
Custodial care	7 (33%)	12 (57%)	2 (10%)	16	21
Three-generation	4 (31%)	6 (46%)	3 (23%)	11	13
Non-coresiding	26 (72%)	6 (17%)	4 (11%)	32	36
total	37 (43%)	24 (34%)	9 (13%)	59	70

Appendix Table 6. Summary of associations in custodial, three-generation and non-coresiding grandparent groups with causal modelling.

Number of results and (% of total number of results)

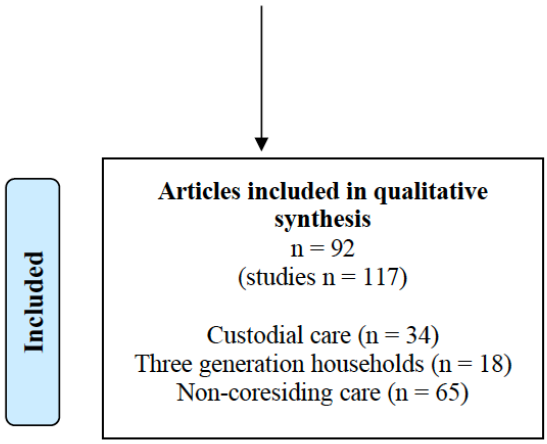
	Positive association	Negative association	No associaton	Total n of studies	Total n of results
Custodial care	2 (33%)	3 (50%)	1 (17%)	5	6
Three-generation	1 (20%)	3 (60%)	1 (20%)	5	5
Non-coresiding	6 (50%)	2 (17%)	4 (33%)	12	12
total	9 (39%)	8 (35%)	6 (26%)	22	23

Appendix Figure 1. Prisma 2009 Flow Diagram.



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.


Included
Articles included in qualitative synthesis
n = 92
(studies n = 117)
Custodial care (n = 34)
Three generation households (n = 18)
Non-coresiding care (n = 65)