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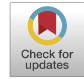

Intensity and changes in grandparental caregiving: Exploring the link to loneliness in Europe

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HIGHLIGHTS

- Grandparental caregiving reduces loneliness, regardless of intensity.
- Stable caregiving roles are linked to lower loneliness than changing roles.
- Newly engaging in grandparent caregiving increases vulnerability to loneliness.
- Grandparental care intensity impacts loneliness more than changes in caregiving.

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ABSTRACT

This study investigates the impact of the overall intensity and changes in grandparental caregiving on loneliness in grandparents in European countries. Data from waves 5 to 8 of the Survey on Health, Ageing, and Retirement in Europe (SHARE) were used ($N_{individuals} = 30{,}896$ and $N_{observations} = 48{,}562$). We included grandparents (aged 50 years and over) with at least one grandchild at the beginning of the study. The analyses reveal that any intensity of grandparental care decreases the risk of loneliness. When looking at changes in grandparental care the results show that stable caregiving roles appeared to reduce loneliness, while starting to provide grandparental care makes grandparents more vulnerable to loneliness. In conclusion, our findings underscore that consistent grandparental care is important for grandparents in mitigating loneliness, highlighting the importance of sustained caregiving roles over fluctuations in caregiving intensity.

1. Introduction

Over the past years, later-life loneliness has become increasingly recognised as an emerging public health problem (Nyqvist et al., 2019; Pan et al., 2023), because of its adverse effects on mental and physical health.

Within the framework of active and healthy ageing, it is recognised that social activities play a crucial role in fostering social interaction and combating loneliness (Quirke et al., 2021). For instance, grandparental care could be viewed as a protective factor against loneliness in later-life care (Quirke et al., 2021; Zhang et al., 2021). Having grandchildren can alleviate loneliness by promoting social integration and connecting grandparents to non-kin relationships, thus creating a broad(er) support network. Additionally, grandchildren can provide informal support to ageing grandparents or vice versa, fostering a sense of belonging (Burholt & Aartsen, 2021). However, being a grandparent can also be demanding and limit the time available for maintaining relationships outside the family, potentially undermining the benefits of grandparental care for addressing loneliness (Di Gessa et al., 2016). In this context, the intensity of grandparental care (Quirke et al., 2021; Zhang et al., 2021), and the changes therein, are crucial in understanding the impact of grandparental caregiving on loneliness (Yang et al., 2022).

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In summary, the objective of this paper is to address the following key research questions: a) Does the intensity of grandparental care relate to loneliness? b) Are changes in grandparental care, specifically increases in such care, connected to loneliness?

1.1. Grandparental care and loneliness: the role of intensity of care and changes therein

Perlman and Peplau (1998) describe loneliness as “a significant mismatch or discrepancy between a person’s actual social relations and his or her needed or desired social relations” (p. 572). As people age, maintaining social interaction becomes more challenging due to factors such as the loss of partners and friends, which increases their vulnerability to loneliness (de Jong Gierveld et al., 2018). However, the emergence of new social ties associated with ageing, such as grandparent-grandchild relationships, can help prevent feelings of loneliness.

Becoming a grandparent can fulfil the social needs of older adults and provide valuable social opportunities (Yang et al., 2022; Zhang et al., 2021). Existing research suggests a positive correlation between providing informal grandparental care and reduced loneliness (Hajek & König, 2021; Quirke et al., 2019). However, the intensity of providing grandparental care (Vasileiou et al., 2017) and the changes therein (Yang et al., 2022) can have significant implications for loneliness. Quirke et al. (2019) in Germany for example show that grandparents who frequently care for their grandchildren report less loneliness. Similarly, research by Tsai et al. (2013) and Tsai (2016) in Taiwan and Zhang et al. (2021) in China show that starting to take care of grandchildren is associated with reduced loneliness among grandparents. However, intensified caregiving can also have the opposite effect, leading to increased loneliness due to the demands of heightened caregiving (Di Gessa et al., 2016) or because of role adaptation (Mandemakers, 2011).

Role enhancement (Sieber, 1974) and role strain (Goode, 1960) theories provide valuable insights into the potential factors contributing to the benefits or burdens associated with the intensity and changes in grandparental care. These theories explain that grandparenthood entails both rewards and obligations (Hajek & König, 2022). Role enhancement suggests that occupying multiple roles, such as providing care, brings well-being and satisfaction for the tasks performed. It is also seen as an opportunity to engage in new activities and to be part of social circles that would not be possible without caregiving responsibilities (Hank et al., 2018; Quirke et al., 2019). The question however may be raised what the impact of increased intensity is. The transition to increased grandparental caregiving or the initiation of caregiving duties may limit older adults’ participation in other activities and may even have detrimental effects on health and well-being, potentially leading to increased stress and isolation from peers who may be experiencing different life circumstances (Hajek & König, 2021; Quirke et al., 2021). Here, the role strain theory indicates that the stress associated with increased caregiving demands may restrict opportunities for social interaction outside of the caregiving context, contributing to feelings of loneliness (Yalcin et al., 2018).

Given these theories, it is plausible to hypothesise that while higher intensity of grandparental care is associated with lower loneliness, increases in grandparental care over time are associated with a heightened risk of loneliness compared to stable patterns of grandparental care.

2. Material and methods

2.1. Data

This study employed data from the Survey of Health, Ageing and Retirement in Europe (SHARE), a biennial longitudinal study which collects information from people aged 50 years and over living in 27 European countries and Israel. SHARE data is publicly available and widely employed by researchers to investigate ageing-related issues.

Data collection involved face-to-face interviews using computer-assisted personal interviewing (CAPI) technology. These interviews covered various aspects of participants’ lives, including health, employment, family, and social support. Eligible participants were followed over time; when participants withdrew from the study, new individuals were recruited to maintain the sample size. In cases where a participant was deceased, a proxy respondent, typically a family member, provided relevant information through an "end-of-life interview”. If contact with a participant could not be established, their interview was classified as "missing”.

The SHARE study was approved by the Ethics Committee of the University of Mannheim for waves 1 to 4. In 2021, the Ethics Council of the Max Planck Society for the Advancement of Science assessed and approved the 4 subsequent waves of the SHARE project. The research adheres to the principles outlined in the Declaration of Helsinki, and written informed consent was obtained from all participants before their participation (Bergmann et al. 2019a, 2019b; Bergmann & Börsch-Supan 2021; Börsch-Supan et al. 2013; Börsch-Supan 2022a, 2022b, 2022c, 2022d; Malter & Börsch-Supan 2015, 2017; Scherpenzeel et al. 2020).

Our study specifically focused on information from waves 5, 6, 7, and 8, conducted in 2013, 2015, 2017, and 2019, respectively. These waves were selected because they included questions specifically designed to measure loneliness. Wave 7 of the SHARE survey differs from the other waves, as it included a special module called SHARELIFE, which collected information about participants’ past life histories ranging from partners and children to housing and work history to detailed questions on health and health care. However, some individuals in wave 7 did not participate in the SHARELIFE module and instead completed the standard interview, which follows the same structure as the other waves. To ensure consistency and allow for clear comparisons across all waves, only individuals from wave 7 who completed the standard interview were included in the sample.

The study sample was limited to grandparents with at least one grandchild who were not residing in nursing homes. Individuals who had never been grandparents or who became grandparents during the analysis period were excluded from the sample. The analysis encompassed individuals and countries that participated in at least two waves of SHARE data (waves 5 to 8), covering a total of 15 European countries: Austria, Belgium, Czech Republic, Denmark, Estonia, France, Germany, Greece, Italy, Luxembourg, Poland, Slovenia, Spain, Sweden, and Switzerland.

To address our two research questions, we conducted two separate analyses. The first analysis examined the *overall intensity of grandparental care* using the most recent response ($N_{individuals} = 30{,}896$). The second analysis explored *changes in grandparental care* (increased intensity vs stable patterns) from one wave to the previous one, with the sample including $N_{individuals} = 30{,}896$ and $N_{observations} = 48{,}562$.

2.2. Measures

An overview of the measures is provided in Appendix A, Tables A.1 and A.2 for both analyses, respectively.

2.2.1. Dependent variable

Loneliness was measured using the short version of the Revised University of California, Los Angeles (R-UCLA) scale (Hughes et al., 2004; Russell et al., 1980). It consisted of three items that capture different aspects of loneliness: a) How much of the time do you feel a lack of companionship, b) feel left out, and c) feel isolated from others? Answering categories were often, some of the time and hardly ever or never. The measure was calculated by initially rescaling each item so that a higher score indicated a greater degree of loneliness. The scores on these three variables were then summed to create a scale ranging from 0 to 6. Subsequently, following the official dichotomization of R-UCLA,

the loneliness variable was converted into a binary factor. Individuals with a score of 0–1 were categorised as “not lonely” while those with a score of 2–6 were categorised as “lonely” (de Jong Gierveld & van Tilburg, 2006).

The R-UCLA scale has been shown to have strong psychometric properties and has been validated in various populations (Hughes et al., 2004). The reliability, as measured by Cronbach’s alpha, was satisfactory across all time points for both analyses. For the first analysis, Cronbach’s alpha values were α = 0.75, 0.77, and 0.73, while for the second analysis, the values were α = 0.73, 0.75, and 0.73, indicating good internal consistency.

2.2.2. Explanatory variables

The main goal of the study was to analyse the impact of the intensity of care (cross-sectionally) and changes in its intensity (longitudinally).

First, *“overall intensity of grandparental care”* was assessed as follows. In waves 5 to 8, grandparents were asked whether they had cared for grandchildren in the previous year (0 = no, 1 = yes). Those who affirmed caring for their grandchildren were further asked how often they provided care. Based on their responses, the frequency of grandparental care was categorised into 5 categories: 0 = no care (this category represents situations where no grandparental care was provided although they had grandchildren), 1 = rarely, 2 = almost every month, 3 = almost every week, 4 = almost every day (See Appendix A, Table A.1).

Second, the variable *“changes in grandparental care”* was made and included 6 categories: non-carers (i.e., grandparents who did not provide care to their grandchildren in both waves), carers with the same intensity in both waves (no change), carers with decreased intensity or those who stopped caring (decreased care), grandparents who started providing non-intensive care (start non-intensive), grandparents who started providing intensive care (start intensive), and carers who increased from non-intensive to intensive care (increased care) (See Appendix A, Table A.2).

2.2.3. Control variables

The analysis controlled for various factors, all of which are related to later-life loneliness and the provision of grandparental care. These factors included gender, socioeconomic circumstances (education, income, and employment status), number of (grand)children, marital status, co-residence with children, health status, and migration background (Burholt & Aartsen, 2021; Hajek & König, 2021) .

2.3. Statistical analysis

To address our research questions, we employed two different methodologies. First, we evaluated the relationship between the overall intensity of grandparental care and loneliness. Due to the dichotomous nature of our dependent variable, we conducted a *logistic regression analysis,* using the most recent answer of 30,896 individuals. This type of model corresponds to the following specifications:

$$logit(Pr(y_i = 1)) = log\left(Pr\left(\frac{y_i = 1}{1 - (y_i = 1)}\right)\right) = x_i{'}\beta + u_i \quad (1)$$

Where $x_i{'}\beta$ denotes the linear combination of the estimators β_i and the independent variables x_i.

To investigate the association between changes in grandparental care intensity (compared to stable patterns) and loneliness, we conducted a *multilevel random intercept logistic regression analysis*, considering the longitudinal and clustered nature of the data. Our analysis involved 48,562 observations (i.e., repeated measures and person-observations) at level 1, nested within 30,896 individuals at level 2. The two-level logistic random intercept model corresponds to the following specification:

$$\begin{aligned} logit\left(Pr\left(y_{ij} = 1\right)\right) &= log\left(Pr\left(\frac{y_{ij} = 1}{1 - \left(y_{ij} = 1\right)}\right)\right) \\ &= \gamma_{00} + \sum_{q=1}^{Q} \gamma_{qj} Z_{qij} + \sum_{s=1}^{S} \gamma_s W_{sj} + \mu_j + r_{ij} \quad (2) \end{aligned}$$

Where y_{ij} is the response for observation i in individual j, γ_{00} is the average intercept across all individuals, with other covariates set to zero; γ_{qj} and γ_s are effects estimates of all q time-varying covariates and s time-constant variables and μ_j , r_{ij}, are the between-individual variance and the within-individual variance, respectively (Rabe-Hesketh & Skrondal, 2012).

Both the logistic regression and multilevel random intercept logistic regression were conducted using STATA 16 software, employing the commands logit and xtmelogit, respectively.

3. Results

3.1. Descriptives

Fig. 1 provides a comparative overview of the mean loneliness across the different intensities of grandparental care (left panel) and changes in intensity (right panel).

First, Fig. 1 shows that similar average values of loneliness are perceived across different intensities of grandparental care. However, grandparents who do not provide grandparental care experience the highest proportions of loneliness.

Second, experiencing no changes in grandparental care intensity shows the lowest mean loneliness, which falls below the overall mean (red horizontal line). Increases in the intensity of care, whether through starting intensive care or non-intensive care and from non-intensive to intensive, are associated with a higher proportion of loneliness. Once again, the group of grandparents who still do not provide grandparental care experience the highest rates of loneliness.

3.2. Multivariate results

3.2.1. Intensity of grandparental care (cross-sectional)

Table 1 presents the results of the logistic regression analysis investigating the relationship between the intensity of grandparental care and loneliness. The results for the full sample, adjusted for relevant control variables, indicate that higher intensity of grandparental care is associated with a lower risk of loneliness.

Fig. 2, based on the estimated coefficients, displays the predicted probability of loneliness among different intensities of grandparental care. Along with the results of our estimations, our findings show that the intensity of caregiving has a significant negative relationship with loneliness. Specifically, providing care on almost a daily basis ($b = -0.30^{***}$, $p < 0.05$) is associated with the lowest risk of loneliness.

3.2.2. Changes in intensity of grandparental care (longitudinal)

Table 2 presents the results regarding changes in the intensity of grandparental care. They show that maintaining the same intensity of caregiving is associated with the lowest risk of loneliness compared to other transition roles, except in the case of increased intensity (transition from non-intensive to intensive care), where the association is not significant.

Fig. 3, based on the estimated coefficients, shows that stable caregiving roles appeared to reduce loneliness compared to other caregiving transitions. Grandparents who provided no care ($b = 0.46^{***}$, $p < 0.05$), reduced care ($b = 0.26^{***}$, $p < 0.05$) or newly engaged in caregiving roles (whether starting non-intensive ($b = 0.43^{***}$, $p < 0.05$) or intensive care ($b = 0.21^{*}$, $p < 0.05$), are more likely to experience loneliness than those maintaining stable caregiving roles.

An additional analysis was conducted to further explore the

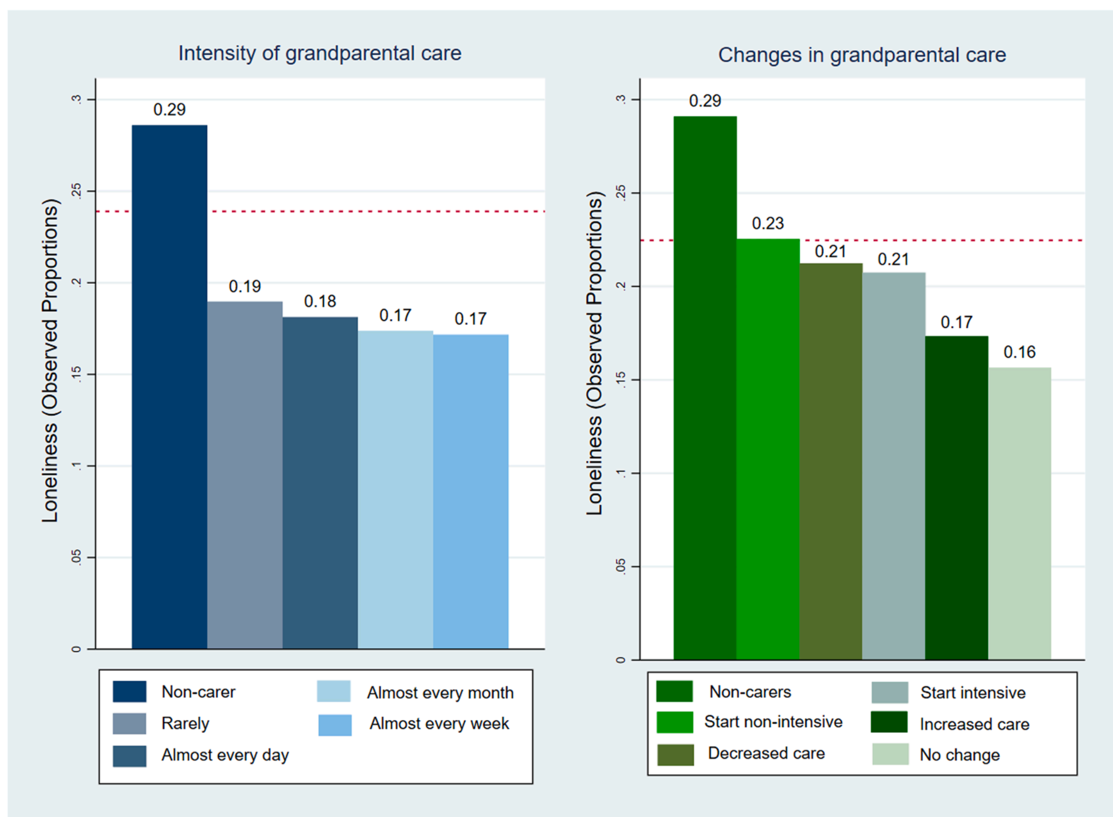

Fig. 1. Mean loneliness by intensity of grandparental care (cross-sectional) and changes in intensity (longitudinal) (proportions).

relationship between intensity changes in grandparental care and loneliness. In this case, the intensification of caregiving (starting non-intensive/intensive and increased care) was combined into a single category (increased intensity). The findings reveal that grandparents who experienced an increased intensity of care were more likely to experience feelings of loneliness compared to those who maintained their caregiving intensity. Additional details regarding this analysis can be found in Appendix A, Table A.3 (Comparative analysis focusing on changes in grandparental care: predicted log odds of loneliness; $N_{individuals} = 30{,}896$ and $N_{observations} = 48{,}562$).

4. Discussion

Previous studies have provided evidence of a connection between providing care to grandchildren and experiencing loneliness among grandparents (Quirke et al., 2019, 2021; Tsai, 2016; Zhang et al., 2021). Our study aims to provide a more comprehensive understanding of this relationship by examining the impact of (a) the intensity of grandparental caregiving and (b) changes in grandparental caregiving compared to stable roles. In this context, a critical question arises: which is more important, the overall intensity of caregiving or the changes in caregiving?

Based on the findings of our analyses, several conclusions can be drawn. First, the results indicate that any intensity of caregiving is generally associated with lower loneliness, suggesting that caregiving, even small and infrequent caregiving, can provide social and emotional benefits (Yang et al., 2022; Zhang et al., 2021). The mere act of caring for grandchildren can have a positive impact on loneliness.

Second, the consistently significant negative relationship between caregiving intensity and loneliness suggests that the accumulation of multiple roles results in higher social support, acting as a buffer and mitigating the impact of stress (Quirke et al., 2019). The social and emotional support gained from intergenerational caregiving relationships can have a positive impact on grandparents' well-being and feelings of loneliness, even though the caregiving responsibilities have increased (Arpino et al., 2018).

Third, not only the cross-sectional intensity of care but also changes therein, matter to loneliness. While stable caregiving roles appeared to reduce loneliness compared to other caregiving roles (no care or reduced care), increased caregiving intensity had a variable impact that was not always significant. An additional analysis showed that grandparents who intensified their caregiving intensity were more likely to experience loneliness compared to those who experienced no changes in caregiving responsibilities (Table A.3 in the Appendix A). Interestingly, grandparents newly engaging in caregiving experienced increased loneliness compared to those with stable caregiving roles.

These findings align with role enhancement theory (Sieber, 1974), which suggests that engaging in multiple roles, such as grandparental caregiving, enhances well-being and satisfaction from the tasks performed, regardless of intensity. However, role strain theory (Goode, 1960) is also relevant, as increased caregiving demands can lead to stress and restrict opportunities for social interaction outside the caregiving context, contributing to feelings of loneliness (Yalcin et al., 2018), particularly when grandparents are newly engaging in caregiving. This dual perspective helps explain why stable caregiving roles reduce loneliness, while newly engaging in caregiving – possibly involving significant lifestyle changes and stress – can increase loneliness.

Grandparents who are already engaged in caregiving may have developed coping mechanisms and support systems to manage their responsibilities with a stable routine (Zhang et al., 2021). This stability can lead to greater satisfaction in caregiving, a sense of purpose, and stronger social connections, mitigating additional feelings of loneliness despite the intensity of caregiving (Hank et al., 2018). However, transitioning from a non-carer to a caregiver role involves significant lifestyle changes and adjustments. The initial phase of caregiving may

Table 1
Results of logistic regression analysis focusing on the intensity of grandparental care: predicted log odds of loneliness ($N_{individuals}$=30,896).

Variables	Dependent variable = lonely	
	Log odds	Robust standard errors
Intensity of grandparental care (ref. non-carers)		
Rarely	-0.10	(0.05)*
Almost every month	-0.18	(0.05)***
Almost every week	-0.24	(0.05)***
Almost every day	-0.30	(0.06)***
Control variables		
Age	-0.05	(0.02)
Age squared	0.00	(0.00)*
Gender (men = ref.)	0.10	(0.03)**
Functional limitations (no limitations = ref.)	0.68	(0.03)***
Educational level (high education = ref.)		
Low education	0.38	(0.04)***
Middle education	0.05	(0.04)
Marital status (widowed = ref.)		
Married	-0.69	(0.04)***
Single	-0.18	(0.05)***
Employment status (employed = ref.)		
Retired	0.15	(0.06)*
Unemployed or other	0.49	(0.07)***
Urbanization (rural = ref.)	0.06	(0.03)*
Migration background (native = ref.)	0.02	(0.05)
Income	-0.87	(0.13)***
Co-residence with children (no = ref.)	-0.06	(0.03)
Number of children	-0.02	(0.02)
Number of grandchildren	-0.01	(0.01)*
Constant	0.21	(0.87)
N	30,896	
AIC	31,435.40	
BIC	31,610.50	
L2 Log-Likelihood	-15,696.70	

Notes: Significance level, * p<0.05, ** p<0.01, *** p<0.001.
These calculations use data from SHARE data Survey Release 8.0.0., waves 5 (2013) to 8 (2019).

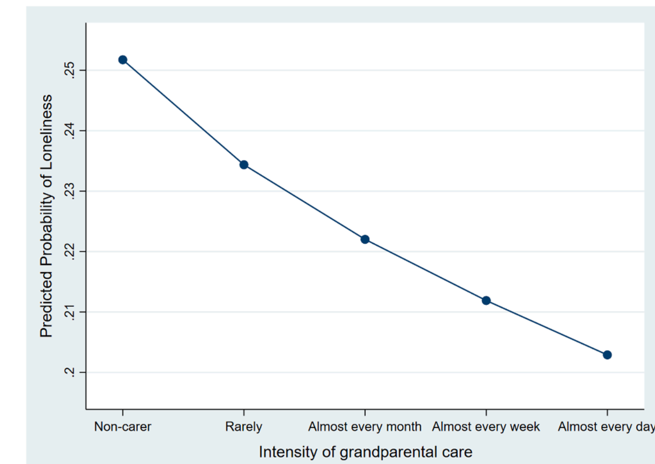

Fig. 2. Predicted probabilities of loneliness based on the intensity of grandparental care ($N_{individuals}$=30,896).

include learning new skills and establishing routines, which can be challenging (Hajek & König, 2021). In such cases, starting with caregiving may result in feeling overburdened, particularly when there is insufficient support, inadequate preparation, or a lack of recognition, and this transition may not be accompanied by the necessary resources and support.

In our study, the direction of change in caregiving did not seem to be as important as the intensity. Indeed, compared to stable roles, not

Table 2
Results of two-level logistic regression analysis focusing on changes in grandparental care: predicted log odds of loneliness ($N_{individuals}$ = 30,896 and $N_{observations}$ = 48,562).

Variables	Dependent variable = lonely	
	Log odds	Robust standard errors
Changes in grandparental care (ref. no change)		
Non-carers	0.46	(0.05)***
Decreased care	0.26	(0.05)***
Start non-intensive	0.43	(0.09)***
Start intensive	0.21	(0.10)*
Increased care	0.11	(0.09)
Control variables		
Age	-0.11	(0.03)***
Age squared	0.00	(0.00)***
Gender (men = ref.)	0.19	(0.04)***
Functional limitations (no limitations = ref.)	0.96	(0.04)***
Educational level (high education = ref)		
Low education	0.66	(0.06)***
Middle education	0.12	(0.06)
Marital status (widowed = ref.)		
Married	-1.21	(0.06)***
Single	-0.38	(0.07)***
Employment status (employed = ref.)		
Retired	0.21	(0.08)**
Unemployed or other	0.71	(0.09)***
Urbanization (rural = ref.)	0.08	(0.04)*
Migration background (native = ref.)	0.07	(0.07)
Income	-1.06	(0.10)***
Co-residence with children (no = ref.)	-0.12	(0.05)**
Number of children	-0.02	(0.02)
Number of grandchildren	-0.03	(0.01)**
Constant	1.34	(1.19)
Var(residual)	4.43	(0.20)***
N	48,562	
AIC	45,728.30	
BIC	45,930.50	
L2 Log-Likelihood	-22,841.10	

Notes: Significance level, * p<0.05, ** p<0.01, *** p<0.001.
These calculations use data from SHARE data Survey Release 8.0.0., waves 5 (2013) to 8 (2019).

providing care generally increased loneliness more significantly than changes in caregiving intensity (whether increased or decreased). Consequently, the intensity of caregiving, rather than the transition into or out of caregiving roles, may be the more critical factor in understanding its association with loneliness among grandparents.

4.1. Limitations and future research

Our analysis has limitations that should be acknowledged. Firstly, although our measure of loneliness is an established tool, it does not distinguish between emotional and social loneliness due to constraints in the available variables within the SHARE data. Emotional loneliness refers to the absence of intimate attachments, while social loneliness relates to the feeling of belonging to a broader group of friends and acquaintances (Weiss, 1973). This limitation is unfortunate, as grandparental caregiving may yield different consequences for these two types of loneliness. Therefore, future research could aim to incorporate this important distinction.

Another limitation of our study is that the SHARE data does not provide detailed information on the specific type of care performed by grandparents. For example, it does not capture the specific activities they engage in when caring for their grandchildren or the underlying reasons for their involvement (e.g., parental workload, family attachment, etc.). As mentioned by Hajek and König (2022), who used the same database and measure, obtaining such information would have been valuable to distinguish and better understand the role played by

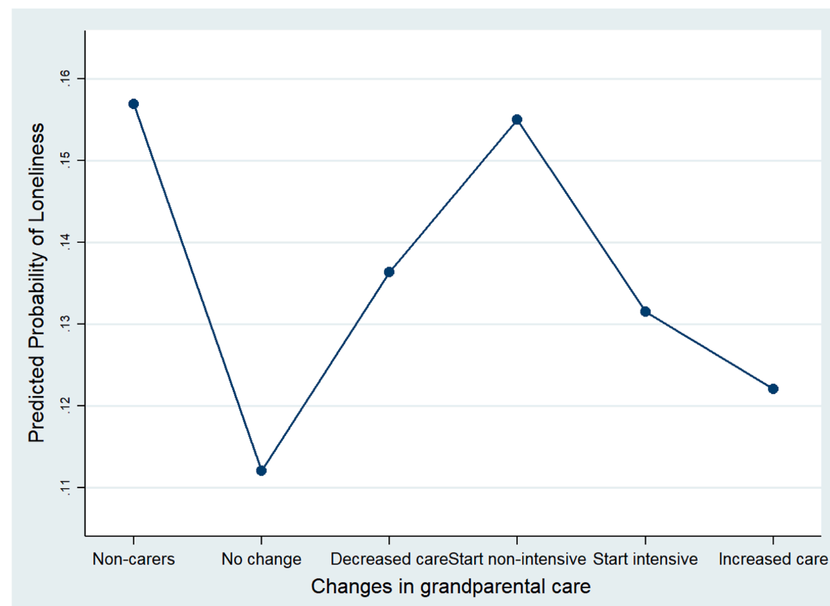

Fig. 3. Predicted probabilities of loneliness based on changes in grandparental care ($N_{individuals}$=30,896 and $N_{observations}$ = 48,562).

grandparents within the family and the burdens that come with engaging in multiple roles, as well as its connection to the type of loneliness in more detail.

Furthermore, once we divided the categories related to care intensification (start non-intensive/intensive and increased care), the number of observations for these specific categories became relatively small compared to other grandparental care transition intensity categories. We should therefore consider this limitation for analytical implications and the generalisability of our findings. In future research, a longer study period could help make the results more robust.

Lastly, although our research did not explore this aspect in detail due to our specific objectives, it is important to note that grandparental care might be differently experienced by men and women. A longitudinal study by Quirke et al. (2021) in Germany, for example, revealed that while caring for grandchildren may be perceived as an opportunity for leisure and recreational activities for some grandparents, for women, it may be seen as an additional burden of physical tasks associated with their ongoing role as mothers (Quirke et al., 2021). Given this, future research could prioritise conducting a detailed and in-depth examination of women's specific roles.

5. Conclusion

In sum, this study underscores that any intensity of grandparental care, even small and infrequent caregiving, decreases the risk of loneliness. As for change, while maintaining a stable caregiving role appeared to reduce loneliness, intensifying caregiving, particularly for grandparents newly engaging in caregiving, may lead to increased loneliness. The key finding is that the overall intensity of grandparental care matters more for loneliness than changes in caregiving intensity.

These findings have important implications for social policy and future research. Many grandparents show a genuine willingness to take on caregiving roles, regardless of the level of intensity, as this engagement benefits their social networks and emotional well-being. However, to reduce their vulnerability to loneliness, it is essential to promote stability in caregiving roles and provide adequate support for grandparents, particularly those who are new to caregiving. Ensuring they have access to necessary resources is crucial. Interventions could include respite care, mental health services, and community programmes aimed at strengthening support systems and alleviating the stress and loneliness associated with this transition.

In addition, future research could investigate the distinction between social and emotional loneliness and consider the specific types of caregiving activities undertaken. Also, the gendered aspects of grandparental caregiving merits further exploration. By focusing on these issues, policies and interventions can be better tailored to the unique challenges that grandparents encounter in their caregiving responsibilities. This approach would help improve their overall well-being and decrease their risk of experiencing loneliness.

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CRediT authorship contribution statement

Fernanda Juma: Writing – original draft, Data curation, Conceptualization, Methodology, Formal analysis, Writing – review & editing. **Ana Fernández-Sainz:** Methodology, Formal analysis, Supervision. **Toon Vercauteren:** Writing – review & editing. **Hannelore Stegen:** Writing – review & editing. **Freya Häussermann:** Writing – review & editing. **Liesbeth De Donder:** Conceptualization, Writing – review & editing, Supervision. **Katrijn Delaruelle:** Conceptualization, Methodology, Formal analysis, Writing – review & editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A

Table A.1
Descriptives of the sample for the intensity of grandparental care ($N_{individuals} = 30,896$).

Variables	Description	%	N
Loneliness	Feeling lonely	23.90	7,385
Intensity of grandparental care			
Non-carer	Grandparent did not provide care	56.35	17,411
Rarely	Grandparent provided care rarely	11.81	3,648
Almost every month	Grandparent provided care almost every month	10.19	3,149
Almost every week	Grandparent provided care almost every week	15.14	4,679
Almost every day	Grandparent provided care almost every day	6.50	2,009
Education level (based on UNESCO's 2011 International Standard Classification of Education (ISCED))			
Low education	Did not study, completed lower secondary or primary	42.08	13,001
Middle education	Completed upper secondary education or postsecondary	38.27	11,823
High education	Completed the short cycle tertiary, bachelor, master, or PhD	19.65	6,072
Marital status			
Married	Married	68.45	21,149
Single	Separated, divorced or single	10.56	3,264
Widowed	Widowed	20.98	6,483
Employment status			
Retired	Retired	77.43	23,922
Employed	Employed	10.34	3,196
Unemployment	Homemaker, disabled or other	12.23	3,778
Gender	Female	58.73	18,146
Functional limitations	Person experiences long-standing activity limitations	53.28	16,460
Urbanization	Lives in an urban area	55.11	17,028
Migrant	Migrant	8.48	2,621
Co-residence with children	Co-residence with children	23.31	7,201
		mean	**SD**
Age	Age of the grandparents in years	72.90	8.96
Income	Household net income per year/ 100,000	0.26	0.61
Number of children	Number of children	4.15	2.78
Number of grandchildren	Number of grandchildren	2.48	1.18

Notes: These calculations use data from SHARE data Survey Release 8.0.0., waves 5 (2013) to 8 (2019).

Table A.2
Descriptives of the sample for changes in grandparental care ($N_{individuals} = 30,896$, $N_{observations} = 48,562$).

Variables	Description	%	N
Loneliness	Feeling lonely	22.47	10,911
Changes in grandparental care			
Non-carer	Grandparent did not provide care in both waves	38.18	18,539
No change	Grandparent provided the same pattern of care in both waves	29.25	14,202
Decreased care	Grandparent has been a caregiver (non-intensive care or intensive care) and decreased the intensity of caring	19.91	9,667
Start non-intensive	Grandparent started providing non-intensive care (from no carer to non-intensive care).	4.66	2,263
Start intensive	Grandparent started providing intensive care (from no carer to intensive care).	3.47	1,687
Increased care	Grandparent increased the intensity of care (from non-intensive care to intensive care).	4.54	2,204
Education level (based on UNESCO's 2011 International Standard Classification of Education (ISCED))			
Low education	Did not study, completed lower secondary or primary	41.43	20,121
Middle education	Completed upper secondary education or postsecondary	38.01	18,458
High education	Completed the short cycle tertiary, bachelor, master, or PhD	20.56	9,983
Marital status			
Married	Married	69.48	33,741
Single	Separated, divorced or single	10.55	5,122

(*continued on next page*)

Table A.2 (*continued*)

Variables	Description	%	N
Widowed	Widowed	19.97	9,699
Employment status			
Retired	Retired	76.58	37,189
Employed	Employed	11.26	5,470
Unemployment	Homemaker, disabled or other	12.16	5,903
Gender	Female	59.18	28,740
Functional limitations	Person experiences long-standing activity limitations	50.89	24,712
Urbanization	Lives in an urban area	54.54	26,485
Migrant	Migrant	7.87	3,824
Co-residence with children	Co-residence with children	23.04	11,191
		mean	**SD**
Age	Age of the grandparents in years	72.19	8.69
Income	Household net income per year/ 100,000	0.27	0.51
Number of children	Number of children	2.50	1.17
Number of grandchildren	Number of grandchildren	4.14	2.76

Notes: These calculations use data from SHARE data Survey Release 8.0.0., waves 5 (2013) to 8 (2019).

Table A.3
Comparative analysis of focusing on changes in grandparental care: predicted log odds of loneliness ($N_{individuals}$=30,896 and $N_{observations}$=48,562).

Variables	Dependent variable = lonely	
	Log odds	Robust standard errors
Changes in grandparental care (ref. no change)		
Non-carers	0.44	(0.05)***
Decreased care	0.25	(0.05)***
Intensified care	0.26	(0.06)***
Control variables		
Age	-0.11	(0.03)***
Age squared	0.00	(0.00)***
Gender (men = ref.)	0.19	(0.04)***
Functional limitations (no limitations = ref.)	0.96	(0.04)***
Educational level (high education = ref.)		
Low education	0.66	(0.06)***
Middle education	0.12	(0.06)*
Marital status (widowed = ref.)		
Married	-1.22	(0.06)***
Single	-0.38	(0.07)***
Employment status (employed = ref.)		
Retired	0.21	(0.08)**
Unemployed or other	0.71	(0.09)***
Urbanization (rural = ref.)	0.08	(0.04)*
Migration background (native = ref.)	0.07	(0.07)
Income	-1.06	(0.10)***
Co-residence with children (no = ref.)	-0.12	(0.05)**
Number of children	-0.02	(0.02)
Number of grandchildren	-0.03	(0.01)**
Constant	1.33	(1.20)
Var(residual)	4.43	(0.20)***
N	48,562	
AIC	45,733	
BIC	45,917	
L2 Log-Likelihood	-22,845	

Notes: Significance level, * $p<0.05$, ** $p<0.01$, *** $p<0.001$.
These calculations use data from SHARE data Survey Release 8.0.0., waves 5 (2013) to 8 (2019).

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