



Association Between Social Isolation and Mental Well-Being in Later Life. What is the Role of Loneliness?

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Abstract

In this study, we evaluate whether the association between three types of social isolation (SI) and mental well-being (MWB) is mediated by loneliness. We include a pooled sample ($N=8,525$) of people aged 65 or older, participating in the 2016 European Quality of Life Survey (EQLS). MWB is assessed with the World Health Organization Well-Being Index (WHO-5), and SI is operationalised as living alone, having no or little contact with family members, or having no or little contact with friends and neighbours. We assess a full mediation model with loneliness as a mediator between each type of SI and MWB, which we compare with a partial mediation model and control for age, gender, urbanity, and subjective income. Estimates for the full mediation model indicate that each type of SI is associated with enhanced loneliness, which in turn is negatively associated with MWB. In addition, the total effect of each type of SI on MWB is negative, with the strongest negative path from living alone to MWB. However, when including the direct effects of each type of SI on MWB in the partial mediating model, the total effect of contact with family members on MWB loses statistical significance. The specific indirect effects of the three facets of SI on MWB remain significant and negative. These findings suggest that different aspects of SI have distinct relationships with MWB, and that absence of contact with family members influences MWB only if they activate the feeling of loneliness.

Keywords Social isolation · Loneliness · Mental well-being · Ageing · European Quality of Life Survey · Path analysis

Introduction

Social relations are inextricably linked to the health and well-being of individuals (Baranowska-Rataj & Abramowska-Kmon, 2019; Cornwell & Waite, 2009; Smith & Victor, 2019; Wojszel & Politynska, 2021). Urbanization and improved standard

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of living change filial expectations, older people looking more for emotional support than material and instrumental support (Ren et al., 2022; Wilson et al., 2019). But current demographic developments of smaller families and higher divorce rates which translate to lower familism (i.e. commitment an individual has to his or her family), raise concerns that people can become socially isolated and lonely (De Jong Gierveld & Dykstra, 2008), increasing the risk of developing health problems (Sorokin et al., 2002). Older people have an increased risk of becoming socially isolated due to losing connections by retirement, widowhood (Cheng et al., 2021), children moving out or family migration (Wilson et al., 2019), as well as to lower mobility, increasing health problems, or a mix of these factors (Tesch-Roemer & Huxhold, 2019). Social distancing measures during the recent COVID-19 pandemic have further increased the risk of social isolation (SI) and mental health problems for older people. As the estimated avoidable costs of mental health problems are very high (OECD/EU, 2018), even without the burden of the COVID-19 pandemic, it is important to understand how mental health can be linked to SI and loneliness to inform policies that stimulate mental health in an ageing population in the EU28 (European Commission. Statistical Office of the European Union, 2020). Estimations show that expenditure with mental health can be significantly reduced with just 10% decrease in loneliness (Rohde et al., 2016).

SI may influence health and well-being because low social engagement, lack of support provision, and lack of access to goods or services influences health behaviour and leads to physical and psychological responses such as depression (Berkman et al., 2000; Miceli et al., 2019; Salinas-Rodríguez et al., 2018; Walsh et al., 2017). Loneliness, has also a detrimental effect for health, contributing to biological ageing (Galkin et al., 2022), and increasing the odds for developing depression even after adjusting for other factors such as social support (Mann et al., 2022). However, the actual mechanism linking SI, loneliness, and mental well-being (MWB) is less studied although research shows that SI and loneliness are related with poor MWB, while loneliness is the subjective negative experience of SI. MWB of older people is lower when their networks are more restricted (i.e. low number of kin and peers and low contact with them) (Djundeva et al., 2019) and when the social network of older people changes in time from a close-family network type (i.e. spouse and/or children) to another network type (i.e. other family, friends or other) (Litwin et al., 2020). The effect of living alone for positive MWB, the type of MWB we are interested in this study, is inconclusive and still a novel field of research (Tamminen et al., 2019). Loneliness has negative effects for MWB, being the result of poor social integration (De Jong Gierveld & Dykstra, 2008; de Jong Gierveld & Tesch-Römer, 2012). Loneliness and SI are sometimes used interchangeably, which may be one of the reasons why we know little about the comparative associations of SI, loneliness, and MWB (Valtorta et al., 2016). However, scholars agree that SI and loneliness are different aspects of social relationships. SI is the objective absence of social connections (Weldrick & Grenier, 2018) (i.e. a situation in which people live alone, lack social contact and communication with family outside the household, friends, or neighbours), while loneliness is the subjective experience of the discrepancy between what people want and what people have regarding the quantity and quality of social relations (de Jong Gierveld & van Tilburg, 2016; de Jong

Gierveld et al., 2006; Newall & Menec, 2019; Perlman & Peplau, 1998). Therefore, by definition, loneliness is different from SI. While SI refers to the objective situation in which people have very little contact with other people, loneliness refers to the subjective feeling that the number or quality of social relations is lower than one would like to have. Loneliness is the result of an evaluation: if older people have fewer and unfulfilling social relations than desired, then it is highly likely that they will feel lonely. Scholars even distinguish between emotional and social loneliness (Weiss, 1973) and each type has its own antecedents. Emotional loneliness often occurs after bereavement, or due to lack of an attachment figure or confidant such as an intimate partner or close friend, while social loneliness is related to the lack of social integration for example by losing contacts through retirement or relocation or by not having adequate sources of social support (van Baarsen et al., 2001). SI may not necessarily have a negative impact on mental health if people prefer to have little contact with other people. Only if SI is unwanted, a situation visible through loneliness, will there be a negative association with mental health. Perceived SI or loneliness activates the signal of potential danger and increases attention to social threats contributing to higher rates of morbidity and mortality in older adults (Cacioppo et al., 2011). However, we should not overestimate the importance of loneliness in the detriment of SI, because both SI and loneliness predict mortality over years, with SI remaining a strong predictor after controlling for demographic, health, and mobility factors, while loneliness loses leverage, therefore emphasising the importance of SI beyond the psychological mediation mechanism by loneliness (Steptoe et al., 2013).

Objective isolation can be the starting point of a negative downward spiral, leading to a low level of MWB (Santini et al., 2020). The experience of pleasant emotions or positive MWB (i.e. sense of freshness, feeling energetic, calmness) (Kusier & Folker, 2019) can be impaired when people are not involved in relationships inside and outside their private sphere. According to World Health Organization (2022) mental health is an integral part of health and well-being. However, there is less quantification of the negative effects of SI for mental health in comparison with the negative effect of SI for physical health which was found to be similar to the effects of smoking several cigarettes a day (Holt-Lunstad et al., 2015; Leigh-Hunt et al., 2017; Pantell et al., 2013). Studies investigating the independent effects of SI or loneliness on MWB sometimes acknowledge the potential importance of loneliness but do not test its role as mediator. Others identify groups based on levels of SI (i.e. living alone, frequency of contact with children, family, or friends) and loneliness showing that older people from the most isolated and lonely group also have depressive symptoms (Smith & Victor, 2019). When studies take mediation into account, they often focus on specific groups. Given the sometimes-specific set of social institutional factors of these groups such as family structures, results may be only valid for them (Gundelach, 1994). For example, in a study among older Korean Americans it was observed that loneliness mediates the relationship between living alone and depressive symptoms, but this specific group highly values co-residence of older parents with adult children and their families, which may be less relevant in other groups (Park et al., 2017). By focusing on the general population, we may overcome this problem. Other scholars (Alpass & Neville, 2003; Cornwell & Waite,

2009; Coyle & Dugan, 2012) that consider mediation do not apply a robust analytical technique to examine potential pathways from SI to MWB, but instead compare changes in statistical significance and regression coefficients when entering new blocks of variables in the analysis (Alpass & Neville, 2003; Steptoe et al., 2013). Here, we propose an analytical approach that overcomes cultural and methodological limitations by estimating a path model in a structural equation framework, considering loneliness as a mediator between SI and MWB, and by using data from nationally representative samples. This allows us to estimate the independent effects of both variables and their combined effects. Although SI is often measured with scales or indices (Cornwell & Waite, 2009; Coyle & Dugan, 2012; Santini et al., 2020), being justified by the complexity of its content, this approach does not allow to see which types of SI are important and which not for MWB. We consider that different types of SI refer to distinct sociability spheres (Gallie et al., 2003), each having potentially different associations with loneliness and MWB. Therefore, we can think of different policy implications for improving MWB when we consider these distinct types of SI. The implication is that this can be addressed with intervention programmes, allowing different paths to address loneliness as an important precursor of MWB. Most studies equate MWB with depression or psychological distress, while positive MWB is a relatively new concept (Tamminen et al., 2019). We look at positive MWB, which can be thought of as a proactive approach for enhancing the quality of life of older people instead of being reactive after depression emerges. Because positive and negative affect can co-exist, it is important to understand this path as well.

In this study, we explore the association between three types of objective SI and MWB and examine the potential mediating role of loneliness. Specifically, we look at associations between MWB and different aspects of SI (i.e. living alone, contact with family outside the household, and contact with friends and neighbours), with loneliness as the intervening variable (see Fig. 1). We are interested in the separate

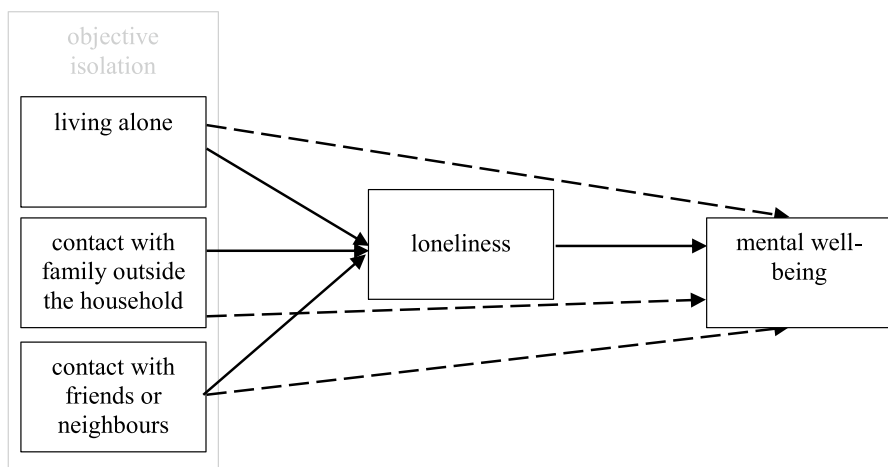


Fig. 1 Theoretical model of relationships between SI, loneliness, and MWB

relationships between these three types of SI, loneliness, and MWB, as showed in Fig. 1, we do not use a latent variable for SI as a “summarizing device” (Bollen, 1989), instead we include them as separate variables in the mediation model. Current evidence about associations between these types of SI and MWB, and the mediating role of loneliness in later life is rather mixed, and probably varies across people. There is little evidence of an association between living alone and positive MWB in old age, this being an understudied domain (Tamminen et al., 2019), while widowhood, which in older age conduces for many to living alone, has a negative relationship with subjective well-being directly and by lowering recreational involvement frequency (Cheng et al., 2021). We know that people living alone who also have restricted networks (i.e. low number of kin, non-kin members, and low contact) are more depressed than those living with others (Djundeva et al., 2019). Low face-to-face contact of older parents with their children increases depressive symptoms, but low phone or social media contact with other people increases depressive symptoms even more, probably because older people expect a higher frequency of online contact, which is easier to establish than face-to-face contact (Chiao et al., 2021). Older people living alone do not necessarily feel lonely or depressed, especially if they are in frequent contact with family or friends, but when loneliness sets in, depression becomes more likely, especially when they are not only living alone but are also isolated from family, friends, and the wider society (Lara et al., 2020; Smith & Victor, 2019). Living with adult children may be a protective factor but also a risk factor for loneliness if we disentangle it into emotional and social loneliness. Co-residence protects older parents from social loneliness which can settle when losing contact with peers and friends for example through retirement, but is less effective for emotional loneliness which manifest when losing confidants for example through bereavement or separation, or when older parents feel that they lose privacy, independence, or feel an imbalance in not being able to compensate for the effort put by their children into caregiving (Hagan et al., 2020). According to the theory of socio-emotional selectivity, emotional bond is essential for older people, therefore the contact should be an authentic engagement with love, caring, respect, reciprocity, rather than being pure instrumental and underlying the unidirectional help that adult children give to the old parent through shelter, food, healthcare (Ren et al., 2022). Living alone is not, in itself, associated with psychological distress but, at least in the short term, it is rather the transition to living alone from living with a partner that increases the risk of psychological distress, whereas a transition to living alone from living with at least one child improves mental health (Stone et al., 2013). Taking all these studies into account, we understand that living alone, contact with family, and contact with friends or neighbours can have direct relationships with MWB because they do not necessarily produce loneliness, and, in some scenarios, also indirect relationships with MWB through loneliness. Therefore, the partial mediation model (Fig. 1, all arrows) is plausible and must be formally tested.

Several individual characteristics should be considered when analysing the associations between SI, loneliness, and MWB. Women report more loneliness than men (Aartsen & Jylhä, 2011; Domènech-Abella et al., 2017; Dykstra, 2009; Golden et al., 2009; Hansen & Slagsvold, 2016), and women are more often depressed than men. In addition, associations between social relations and

MWB may be different across various age groups, with the oldest old (80+) deriving MWB more from feeling respected and appreciated rather than from giving and receiving support or being in contact with others as is the case with their younger counterparts (Donisi et al., 2021). The oldest old, especially those with low material resources who live in communities where the norm is to provide care for the older parent, have higher chances of being involved in family-dependent networks, to live in high proximity with children, to have low social involvement, therefore to have lower chances of being involved in locally integrated networks (Wojszel & Politynska, 2021). Older people with this configuration of their social relations are more exposed to loneliness and depression. The oldest-old, especially men, are more likely than young-old to suffer from psychological distress when losing friends support because friends at this age are even more important given their decreasing number through death, withdrawal due to low mobility, etc. (Matt & Dean, 1993). Friends and neighbours may have a positive influence on MWB by providing emotional support because they are in the same life cycle stage with specific needs, in contrast with the (younger) family, understanding the care needs better; on the other hand, being in contact with family may have a positive influence for MWB through instrumental support especially in collectivistic cultures where familism is valued (Yeung & Fung, 2007), otherwise loneliness can set in and MWB will suffer (Tian, 2016).

In Fig. 1 we visualize our theoretical model. We test whether the three types of SI have direct relationships with MWB or whether they are entirely mediated through loneliness. Assessing the direct relationships (the dashed arrows in Fig. 1) is justified by the fact that loneliness is just one of the sociopsychological mechanisms linking SI and MWB. Assuming only the validity of the full mediation model (the full arrows in Fig. 1), would ignore the agency of older people and even imply an ageist perspective if, for example, we ignore the potential benefits of living alone in terms of independence and possibility to live a full life after retirement, detachment from care for children and avoidance of social conflicts. Specifically, in line with the loneliness model (Hawkey & Cacioppo, 2010), we expect that people living alone will feel lonelier than those living with others; therefore, they will have a lower MWB (H1a). People with less frequent contact with family living outside the household (H1b), friends, or neighbours (H1c) also will feel lonelier than people with more frequent contact, and consequently, they will have a lower MWB. We also expect direct associations between living alone, frequency of contacts and MWB. Hence, we further hypothesise that people living alone have lower MWB than those living with others (H2a), although a positive relationship is also plausible. People with less frequent contact with family living outside the household (H2b) or friends and neighbours (H2c) have a lower MWB than those with more frequent contact. Finally, we expect to see negative total effects for each type of SI for MWB both in partial and full mediation models (H3), although their size may differ due to the possibility of the direct effects expected in H2.

Methods

Data

The data come from the fourth wave of the European Quality of Life Survey (EQLS) carried out by the European Foundation for the Improvement of Living and Working Conditions (2023) (from September 2016 to March 2017) in 28 Member States of the European Union and in five EU candidate countries (Albania, former Yugoslav Republic of Macedonia, Montenegro, Serbia and Turkey) (Eurofound, 2018). The EQLS aims to investigate quality of life for all persons aged 18 and over residents in the participating countries. The target sample size was 1000 except for Germany ($n = 1600$), France ($n = 1200$), Italy ($n = 2000$), United Kingdom ($n = 1300$), and Turkey ($n = 2000$). The questionnaire includes variables covering topics such as employment, material resources, housing, access to services, work-life balance, subjective well-being, and perceptions about quality of society. A stratified, clustered, multi-stage sample design was used for the selection of the respondents. The pooled sample of EQLS is 36,908 cases. In this study we focus on people aged 65 years or older from the 28 EU countries. The unweighted sample size available for the analysis is 8,525 cases, providing sufficient statistical power to test mediation relationships (MacKinnon et al., 2007). When estimating the path models, missing values were treated listwise, therefore the mediation model used the cases with valid values for all variables in the model (cases with complete response).

Measures

Our dependent variable is MWB. We assess this with the World Health Organization Well-Being Index (WHO-5 scale) (Bech et al., 2003) that focuses on positive emotions (Kusier & Folker, 2019). The scale includes five items: 1. "I have felt cheerful and in good spirits", 2. "I have felt calm and relaxed", 3. "I have felt active and vigorous", 4. "I woke up feeling fresh and rested", and 5. "My daily life has been filled with things that interest me". Respondents were asked to rate how well each of the five statements applies to them when taking into consideration the past two weeks. Items are scored from 1 (all the time) to 6 (at no time). We reversed the response scale for each item so that 0 represents at no time and 5 all the time. We summed the reversed indicators to obtain an index of MWB with a minimum value of 0 (the worst MWB captured by this scale) and a maximum value of 25 (the best MWB). We include in the index variable only respondents with complete responses for all five indicators (missing values are treated listwise). This scale has been proven to have good validity in clinical studies and can be used across different study domains to assess subjective well-being (Topp et al., 2015). Cronbach's alpha in our study sample is 0.90, while the exclusion of each indicator from the scale reduces the coefficient, a sign of strong relationships between items.

We measure objective SI with three indicators: living alone, frequency of contact with family outside the household, and frequency of contact with friends or neighbours. In the dataset, we have a variable showing the household structure with five

values: 1. single, 2. couple, 3. single with children, 4. couple with children, and 5. other. We make a dummy variable where the value 1 reflects living alone and the values from 2 to 5 become 0, reflecting other situations. For frequency of contact, we create two index variables. In the questionnaire, people were asked to report on average how often they had direct face-to-face contact or by phone, Internet, or by post with any family members or relatives living outside the household or with any friends or neighbours. The response scale was similar for all four indicators: 1. every day or almost every day, 2. at least once a week, 3. one to three times a month, 4. less often, and 4. never. We compute two summative index variables: one for frequency of contact with family and one for friends or neighbours. We include in the index variables only respondents with complete responses for all four indicators (missing values are treated listwise). The minimum value for both is 1, representing the highest frequency of contact, and the maximum value is 5, representing no contact.

Our mediator is loneliness, which was measured by asking whether people felt lonely in the last two weeks before the survey. Answering categories ranged from 1 (all the time) to 6 (at no time). We reversed the response scale such that 0 represents at no time and 5 all the time; therefore, a higher score represents more loneliness.

We control for sex, age, living in a rural locality, and subjective income. Sex is a dummy variable, with 1 for women and 0 for men. Age is a continuous variable with values between 65 and 95. The dataset provider truncated the maximum value. Residence is a dummy variable, with 1 rural and 0 urban locality provided by the dataset. We use subjective income to account for material resources, as the two objective indicators available have many missing values (17% and 33%). For subjective income, respondents had to assess the difficulty of their household in making ends meet with their household's total monthly income, using a response scale with six values: 1. very easily, 2. easily, 3. fairly easily, 4. with some difficulty, 5. with difficulty, and 6. with great difficulty. We reversed the response scale so that 1 is with great difficulty and 6 very easily, therefore, a higher score shows a better standard of living.

Analytical Strategy

Figure 1 presents the theoretical model which, in the path analysis approach, is a partial mediation model (the solid and dotted lines in Fig. 1) because we assume the plausibility of both direct relationships between the three predictors and the outcome, but also for the intervening role of loneliness between types of SI and MWB. The full mediation model (the solid lines in Fig. 1) assumes that people living alone and with low frequency of contacts will always feel lonely and loneliness reduces MWB. If the partial mediation model is plausible than we will see statistically significant relationships between aspects of SI with MWB, otherwise we will prove that loneliness is the sole negative affect of SI. Due to the fact that our sample is large and even small effects can appear by chance, testing both models will work also as a robustness check. We use Mplus 8.6 to test these models.

The mediator, loneliness, has a censored from below distribution (53% of the responses are on value 0, 22% on value 1, 9% on value 2, 6% on value 3, 7% on value 4, and 3% on value 5), and we take this property into account when estimating

the models. We base our interpretation of the results on the bootstrap confidence intervals for path coefficients, as they address several issues related to standard significance testing such as the assumption that the sampling distribution of the indirect effect term is normal, which is difficult to demonstrate, and has lower power and is less accurate (Hayes, 2018; MacKinnon et al., 2007). We use 10,000 bootstrap samples (Hayes, 2009, 2018). Because we used the bootstrap approach in testing mediation, we do not have global fit indices. As a rule, if the 95% bootstrap confidence intervals contain the value zero, then the predictor has no effect on MWB. According to Eurofound (2018) guidelines, we weight the data with the variable suitable for country level, within-country analysis, and EU28 averages. We use a robust weighted least squares estimator (WLSMV) (Muthén & Muthén, 2017).

Results

The descriptive statistics for the variables included in our study are presented in Table 1 for the unweighted and weighted data. The following results were obtained from the weighted sample: Table 2 presents the correlations between the variables in the model, and Table 3 presents the point estimates and 95% bootstrap confidence intervals for the path coefficients. The sample mean of MWB is 15.4, 45% of the people 65 years or older have a value equal or lower with 15, while 27% have values under the cut-off for screening clinical depression (Topp et al., 2015). One-third of the sample lives alone, with the frequency of contact with family living outside the household, friends, or neighbours being rather high. Only 1% are never in contact with either of them, while 66% have face-to-face, phone, Internet, or post contact at least once a week with family and 59% with friends or neighbours. Half of the older people never felt lonely in the two weeks before the survey (53%), while 16% felt lonely more than half of the time, most of the time, or all the time. Slightly more than half are women (57%) and live in a rural locality (58%). On average, this age group can make ends meet fairly easily with their available income.

Table 1 Descriptive statistics for the study variables

The sample ($n = 8323$) is: Descriptive statistics are:	Unweighted		Weighted	
	Mean	SD	Mean	SD
Mental well-being (0–25, worse to best)	15.2	5.7	15.4	5.5
Loneliness (0–5, at no time–all of the time)	1.5	1.5	1.0	1.4
Proportion of people living alone	44.0		33.4	
Frequency of contact with family outside household (1–5, every day to never)	2.0	0.9	2.0	0.9
Frequency of contact with friends or neighbours (1–5, every day to never)	2.2	0.9	2.2	0.9
Proportion of women	58.0		57.1	
Age in years (65–95)	73.7	6.6	73.9	6.5
Proportion of people living in rural area	55.0		58.2	
Subjective income (1–6, with great difficulty to very easily)	3.7	1.4	3.9	1.3

Table 2 Correlations between variables in the models (Pearson product correlation for metric variables, Pearson point biserial correlation for metric and dichotomous variables, Phi coefficient for dichotomous variables)

	0	1	2	3	4	5	6	7	8
0	1								
1	-0.42**	1							
2	-0.09**	0.32**	1						
3	-0.09**	0.16**	0.06**	1					
4	-0.16**	0.15**	0.02	0.39**	1				
5	-0.09**	0.11**	0.22**	-0.08**	-0.01	1			
6	-0.13**	0.15**	0.21**	0.03**	0.09**	0.09**	1		
7	-0.05**	0.00	-0.07**	-0.03*	0.03*	0	-0.02	1	
8	0.39**	-0.34**	-0.05**	-0.04*	-0.09**	-0.1**	0	0	1

**Correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level

Missing values are treated listwise. Weighted n for all except with woman is 7.029. Weighted n for correlation with woman is 7.248

Table 3 Bootstrap confidence intervals for path coefficients in the partial and fully mediated model. Unstandardised and standardised (STDY) estimates

95% CI	Partial mediation						Full mediation					
	unstandardised			standardised			unstandardised			standardised		
	B	LL	UL	BETA	LL	UL	B	LL	UL	BETA	LL	UL
mental well-being (0–25, worse to best) on:												
Direct effects												
lonely (0–5, at no time to all of the time)	-0.78**	-0.88	-0.70	-0.33**	-0.36	-0.29	-0.74**	-0.83	-0.66	-0.31**	-0.35	-0.28
lives alone (0/1, no/yes)	0.69**	0.29	1.09	0.12**	0.05	0.20	@0	@0	@0	@0	@0	@0
contact with family outside household (1–5, every day to never)	0.07	-0.17	0.31	0.01	-0.03	0.06	@0	@0	@0	@0	@0	@0
contact with friends or neighbours (1–5, every day to never)	-0.54**	-0.77	-0.31	-0.10**	-0.14	-0.06	@0	@0	@0	@0	@0	@0
woman (0/1, no/yes)	-0.45*	-0.85	-0.06	-0.08*	-0.15	-0.01	-0.45*	-0.85	-0.06	-0.08*	-0.15	-0.01
age (65–95)	-0.09**	-0.12	-0.06	-0.02**	-0.02	-0.01	-0.09**	-0.12	-0.06	-0.01**	-0.02	-0.01
rural (0/1, no/yes)	-0.64**	-1.02	-0.24	-0.12**	-0.18	-0.04	-0.63**	-1.02	-0.24	-0.12**	-0.19	-0.04
subjective income (1–6, with great difficulty to very easily)	1.58**	1.44	1.71	0.29**	0.26	0.31	1.57**	1.44	1.71	0.29**	0.27	0.31
Specific indirect effects												
lonely on lives alone	-1.20**	-1.41	-1.00	-0.22**	-0.26	-0.18	-1.05**	-1.24	-0.87	-0.19**	-0.23	-0.16
lonely on contact with family outside household	-0.25**	-0.35	-0.16	-0.05**	-0.06	-0.03	-0.23**	-0.32	-0.14	-0.04**	-0.06	-0.03
lonely on contact with friends or neighbours	-0.10*	-0.20	-0.01	-0.02*	-0.04	-0.001	-0.17**	-0.27	-0.07	-0.03**	-0.05	-0.01
Total effects												
lives alone (0/1, no/yes)	-0.51*	-0.90	-0.11	-0.09*	-0.16	-0.02	-1.05**	-1.24	-0.87	-0.19**	-0.23	-0.16
contact with family outside household (1–5, every day to never)	-0.18	-0.43	0.07	-0.03	-0.08	0.01	-0.23**	-0.32	-0.14	-0.04**	-0.06	-0.03
contact with friends or neighbours (1–5, every day to never)	-0.64**	-0.89	-0.40	-0.12**	-0.16	-0.07	-0.17**	-0.27	-0.07	-0.03**	-0.05	-0.01
Lonely (0–5, at no time to all of the time) on:												
lives alone (0/1, no/yes)	1.53**	1.32	1.72	0.67**	0.59	0.75	1.42**	1.20	1.62	0.62**	0.53	0.70
contact with family outside household (1–5, every day to never)	0.32**	0.20	0.44	0.14**	0.09	0.19	0.31**	0.19	0.43	0.14**	0.08	0.19
contact with friends or neighbours (1–5, every day to never)	0.13*	0.01	0.25	0.05*	0.004	0.11	0.22**	0.10	0.35	0.10**	0.04	0.15

Table 3 (continued)

95% CI	Partial mediation				Full mediation			
	unstandardised		standardised		unstandardised		standardised	
	B	LL UL	BETA	LL UL	B	LL UL	BETA	LL UL
mental well-being (0–25, worse to best) on:								
R-squared:								
mental well-being (0–25, worse to best)		0.289				0.275		
lonely (0–5, at no time to all of the time)		0.127				0.119		

The results of the path analysis, that is point estimates and bootstrap confidence intervals for path coefficients, are presented in Table 3. Some intervals have one limit very close to zero; for example, the upper 2.5% limit for the specific indirect effect for MWB of contact with friends or neighbours through loneliness, which is -0.01. Therefore, we should interpret them carefully, especially regarding their relevance in substantive terms (Wasserstein et al., 2019). When comparing models in text, we report unstandardised path estimates, while in Table 3 we also report standardised path estimates (STDY) when describing effects on the dependent variable within one model, as an effect is “interpreted as the change in y in y standard deviation units for a standard deviation change in x which is appropriate for binary covariates” (Muthén & Muthén, 2017, pp. 799–800).

Estimates for the full mediation model suggest that living alone ($B=1.42$, 95% CI=[1.20; 1.62]), fewer contact with family members outside the household ($B=0.31$, 95% CI=[0.19; 0.43]), and fewer contact with friends and neighbours ($B=0.22$, 95% CI=[0.10; 0.35]) are associated with higher levels of loneliness, and higher levels of loneliness are related to lower levels of MWB ($B=-0.74$, 95% CI=[-0.83; -0.66]). The total effects of the three types of SI on MWB are negative and significant, $B=-1.05$, 95% CI=[-1.24; -0.87] for living alone, $B=-0.23$, 95% CI=[-0.32; -0.14] for frequency of contact with family outside the household, and $B=-0.17$, 95% CI=[-0.27; -0.07] for frequency of contact with friends or neighbours, indicating that each type of SI is associated with MWB through enhanced levels of loneliness. We also test a partial mediation model to understand whether this link is unique or, future research, should take into consideration additional links. In the partial mediation model, similar associations between each type of SI and loneliness and between loneliness and MWB can be observed: living alone ($B=1.53$, 95% CI=[1.32; 1.72]), fewer contact with family members outside the household ($B=0.32$, 95% CI=[0.20; 0.44]), and fewer contacts with friends and neighbours ($B=0.13$, 95% CI=[0.01; 0.25]) are associated with higher levels of loneliness, and higher levels of loneliness are related to lower levels of MWB ($B=-0.78$, 95% CI=[-0.88; -0.70]). However, there are also significant direct effects of two types of SI on MWB, resulting in different total effects for MWB. We see a positive direct effect of living alone for MWB ($B=0.69$, 95% CI=[0.29; 1.09]), a statistically nonsignificant direct effect of frequency of contact with family outside the household ($B=0.07$, 95% CI=[-0.18; 0.31]), and a negative direct effect of frequency of contact with friends or neighbours ($B=-0.54$, 95% CI=[-0.77; -0.31]). Therefore, we obtain a negative total effect of living alone for MWB ($B=-0.51$, 95% CI=[-0.90; -0.11]), a statistically nonsignificant total effect of frequency of family outside the household ($B=-0.18$, 95% CI=[-0.43; 0.07]), and a negative total effect of frequency of contact with friends or neighbours ($B=-0.64$, 95% CI=[-0.89; -0.40]). As we mentioned, if each type of SI would link with MWB only through loneliness, then no statistically significant direct effects would appear. This is the case only for frequency of contact with family outside the household. The positive direct effect of living alone for MWB attenuates the negative effect of loneliness for MWB, therefore we see a lower point estimate for the total effect for living alone (direct plus indirect effect) ($B=-0.51$, 95% CI=[-0.90; -0.11]) than in the full mediation model ($B=-1.05$, 95% CI=[-1.24; -0.87]) and barely overlapping 95% CI. The

statistically nonsignificant direct effect of contact with family members ($B=0.07$, 95% CI=[-0.17; 0.31]) leads to an overall non-significant association with MWB ($B=-0.18$, 95% CI=[-0.43; 0.07]) in the partial mediation model in contrast with the statistically negative total effect seen in the full mediation model ($B=-0.23$, 95% CI=[-0.32; -0.14]). However, the negative direct effect of frequency of contact with friends and neighbours on MWB ($B=-0.54$, 95% CI=[-0.77; -0.31]) amplifies the total effect on MWB ($B=-0.64$, 95% CI=[-0.89; -0.40]) in the partial mediation model instead of $B=-0.17$, 95% CI=[-0.27; -0.07] in the full mediation model).

Therefore, the relationships between loneliness, SI, and MWB are not similar in these models making evident a more nuanced view of their effects for MWB and for loneliness as the sole sociopsychological link between them.

These associations lend partial empirical support for H1 and H2. According to H1a-H1c, we expected to see negative direct effects of each type of SI for loneliness and a negative direct effect of loneliness for MWB resulting in negative specific indirect effects. All three indirect paths are statistically significant and in the expected direction, although the path from contact with friends or neighbours through loneliness has the upper limit of 95% bootstrap confidence intervals very close to zero in the partial mediation model (-0.01). According to H2a-H2c, we expected to see negative direct associations between each type of SI and MWB, making plausible other links between them and MWB than exclusively through loneliness. The direct effect of living alone is statistically significant, but the relationship is positive, while a negative path was expected. On average, people 65 years or older living alone have a better MWB than those living in a different household arrangement. This happens even when ruling out direct effects of frequency of contact with family outside the household, frequency of contacts with friends or neighbours and of confounders such as being a woman, age, residence, or material resources, or the intervening role of loneliness. The direct effect of contact with family living outside the household is statistically non-significant, making plausible the full mediation link through loneliness. According to H3 we expected statistically significant negative total effects in both partial and full mediation models. Our results offer partial support for this hypothesis. If we take two people 65 years or older with the same frequency of contact with kin or friends and same values on the confounders, the person living alone will have on average better MWB than the person living in a different household arrangement, but because living alone favours loneliness the total effect for MWB of this type of association is negative. So, if the older person living alone feels lonely, then this person's MWB will be lower, but because the path coefficient is lower in the partial mediation model than in the full mediation, where we ignore the direct link between living alone and MWB, it is plausible to say that for older people living alone there are other mechanism regulating MWB beside loneliness. The total effect of frequency of contact with family outside the household is not statistically significant in the partial mediation model and statistically significant in the full mediation model, while the total effect of frequency of contact with friends or neighbours is negative and larger in the partial mediation model than in the full mediation model. As we mentioned for H2b, the absence of family is fully linked with MWB through loneliness while the absence of friends and neighbours is not. All control variables are associated with MWB. Being a woman, becoming older, and living in a rural

locality are disadvantages for MWB, while being able to satisfy needs with current income is an advantage.

Discussion

In this study, we set out to understand the association between three types of SI (i.e. living alone, frequency of contact with family living outside the household, frequency of contact with friends and neighbours) and MWB in people aged 65 and over living in the EU and the intervening role of loneliness between them in later life. We tested two models to investigate whether the relationship between each type of SI and MWB is fully mediated through loneliness or not. In the full mediation model, associations between SI and MWB are restricted to running through loneliness only. This model suggests that all three aspects of SI are negatively associated with MWB through loneliness. If loneliness would be the sole link between each type of SI and MWB than we should not see statistically significant direct associations between each type of SI and MWB. Our results show that contact with family outside the household is not directly associated with MWB, while living alone and contact with friends or neighbours are. Older people living alone have a higher level of MWB, while MWB is decreasing when frequency of contact with friends or neighbours decreases. While the total effect of living alone is rather similar in the partial and full mediation model because the lower limits of the 95% bootstrap CIs overlaps (-0.90 versus -0.87), the total effect of frequency of contact with friends or neighbours is stronger in the partial mediation model. Therefore, the results highlight the important role that different facets of SI play in the MWB of older people, as neither one can substitute for the others. In conclusion, we adopt the partial mediation model as the starting point for further studies. Frequency of contact with friends or neighbours is not a precise measure for social capital because it does not differentiate between superficial contacts and close relationships, but this ambiguity opens possibilities for future studies such as the intervening role of the feeling of belonging; being in contact with similar others, even superficial contact, creates 'public familiarity' – being recognized and developing a level of acquaintance, which creates a 'comfort zone' of familiarity and predictability (Blokland & Nast, 2014) in contrast with the unsafety feeling and vigilance experienced by lonely people (Hawkey & Cacioppo, 2010), therefore having higher changes to increase their MWB. Our findings, which is the importance of contact with friends for MWB and the statistically nonsignificant association of MWB with frequency of contact with family outside the household, is in line with previous studies showing that friendships may be more important than family relations for MWB (Fiori et al., 2006). The statistically nonsignificant effect of frequency of contact with family living outside the household suggests the need to also account, maybe as an intervening variable, for the quality of relationships from both parties: what parents, children, or other relatives put into the relationship. Filial piety (i.e. support from children, respect) and generativity (i.e. the opportunity given to older parents to take care of their adult children) are important in alleviation of loneliness, although they can be detrimental because to avoid burdening their children, older parents may suppress genuine needs

while developing an attitude of self-abnegation (Ren et al., 2022) which we believe can take a toll for MWB. Each relationship has distinct benefits for physical and MWB, and there are many mediational mechanisms that researchers should test (e.g. sense of mattering, self-esteem, mastery, belonging) (Thoits, 2011). Although both family and friends can provide material and emotional support, their provision takes specific and complementary forms. Friends have similar experiences of life and face similar problems on a day-to-day basis. Therefore, friends may be better confidants than family, and this helps to reach MWB faster while surpassing loneliness on the way. Moreover, friends and neighbours can contribute to a sense of collective belonging, and when someone feels left outside of this belonging, MWB can be affected. While presence of friends can have positive impact even when it is sporadic and superficial, family support is 'mandatory', therefore loneliness can instantly be felt in its absence making it the most plausible sociopsychological mechanism antecedent to MWB.

While there is no consensus in the literature on how living alone affects MWB (Djundeva et al., 2019; Tamminen et al., 2019), our results contribute to the line of thinking underlying that living alone can have benefits for MWB (Hughes & Gove, 1981). This is in contrast with the bivariate relationship (see Table 2), which shows that older people living alone experience a lower frequency of positive emotions. When controlling for the other predictors in our model, we see that the bivariate relationship is misleading. Our results support the positive effect of independence in old age, which has received increased attention recently, even though independence is still a concept under scrutiny in scientific and policy research (Plath, 2009).

Our study has some limitations. We use cross-sectional data; therefore, we cannot say that we show a causal relationship, but we can speak in terms of associations (Jose, 2019; Mueller & Hancock, 2019). The reader should interpret our results as a highly plausible link between SI > Loneliness > MWB. Robust analytics done on longitudinal data indicate that loneliness precedes distress and mental health, while retirement and other aging related events (e.g., death of family members and peers, decreasing mobility) are highly likely causes of loneliness (Petersen et al., 2016; Rohde et al., 2016), and comes after social disconnectedness (Santini et al., 2020), which gives us confidence in postulating this direction of the relationship in our theoretical model. Because of data availability, we use the direct single-item approach for measuring loneliness (i.e. the measurement explicitly uses the word *lonely*). The single-indicator measure has good face validity (i.e. people know what loneliness is; therefore, they will not confound it with other negative feelings) (de Jong Gierveld & Tilburg, 1999; Jylhä & Saarenheimo, 2010; Victor et al., 2005) and captures differences in desired levels of interpersonal contact (Rohde et al., 2016). Also, empirical data show that at least for the loneliest people the single item works well, and it is even better when the response scale uses absolute frequencies, as is our case, not relative frequencies responses (e.g. always lonely, often lonely, sometimes lonely, never lonely) (Rapolienė & Aartsen, 2021; Victor et al., 2005) making them robust and feasible in research contexts that do not relate with clinical practice where the full complexity of the concept must be captured (Mund et al., 2022). However, it is difficult to assume that a single-item measure can tackle the complexity of this

theoretical concept and does not allow differentiation between types of loneliness, such as emotional, social, or existential loneliness, which may have a different aetiology (van Tilburg, 2021). Also, a single-item measure can underestimate the number of people feeling lonely because of its undesirability, although older adults are less affected by the stigmatising nature of the concept. Because the response scale anchors people in the last two weeks, this single indicator can reflect transient rather than chronic loneliness (Shiovitz-Ezra & Ayalon, 2012). However, this possibility, which is also valid for the WHO-5 scale that captures positive affect within a short period (Kusier & Folker, 2019), can be a strong case for using cross-sectional data instead of longitudinal data that ask for more stable traits, such as satisfaction with life, which exhibit variation when external life circumstances change significantly (Cummins, 2003). In younger samples, with a mean age around 26–30 years, single-item measures of loneliness have proved reliable and trustworthy measures (Mund et al., 2022). However, they have a lower correlation with network characteristics and do not correlate with the frequency of contact with friends compared with multi-item measures. Our results show an increase in loneliness when the frequency of contact with friends or neighbours decreases, although the lower limit of the CI is very close to zero. Future studies should test the model, also using a multi-item measure, or extend the model to estimate the difference between different types of loneliness.

Despite the limitations described above, our results suggest that older people need interactions outside the limited boundaries of their families and households. This is an important finding in the COVID-19 context when social health receives less attention than physical health (Gjerde, 2021): although it is understandable why lockdowns and physical distancing policies are enforced in the long run, their unequal toll (Kuhn et al., 2021) on mental health (Hansen et al., 2021; Shen & Bartram, 2021) and social solidarity (Voicu et al., 2021) can be important. At the same time, these findings are important for interventions that aim to build stronger ties among ageing persons within neighbourhoods and communities to address loneliness and MWB. We may design these interventions from a positive psychology perspective (Linley & Joseph, 2004; Seligman, 2002; Snyder & Lopez 2002), given that the measure we used for MWB, the WHO-5 scale, is focused on positive emotions. Moreover, policy measures could focus on different integrated aspects of supporting sociability and social connectedness amongst ageing persons. Urban planners and community developers could address how neighbourhoods and close areas around seniors evolve as to secure needs of social interactions and participation in late life outside households (like ageing in place measures that focus on age-friendly public places or securing safe interactions for intergenerational encounters). This can be especially important in rapidly gentrifying areas where age-based segregation could develop and where old-age persons feel disconnected in a new and non-inclusive environment, especially for those who are financially excluded and for whom relocation is not an option. Policy measures should target not only old age persons who lack family or support from family (the “obviously lonely”), but also those who show signs of disconnection and lack of participation in their interaction with their neighbours and the nearby environment and community.

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Declarations

Competing Interests The authors have no competing interests to declare that are relevant to the content of this article.

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