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Social Network Size and Virtual Social Network Use in Relation to Social, Emotional, and Overall Loneliness Among Community-Dwelling Older Adults: A Cross-Sectional Study

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Abstract:

Background

Loneliness is one of the major psychosocial challenges of later life and is associated with adverse physical and mental health outcomes. Although both real-life social networks and virtual social networks may influence loneliness, their relative contributions to different dimensions of loneliness remain unclear. This study investigated the relationships between loneliness, social network size, and social media use among community-dwelling older adults.

Methods

This cross-sectional study was conducted among 147 older adults attending day-care centers and Welfare Organization–affiliated centers in Bonab and Maragheh, Iran. Participants completed the De Jong Gierveld Loneliness Scale, the Lubben Social Network Scale-6 (LSNS-6), and the Social Media Use Questionnaire. Pearson and Kendall correlation analyses were used to examine bivariate associations. Multiple and simple linear regression analyses were performed to compare the relative contributions of social network size and social media use to social loneliness, emotional loneliness, and total loneliness. Demographic factors associated with social media use were also examined.

Results

Participants reported relatively high levels of loneliness despite having moderate social network size and moderate social media use. Social network size was inversely correlated with social loneliness ($r = -0.52$, $p < 0.001$) and total loneliness ($r = -0.42$, $p < 0.001$), but not with emotional

loneliness ($p = 0.238$). Social media use was inversely associated with emotional loneliness ($\rho = -0.20$, $p = 0.017$), whereas its association with social loneliness was weaker ($\rho = -0.17$, $p = 0.036$) and it was not significantly correlated with total loneliness ($p = 0.467$). Regression analyses demonstrated that social network size was the strongest predictor of social loneliness ($B = -0.15$, $p < 0.001$) and total loneliness ($B = -0.12$, $p < 0.001$), explaining 27% and 20% of the variance, respectively. In contrast, social media use independently predicted emotional loneliness ($B = -0.04$, $p = 0.037$) but showed a considerably smaller contribution to overall loneliness. Younger age, higher educational attainment, higher income, and greater diversity of social media platforms were associated with higher levels of social media use.

Conclusions

Real-life and virtual social networks appear to influence different dimensions of loneliness in older adults. Expanding real-life social networks may be particularly effective in reducing social and overall loneliness, whereas social media use may primarily support emotionally meaningful relationships and help alleviate emotional loneliness. These findings suggest that digital communication should complement, rather than replace, face-to-face social relationships in interventions designed to reduce loneliness among older adults.

Keywords: Older adults; Loneliness; Social network; Social media; Emotional loneliness; Social loneliness.

1. Introduction

In recent decades, increases in life expectancy and improvements in health indicators have led to a substantial growth in the older adult population worldwide. In Iran, population aging has become one of the most significant demographic challenges. Current data indicate that approximately 14% of the country's population consists of older adults, and this proportion is expected to increase in the coming years (Larijani and Moslehi 2022). Globally, the number of older adults is also rising rapidly, with projections suggesting that the world's elderly population will reach nearly 1.5 billion by 2050 (Navaneetham and Arunachalam 2023). This demographic transition highlights the growing need to address the psychological and social dimensions of aging.

One of the major concerns in later life is loneliness, a subjective and distressing experience that occurs when an individual's actual social relationships do not meet their desired or expected level of social connection (Schmitz, Mauritz et al. 2021). Weiss conceptualized loneliness as comprising two distinct dimensions: emotional loneliness, which results from the absence of a close and intimate relationship, and social loneliness, which arises from a lack of a broader social network and sense of social belonging (Weiss 1975). Among older adults, loneliness has been associated with numerous negative outcomes, including depression, anxiety, sleep disturbances, reduced quality of life, and poorer overall health (Sheikholeslami, Reza Masouleh et al. 2011, Bincy,

Logaraj et al. 2022). Empirical studies also indicate that loneliness is relatively prevalent among older populations, with a considerable proportion of older adults across different cultures and age groups reporting varying degrees of loneliness (Surkalim, Luo et al. 2022).

Alongside this issue, real-life social networks play an important role in the mental health and well-being of older adults. A social network refers to the set of relationships and interactions an individual maintains with family members, friends, and other meaningful social contacts, which may provide emotional, informational, and instrumental support (Fu, Anderson et al. 2007, Marin and Wellman 2011). Theoretical perspectives suggest that individuals with broader and more functional social networks are less likely to experience loneliness (Machielse 2006, Kemperman, van den Berg et al. 2019).

At the same time, the rapid expansion of communication technologies and the increasing use of online social networking platforms have created new forms of social interaction for older adults (Leist 2013). These platforms enable individuals to communicate with others without temporal or spatial limitations (Ellison and Boyd 2013). Castells considers social networks to be a form of social media that enables new ways of communication and content sharing on the Intern (Castells and Kumar 2014). According to the uses and gratifications theory, individuals actively use media and social networking platforms to satisfy various needs, including social, informational, and emotional needs (Whiting and Williams 2013). For older adults, engagement with online social networks may partially compensate for limitations in face-to-face interactions and help maintain social connections. However, research findings regarding the effects of social media use on loneliness among older adults remain inconsistent (Vošner, Bobek et al. 2016, Pakkhesal, Seyfollahi et al. 2020, Jin and Kim 2025).

Despite the growing importance of this topic, most previous studies have focused either on real social networks or on the use of online media, and relatively few have simultaneously examined the role of these two factors in relation to different dimensions of loneliness in older adults (Wang, Chen et al. 2024). Moreover, loneliness has often been assessed as a single overall construct, with less attention given to the distinction between emotional and social loneliness (Simons, Reijnders et al. 2023). Therefore, the present study was conducted to examine the relationship between loneliness, the size of real social networks, and the use of online social networks among older adults.

2. Materials and Methods

2.1. Study Design and Setting

This cross-sectional descriptive–correlational study was conducted among older adults attending day-care centers and welfare organization–affiliated centers in the cities of Bonab and Maragheh, Iran, in 2025. The study aimed to investigate the relationship between loneliness, the size of social networks, and the use of virtual social networks among older adults.

2.2. Participants and Sampling

The study population consisted of individuals aged 60 years and older residing in Bonab and Maragheh who were members of elderly day-care centers or centers supervised by the Welfare Organization. Participants were recruited using a convenience sampling method. Sample size was determined based on statistical power analysis. Considering a significance level of 0.05, statistical power of 0.90, effect size of $f2$=0.15, and 10 predictor variables, the minimum required sample size was calculated as 147 participants using the R statistical software. Therefore, a total of 147 older adults were included in the study. Written informed consent was obtained from all participants before their participation in the study. Participants were included in the study if they met the following criteria: age 60 years or older, no diagnosed cognitive impairment, obtaining a score of 7 or higher (out of 10) on the Abbreviated Mental Test Score (AMTS), access to a smartphone or laptop, no hospitalization within the past two months, data collection instruments, demographic information form.

2.3. Demographic Questionnaire

A researcher-designed demographic questionnaire was used to collect participants′ background characteristics. The form consisted of 12 items, including age, gender, marital status, occupation, education level, income level, number of children, having a migrated child, satisfaction with child migration, type of communication with children, living arrangement, and type of virtual social network used.

2.4. De Jong Gierveld Loneliness Scale

Loneliness was assessed using the 11-item De Jong Gierveld Loneliness Scale, originally developed by De Jong Gierveld and Kamphuis (1985). The scale measures overall loneliness and allows separate assessment of emotional and social loneliness (de Jong-Gierveld and Kamphuis 1985, De Jong Gierveld and Van Tilburg 2010). The Persian version was psychometrically evaluated among Iranian older adults by Hosseini et al. (2021) (Hosseini, Froelicher et al. 2021). Exploratory factor analysis resulted in the removal of three items (items 3, 6, and 10 of the original scale), yielding an 8-item version suitable for use in the Iranian elderly population. Responses are rated on a five-point Likert scale ranging from “never” to “always.” According to the validated Persian scoring procedure, items 1–5 (social loneliness) are reverse scored, while items 6–8 (emotional loneliness) are scored in the positive direction. Total scores range from 0 to 8, with higher scores indicating greater loneliness (Hosseini, Froelicher et al. 2021). The scale provides separate scores for social loneliness (items 1–5) and emotional loneliness (items 6–8), and the sum of these dimensions represents the overall loneliness score. In the validation study conducted among 400 Iranian adults aged 65 years and older, Cronbach’s alpha coefficients were 0.822 for the social loneliness subscale and 0.711 for the emotional loneliness subscale, supporting the reliability of the Persian version for assessing loneliness among Iranian older adults (Hosseini, Froelicher et al. 2021).

2.5. Lubben Social Network Scale (LSNS)

Social network size was assessed using the Persian version of the 6-item Lubben Social Network Scale (LSNS-6). The LSNS-6 is a brief instrument specifically developed to assess social networks and identify older adults at risk of social isolation (James Lubben, Blozik et al.). The scale comprises two subscales: family networks (3 items) and friendship networks (3 items). Each item is rated on a six-point scale, yielding a total score ranging from 0 to 30, with higher scores indicating larger social networks and lower levels of social isolation. A total score below 12 suggests risk of social isolation (Lubben, Blozik et al. 2006).

The Persian version of the LSNS-6 was validated among Iranian older adults by Tavakoli Ghochani et al. (2020). Exploratory factor analysis confirmed the original two-factor structure consisting of family and friendship networks. The scale demonstrated excellent internal consistency, with a Cronbach's alpha coefficient of 0.896 for the total scale. These findings support the validity and reliability of the Persian LSNS-6 for assessing social networks among Iranian older adults (Tavakoli, Lashkardoost et al. 2020).

2.6. Social Networks and Media Questionnaire

Theoretically, social networks represent a new generation of internet-based platforms organized around online communities, each attracting groups of users with shared characteristics. Castells describes these networks as a form of social media that has created new modes of communication and content sharing on the Internet (Castells and Ince 2003). Social media use was measured using the 19-item Social Media Use Questionnaire developed by Jahanbani (Hashemi and Sangi 2024). Items are rated on a Likert-type scale, with higher scores indicating greater social media use. According to the scoring guidelines, scores of 19–38, 39–57, and >57 represent low, moderate, and high levels of social media use, respectively. The questionnaire has demonstrated good reliability, with a test–retest coefficient of 0.90 and a Cronbach's alpha of 0.85 in the original validation study (Hashemi and Sangi 2024).

2.7. Statistical Analysis

Descriptive statistics were used to summarize the study variables. Categorical variables were described using frequencies and percentages, whereas continuous variables were summarized using means, standard deviations, medians, and ranges, as appropriate.

Comparisons of continuous variables across categorical groups were performed using independent-samples t-tests or one-way analysis of variance (ANOVA). When the assumptions for parametric analyses were not met, the Mann–Whitney U test, Wilcoxon rank-sum test, or Kruskal–Wallis test was applied, as appropriate. Associations between continuous variables were examined using Pearson's correlation coefficient, whereas Spearman's rank-order correlation or Kendall's tau correlation coefficient was used for ordinal variables or when distributional assumptions were not satisfied.

Simple and multiple linear regression analyses were conducted to examine the predictive roles of social network size and social media use on social loneliness, emotional loneliness, and total loneliness. All statistical analyses were conducted using R and SPSS software, and a significance level of 0.05 was considered.

2.8. Ethical Considerations

The research proposal was approved by the Ethics Committee of Iran University of Medical Sciences, and an ethical approval code (IR.IUMS.REC.1404.256) was obtained on June 25, 2025. Ethical principles were strictly observed throughout the study. Participation was voluntary, confidentiality of participants' information was ensured, and respondents were informed that they could withdraw from the study at any stage without any consequences. Individuals who were identified as suspected cases of cognitive impairment based on the screening results were provided with appropriate referrals for further clinical evaluation.

3. Results

3.1. Participant Characteristics

A total of 147 older adults participated in this study. Participants were recruited from elderly day-care centers and welfare organization–affiliated centers in the cities of Bonab and Maragheh, Iran. Demographic information was collected using a structured questionnaire that included variables of age, gender, marital status, education level, occupation, income level, number of children, presence of migrant children, satisfaction with children′s migration, living arrangement, type of communication with children, and type of virtual social network used. The demographic characteristics of the participants are presented in Table 1. The mean age of the participants was 69.24 ± 6.12 years, with a minimum of 60 and a maximum of 88 years. The mean number of children was 3.47 ± 1.96, ranging from 0 to 8 children.

Descriptive analyses indicated variability in demographic and social characteristics among participants. These characteristics were examined to better understand the social context in which loneliness, social networks, and virtual social network use occur among older adults.

Table 1: Baseline demographic characteristics of the participants (N = 147)

Variable	Category	N (%)	Mean ± SD
Age (Years)	—	—	69.24 ± 6.12
Gender	Female	80 (54.4)	—
Marital Status	Married	112 (76.2)	—
Occupation	Retired	69 (46.9)	—
	Homemaker	51 (34.7)	
	Employed	18 (12.2)	
	Unemployed	9 (6.1)	
Education Level	Primary School	39 (26.5)	—
	High School/Diploma	32 (21.8)	
	Illiterate	28 (19.0)	

	Middle School	27 (18.4)	
	University	21 (14.3)	
Monthly Income	Low	54 (36.7)	—
	Medium	61 (41.5)	
	High	32 (21.8)	
Number Of Children	—	—	3.47 ± 1.96
Child Migration Status	No Migration	70 (47.6)	—
	Domestic Migration	59 (40.1)	
	International Migration	9 (6.1)	
Satisfaction With Child's Migration*	Yes	47 (69.0)	—
Mode Of Communication†	Face-To-Face Visits	121 (82.3)	—
	Telephone Calls	93 (63.3)	
	Social Networks	48 (32.7)	
Living Arrangement†	With Spouse	116 (78.9)	—
	With Children	38 (25.9)	
	Alone	23 (15.7)	
Type Of Virtual Social Network†	Telegram	90 (61.2)	—
	WhatsApp	82 (55.8)	
	Instagram	81 (55.1)	
	Eitaa (Domestic social networks)	75 (51.0)	—
	Bale (Domestic social networks)	21 (14.3)	—
	Other	6 (4.1)	—

3.2. Descriptive Statistics of the Main Study Variables

Descriptive statistical analyses were conducted to summarize the main study variables, including loneliness, social network size, and social media use. The mean total loneliness score was 5.30 (SD = 2.07) out of a possible score of 8, indicating that participants experienced loneliness levels above the midpoint of the scale. Participants' social network scores were slightly above the recommended cutoff for risk of social isolation. Family network scores were generally higher than friend network scores, suggesting a greater reliance on family ties than friendships for social connectedness. Considerable variability in social network scores was also observed across the sample. Overall, participants demonstrated a moderate level of social media use according to the questionnaire scoring criteria, although substantial variability in social media engagement was evident. Descriptive statistics for the study variables are presented in Table 2.

Table 2: Correlations among loneliness, social network size, and social media use

Variable		Mean (SD)	Range
Loneliness	Social loneliness	3.03 (1.88)	0–5
	Emotional loneliness	2.27 (1.05)	0–3
	Total loneliness	5.30 (2.07)	1–8
Social Network Size	Family network	7.64 (3.48)	0–15
	Friend network	5.61 (3.81)	0–15
	Total social network size	13.25 (6.47)	0–30
Virtual Social Network Use	Frequency of use	13.20 (5.35)	5–25
	Type of use	15.65 (6.30)	7–34
	Users' trust in virtual social networks	14.06 (5.92)	7–34

	Total virtual social network use	42.90 (15.61)	19–86
Variable		Mean (SD)	Range
Loneliness	Social loneliness	3.03 (1.88)	0–5
	Emotional loneliness	2.27 (1.05)	0–3
	Total loneliness	5.30 (2.07)	1–8
Social Network Size	Family network	7.64 (3.48)	0–15
	Friend network	5.61 (3.81)	0–15
	Total social network size	13.25 (6.47)	0–30
Virtual Social Network Use	Frequency of use	13.20 (5.35)	5–25
	Type of use	15.65 (6.30)	7–34
	Users' trust in virtual social networks	14.06 (5.92)	7–34
	Total virtual social network use	42.90 (15.61)	19–86

3.3. Bivariate correlations between study variables

Correlation analyses showed that larger social networks were associated with lower levels of social loneliness and overall loneliness. Social media use was negatively associated with social and emotional loneliness and positively associated with social network size. No significant associations were observed between emotional loneliness and social network size or between total loneliness and social media use. Detailed correlation coefficients are presented in Table 3.

Table 3: Descriptive statistics of loneliness, social network size, and virtual social network use among older adults (n = 147)

Variable	**1**	**2**	**3**	**4**	**5**
1. Social Loneliness	—				
2. Emotional Loneliness	—	—			
3. Total Loneliness	—	—	—		
4. Social Network Size	−0.52***	−0.10	−0.42***	—	
5. Social Media Use	−0.17*	−0.20*	−0.06	0.33***	—

- $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Pearson correlation coefficients are reported for associations involving social network size. Spearman correlation coefficients are reported for associations involving social media use.

3.4. Relative Contributions of Social Network Size and Social Media Use to Loneliness Dimensions

Multiple linear regression analyses were conducted to examine the associations of social network size and social media use with social loneliness, emotional loneliness, and total loneliness. As shown in Table 4, social network size was a significant predictor of social loneliness and total loneliness, with larger social networks being associated with lower loneliness scores. In contrast, social media use was not significantly associated with social loneliness.

Table 4: Regression analyses predicting loneliness dimensions from social network size and social media use

Predictor	Outcome Variable	B	SE	T	P
Social Network Size	Social loneliness	-0.15	0.02	-7.30	<0.001
Social Media Use	Social loneliness	-0.03	0.03	-0.90	0.369
Social Network Size	Emotional loneliness	0.01	0.02	1.19	0.238
Social Media Use	Emotional loneliness	-0.04	0.02	-2.11	0.037
Social Network Size	Total loneliness	-0.12	0.02	-5.33	<0.001
Social Media Use	Total loneliness	-0.09	0.04	-2.59	0.011

To compare the relative contributions of the two predictors, the variance explained by the simple and combined regression models was examined (Table 5). Social network size accounted for a substantially greater proportion of the variance in social loneliness and total loneliness than social media use. In contrast, social media use explained a greater proportion of the variance in emotional loneliness. Overall, these findings indicate that social network size was the primary predictor of social and overall loneliness, whereas social media use was more closely related to emotional loneliness.

Table 5: Comparative contributions of social network size and social media use to social loneliness, emotional loneliness, and total loneliness among older adults

Outcome variable	Main predictor	R^2 (Combined model)	R^2 (Social network size only)	R^2 (Social media use only)
Social loneliness	Social network size	0.27	0.27	0.02
Emotional loneliness	Social media use	0.05	0.01	0.03
Total loneliness	Social network size	0.20	0.18	0.04

3.5. Associations of Social Network Size and Social Media Use with Demographic Characteristics

3.5.1 Social network size

As shown in Table 6, social network size was generally unrelated to most demographic characteristics. The only significant association was observed for satisfaction with a child's migration status. No significant associations were found for age, gender, education, employment status, marital status, income, number of children, migration status of children, communication with children, or living arrangement.

Table 6: Associations between social network size and demographic characteristics

Variable	Test Statistic	P-Value
Age	r = -0.12	0.132
Gender	t = 0.65	0.517
Education level	F (4,142) = 1.22	0.307
Employment status	F (4,142) = 1.32	0.266
Marital status	F (2,144) = 0.32	0.728
Income level	F (2,144) = 2.22	0.112
Number of children	τ = -0.096	0.119
Having a migrant child	F = 0.51	0.600
Satisfaction with child's migration	t = -22.24	<0.001
Communication with children	τ = 0.037	0.560
Living arrangement	τ = -0.020	0.758
Diversity of social media platforms used	τ = 0.107	0.071

Abbreviations: r, Pearson correlation coefficient; τ, Kendall's tau correlation coefficient; F, analysis of variance statistic; t, independent-samples t statistic.

3.5.2 Social media use

As shown in Table 7, social media use was significantly associated with age, education, income, number of children, satisfaction with a child's migration status, and the diversity of social media platforms used. No significant associations were observed for gender, employment status, marital status, having a migrant child, communication with children, or living arrangement.

Table 7: Associations between social media use and demographic characteristic and social media platform diversity

VARIABLE	TEST STATISTIC	P-VALUE
Age	r = -0.17	0.038
Gender	t = 0.93	0.354
Education level	F (4,142) = 8.29	<0.001
Employment status	F (4,142) = 1.46	0.218
Marital status	F (2,144) = 0.06	0.942
Income level	F (2,144) = 12.59	<0.001
Number of children	τ = -0.152	0.013
Having a migrant child	F = 1.92	0.151
Satisfaction with child's migration	W = 0	<0.001
Communication with children	τ = 0.085	0.171
Living arrangement	τ = -0.087	0.178

Diversity of social media platforms used	$\tau = 0.357$	<0.001

Abbreviations: r, Pearson correlation coefficient; τ, Kendall's tau correlation coefficient; F, analysis of variance statistic; t, independent-samples t statistic; W, Wilcoxon test statistic.

4. Discussion

4.1. Main findings and loneliness among older adults

The present study investigated the relationships between loneliness, social network size, and social media use among community-dwelling older adults. Although the Persian version of the De Jong Gierveld Loneliness Scale does not provide an established clinical cutoff score, the observed mean score (5.30 out of 8) indicates a relatively high level of loneliness among the participants, despite their moderate social network size and social media us .Social network size was inversely associated with social loneliness and overall loneliness, whereas social media use was inversely associated with emotional loneliness. Regression analyses further demonstrated that real-life social networks were the strongest predictors of social and overall loneliness, while social media use was more closely associated with emotional loneliness. These findings suggest that real-life and virtual social relationships may influence different dimensions of loneliness and should be considered complementary rather than interchangeable.

The relatively high level of loneliness observed in this study is consistent with previous international and Iranian research identifying loneliness as a major psychosocial and public health concern among older adults (Alaviani, Parvan et al. 2017, Chawla, Kunonga et al. 2021, Bahrevar, Abolfathi Momtaz et al. 2023). Differences between the present findings and those of studies reporting lower levels of loneliness (Beutel, Klein et al. 2017, Rezaeipandari, Ravaei et al. 2020) may be attributable to variations in sampling methods and participant characteristics. In the present study, participants were recruited from day-care centers and welfare organization–affiliated centers, where older adults may experience greater socioeconomic vulnerability, health problems, and reduced social participation. In addition, a considerable proportion of participants had children living outside their hometown or abroad, which may contribute to feelings of loneliness despite ongoing family contact. Previous research has similarly emphasized that the perceived quality of relationships may be more important than the frequency of social interactions in determining loneliness among older adults (Peng and Roth 2025).

Another important finding was that social and emotional loneliness demonstrated distinct patterns of association with social network size and social media use. This observation supports the theoretical framework proposed by De Jong Gierveld, which conceptualizes loneliness as comprising two related but distinct dimensions: social loneliness, reflecting deficiencies in broader social integration, and emotional loneliness, resulting from the absence of close and meaningful relationships (de Jong-Gierveld and Kamphuis 1985, de Jong Gierveld 1998, De Jong Gierveld and Van Tilburg 2010). These findings suggest that loneliness in later life is a multidimensional

phenomenon influenced by both the quantity and quality of social relationships. Consequently, interventions aimed at reducing loneliness among older adults should address not only opportunities for social participation but also the maintenance of meaningful interpersonal and emotional connections.

4.2. Comparative roles of real-life and virtual social network

One of the most important findings of the present study was that real-life social networks and social media use showed distinct associations with different dimensions of loneliness among older adults. Social network size emerged as the strongest predictor of social loneliness and overall loneliness, whereas social media use was primarily associated with emotional loneliness. These findings suggest that real-life and virtual social relationships may serve different psychosocial functions in later life and should therefore be considered complementary rather than interchangeable forms of social connectedness.

The strong inverse association between social network size and social loneliness is consistent with the theoretical framework proposed by De Jong Gierveld, which conceptualizes social loneliness as resulting primarily from deficiencies in broader social integration (De Jong-Gierveld 1987, De Jong Gierveld, van Tilburg et al. 2016). Older adults with larger social networks reported significantly lower levels of social and overall loneliness, whereas social network size was not associated with emotional loneliness. These findings are consistent with previous international and Iranian studies demonstrating that broader social networks, social participation, and frequent interpersonal interactions protect against loneliness (Chawla, Kunonga et al. 2021, Holt-Lunstad 2021, Surkalim, Luo et al. 2022, Avandi, Mahdizadeh et al. 2024). Larger social networks may reduce loneliness by increasing opportunities for social participation, strengthening social identity and belonging, and improving access to emotional and practical support (McNamara, Stevenson et al. 2021).

In contrast, social media use demonstrated a different pattern of association. Although social media use was not significantly associated with social loneliness, it was independently associated with lower emotional loneliness. This finding suggests that virtual communication may be particularly effective in maintaining emotionally meaningful relationships rather than expanding broader social participation. Given that 46.2% of participants had children living outside their hometown or abroad, social media may have served as a means of maintaining emotional contact despite geographical separation. However, this interpretation should be considered exploratory.

Previous studies examining social media use and loneliness among older adults have reported mixed findings (84–89). While some studies have shown that social media use enhances social connectedness and reduces loneliness (Zhang, Kim et al. 2021, Kusumota, Diniz et al. 2022), , others have found no association or questioned its positive effects (Aarts, Peek et al. 2015, Cotten, Schuster et al. 2022, Wiwatkunupakarn, Pateekhum et al. 2022). For example, a large population-based study of community-dwelling older adults in the Netherlands found that the use of social networking sites was unrelated to either emotional or social loneliness after adjustment for

potential confounders (Aarts, Peek et al. 2015). The present findings suggest that these discrepancies may reflect differences in study populations, digital literacy, patterns of social media engagement, and the distinction between active and passive or emotionally meaningful use of social media, rather than social media use per se.

Importantly, the comparative regression analyses demonstrated that the contribution of social network size to social and overall loneliness was substantially greater than that of social media use. These findings indicate that virtual social interaction cannot fully replace the protective effects of real-life social relationships. However, social media use appears to provide an additional and complementary pathway for reducing emotional loneliness, particularly when geographical distance, physical limitations, or family migration restrict opportunities for face-to-face interaction. Taken together, the present findings suggest that loneliness interventions should not regard real-life and virtual social relationships as competing alternatives. Rather, strengthening social networks and facilitating meaningful social media use may represent complementary strategies for addressing different dimensions of loneliness among older adults.

4.3. Demographic and Social Media–Related Factors Associated with Virtual Social Network Use

The findings of the study also indicated that several demographic factors were related to the use of virtual social networks. Age showed a significant negative relationship with virtual social network use, meaning that younger older adults were more likely to use these platforms. Educational level and income were also significantly associated with virtual social network use, suggesting that socioeconomic resources and digital literacy may influence access to and engagement with online communication technologies.

In addition, the number of children showed a significant negative association with social media use, while satisfaction with children's migration was significantly associated with the level of social media use. Previous evidence from Iran suggests that migration of adult children may increase loneliness among older parents by weakening family interactions and kinship networks (Zarghami and Mahmoudian 2017). Although the present study did not directly examine communication patterns between parents and migrant children, these findings raise the possibility that social media may help older adults maintain emotional connections with geographically distant family members.

In addition to demographic characteristics, the diversity of social media platforms used was positively associated with overall social media use. Older adults who used a wider variety of social media platforms reported higher levels of engagement with social media, suggesting that familiarity with multiple platforms may facilitate broader digital communication.

5. Conclusion

In conclusion, the present study demonstrates that real-life and virtual social relationships contribute differently to loneliness among older adults. Larger social networks were primarily associated with lower social and overall loneliness, whereas social media use was more closely related to lower emotional loneliness. These findings suggest that digital communication should be viewed as a complement rather than a substitute for real-life social relationships. Interventions aimed at reducing loneliness in later life should therefore combine strategies that strengthen community-based social networks with initiatives that promote meaningful and accessible digital communication, particularly for older adults who experience geographical separation from family members.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, its cross-sectional design precludes causal inferences regarding the relationships between loneliness, social network size, and social media use. Second, participants were recruited through convenience sampling from community day-care centers and welfare organization–affiliated centers in two cities, which may limit the generalizability of the findings to other populations of older adults. Third, all variables were assessed using self-report questionnaires and may therefore be subject to recall and social desirability biases. Finally, although cognitive status was screened before participation, important factors such as digital literacy, technological competence, depressive symptoms, and the quality of social relationships were not comprehensively assessed and may have influenced the observed associations. Future longitudinal studies using more representative samples and incorporating objective measures of social interaction and digital engagement are warranted to confirm and extend these findings.

Declarations

Consent to participate: Written informed consent was obtained from all participants before their participation in the study.

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