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Article

Frailty Assessment and Its Impact on Loneliness among Older Adults Receiving Home-Based Healthcare: A Cross-Sectional Study

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Abstract: To identify the effect of frailty on loneliness of older adults receiving home care, considering their socioeconomic and homebound status. This cross-sectional study enrolled 218 individuals aged ≥ 65 years receiving home-based health services “Help at Home” in the Region of Evrytania, Greece, after an open invitation by Municipality authorities from March to June 2022. Tilburg Frailty Indicator (TFI) was used for the evaluation of frailty, UCLA Loneliness Scale version 3 for loneliness and social isolation was accessed through five questions (living alone, frequency of interaction with children, relatives, friends, and participation in social organizations). The mean age of the participants was 81.48 ± 9.06 , 61.9% were female, 54.1% experienced high levels of loneliness (UCLA-3 mean 45.76 ± 11.10 [range 20–68]), and 46.3% of the participants identified as socially isolated. Also, 58.3% of the individuals were classified as frail (TFI mean 5.95 ± 3.07 , [TFI range 0–13], with 57.3% experiencing physical frailty, 43.6% psychological frailty, and 27.1% social frailty. An analysis of covariance (ANCOVA) placing UCLA-3 as the dependent variable revealed that loneliness and across all domains of TFI were significantly higher in participants with frailty (total frailty [yes] 49.27 vs. [no] 40.87 $p < 0.001$) particularly, (physical frailty [Yes]=48.99 vs. [No]=41.42, $p < 0.001$, psychological: 48.60 vs. 43.57 $p < 0.001$ and social: 53.38 vs. 42.94 $p < 0.001$) compared to non-frail individuals, even after adjusting for potential confounding effects (covariates: gender, age, marital status, family status, living status, educational level, annual income, chronic diseases, homebound status, and social isolation). Our data analysis confirmed that frailty is a significant risk factor for higher levels of loneliness among older adults who received home-based healthcare.

Keywords: frailty; loneliness; social isolation; older adults; homecare; ageing

1. Introduction

Loneliness in older adults has emerged as an urgent public health concern, owing to the high prevalence of loneliness and its adverse health impacts in old age. Interestingly, the prevalence of loneliness in people ≥ 60 years old in European countries was 11.9–19.3% [1]. Especially in old age, various factors have been identified as contributing to an elevated sense of loneliness and are commonly linked to the person's social disadvantages (living alone, low educational level and restricted social connections), psychological elements (depressive symptoms), as well as poor quality of life [2]. In addition, the risk of mortality due to loneliness is comparable to well-documented clinical risk factors such as smoking and high blood pressure [3].

It has also been suggested that loneliness is strongly related to substantial health repercussions, encompassing physiological impacts such as obesity, cardiovascular issues, sleep disturbances, weakened immunity, as well as psychological effects including depression, social anxiety, and cognitive decline [4]. Most importantly, loneliness represents a subjective displeased feeling stemming from the individual's perception that social relationships are unsatisfactory in either quantity or quality [5]. Thus, it is important to distinguish loneliness from social isolation, which refers to one's objectively limited network of relationships. These two conditions may co-exist independently, for instance, someone might feel lonely despite having many social connections, or might not experience loneliness even if with limited social interconnections [6,7].

On the other hand, frailty is also frequent among community-dwelling people aged 75 Years or older and leads to poorer quality of life [8], especially for those receiving homecare varying from 14% to 38% [9]. It is widely recognized as a gradual decline in the functioning of physiological systems associated with increased age, leading to negative health outcomes [10], particularly restrictions in mobility, disability, increased risk of cognitive declines, falls, hospitalization and premature deaths [11–13]. Given that there is no consensus definition for frailty, frailty assessment is usually based on the model of cumulative deficit frailty considered a multifactorial and dynamic condition, where the classification of the elderly is done on a continuous spectrum based on a multitude of deficits. Although several European projects under the European platform of WE4AHA & EIPonAHA have extensively investigated the multidimensional nature of frailty in recent years, the assessment of physical, psychological, and social domains including sociodemographic factors (age, marital status, education, and income) that increased the risk for frailty development has become apparent [14].

There has been growing concern globally about the association between frailty and loneliness as shared comparable psycho-socio-economic factors among community-dwelling older adults [15], highlighting the significance of examining frailty employing a multidimensional approach and, the importance of social determinants on physical health in ageing [16,17] and, demonstrating that a bidirectional relationship may exist between loneliness and frailty. In this perspective, the widespread occurrence of frailty in older adults, along with its various impacts on daily life and multidimensional nature, makes it important to explore how frailty may contribute to increased loneliness. Understanding this link could highlight the potential for preventive interventions targeting frailty to alleviate loneliness among seniors. Thus, the exploration of the factors particularly socioeconomic associated with higher levels of loneliness will help in identifying and implementing appropriate and effective interventions.

Therefore, this study aimed to identify the impact of frailty on loneliness of older adults receiving home-based healthcare taking into consideration patients' homebound status, social isolation, and existing comorbidities.

2. Materials and Methods

2.1. Study Design

A cross-sectional study was conducted from March to June 2022 in the region of Evrytania, Greece. The study recruited individuals aged 65 years old and over, registered members of the home-based community program "Help at Home". These members are mainly elders with disadvantaged social status of poor family support that receive medical, nursing, and social care. In this convenience sampling study, data was collected by the main researcher (psychologist) through door-to-door screenings focused on frailty, loneliness, and social isolation. After an open invitation by the local municipality authorities, a total of 358 older adults (registered members of the "Help at Home" program) were screened. A few members were excluded if they: (1) were aged ≤ 65 years old; (2) had severe visual or hearing impairments; (3) refused to participate in the questionnaire survey; (4) had a diagnosis of severe dementia and post-stroke implications; (5) could not communicate and complete the questionnaire. Finally, 218 individuals with full data met our criteria and were involved in the statistical analysis (response rate 60.9%).

2.2. Instruments

2.2.1. Loneliness Assessment

A feeling of loneliness was investigated with the University of California, Los Angeles Loneliness Scale-Version 3 (UCLA Loneliness Scale Version 3) [18]. This is a 20-item scale and each item had four options to reflect the frequency (1 = never, 2 = rarely, 3 = sometimes and 4 = often). The total score is calculated by adding the individual scores of each item, with 9 out of the 20 questions being reverse scored. The total score ranged from 20 to 80, with the higher scores corresponding to a greater level of loneliness. In this study, to evaluate loneliness severity, the cut-off criteria were used as follows: < 28 = No/Low Loneliness, 28 – 43 = Moderate Loneliness, and > 43 = High loneliness [19]. Currently, the UCLA-3 scale was validated in Greek adults showing strong correlations with the Hospital Anxiety Depression Scale (construct validity $p < 0.05$) and significant test-retest reliability for social loneliness 0.826, for psychological loneliness 0.980 and isolation 0.880 [20]. In our study, the UCLA-3 reliability was $\alpha = 0.952$.

2.2.2. Frailty Assessment

Frailty was evaluated utilizing section B of the Tilburg Frailty Indicator (TFI), comprising 15 elements organized into three distinct domains of frailty. The components of the physical domain are poor physical health, unintended weight loss, difficulty in walking, maintaining balance, poor hearing, poor vision, lack of strength in the hands, and physical tiredness. The evaluation of the psychological domain consists of problems with memory, feeling down, feeling nervous or anxious, and inability to cope with problems. Finally, the social domain includes living alone, missing other people, and lack of social support. The scores range from 0 to 15 (total frailty), 0 to 8 (physical frailty), 0 to 4 (psychological frailty), and 0 to 3 (social frailty), with the higher scores referring to a higher level of frailty [21]. Total frailty is recognized if the total score is at least 5. In terms of individual domains, the thresholds are at least 3 out of 8 components for physical frailty, at least 2 out of 4 for psychological frailty and at least 2 out of 3 for social frailty [22]. Part A of the TFI includes 10 determinants of frailty, but in this study, we collect the data of 6 determinants (age, sex, marital status, economic status, education and presence of chronic diseases), as they consider as well-known sociodemographic determinants both of frailty and loneliness [2,23].

The TFI has recently been validated for the Greek community-dwelling older people (mean age = 79.7 years) as well as its physical, psychological, and social domains using Pearson correlation coefficients between the domains and alternative measures. Among other criteria, feeling lonely was also applied (De Jong Gierveld loneliness scale) as a criterion for its concurrent validity (≥ 0.70) [24]. In our study, the reliability of TFI was $\alpha = 0.744$.

2.2.3. Social Isolation

For the assessment of social isolation, we used an approach that was previously applied in recent British longitudinal studies [25,26]. One point was assigned for each of the following criteria: residing alone (unmarried or not cohabiting), having less than monthly contact with each child, other family members and friends (whether in person, through written communication or via telephone) and not being affiliated with any kind of organizations-groups. These scores were totalled and ranged from 0 to 5. Higher totals indicated a greater degree of social isolation. For the regression analyses we divided the participants into three categories according to whether their score was low (0), average (1) or high (≥ 2).

2.2.4. Socioeconomic Assessments

Socioeconomic status was estimated by recording the individual characteristics of participants (sex, education level, marital status, having children, living alone, annual individual income). In particular, an annual individual income of less than 5.269 Euros was considered as the "poverty threshold" according to the Hellenic Statistical Authority [27].

Homebound status was determined based on the ability of elders to leave the home due to each illness in the last month as follows: (1) homebound - individuals never or rarely left the home during the last month; (2) semi-homebound - individuals had difficulty to leave the home (some times per week) but only with assistance; (3) non-homebound – individuals who had no difficulty or need for help to leave the house at least twice per week [28].

Comorbidity was assessed by recording the most common chronic diseases of the participants according to their medical history such as cancer diagnosis, history of cardiovascular diseases, stroke, chronic obstructive pulmonary disease, hypertension, diabetes mellitus, arthritis, kidney disease, etc. Multimorbidity was defined as a documented history of at least two chronic diseases and categorized as follows: 0, 1, 2 and at least 3 [29].

2.3. Ethical Consideration

This study is a part of clinical interventions of the Community Nursing Laboratory of the Department of Nursing, University of Thessaly, Greece. The research protocol was ethically approved by the local municipality authorities (“Help at Home” program of Evrytania - Pr. No. 178/29-3-2022). Before its implementation, the participants provided their oral informed consent, fully aware that their participation was voluntary. Also, the process was anonymous and, participants could withdraw from the study at any time in full compliance with the General Data Protection Regulation (GDPR,) [EU 2016/679] regarding sensitive personal data.

2.4. Statistical Analysis

Descriptive statistics were generated as appropriate for each variable. Categorical variables were summarized as frequencies (n) and percentages (%), while continuous variables were presented as mean and standard deviation (SD). Shapiro–Wilk’s test, along with the visual overview of the corresponding histograms, normal Q–Q plots, and box plots were used to assess the normality of quantitative variables. Associations between sociodemographic and health-related characteristics, and loneliness symptoms were explored using chi-square tests. The comparison was made between high loneliness (UCLA-3 score > 43) and low/moderate loneliness (UCLA-3 score ≤ 43). Associations between the Frailty (TFI) domain score and the Loneliness (UCLA-3) score were explored with Pearson’s correlation coefficients. In addition, to investigate the impact of frailty on loneliness, analysis of covariance (ANCOVA) was performed with UCLA-3 score placed as dependent variable, frailty domains as independent variables and gender, age, marital status, family status, living status, educational level, annual income, chronic diseases, homebound status, and social isolation level as covariates. Marginal means along with 95% confidence intervals (CI) are reported from the analysis of covariance. A p-value < 0.05 was preset as statistically significant. Data were encoded and analyzed using the IBM SPSS 26.0 software.

3. Results

In Table 1 the demographic characteristics of the study participants are presented. The mean age of 218 participants (female 61.9%) was 81.45± 9 with 60.1% of them aged ≥80 years old and over. In brief, 62% had at least a primary educational level, 53.7% were married and 85.3% had at least one child. Also, 28.9% lived alone, and 59.6% lived under the poverty threshold. 20.6% of the older adults were free from any chronic diseases while 33% had 2,4% had at least 3 chronic diseases and 21.1% were homebound.

Table 1. Descriptive characteristics of the participants (n =218).

Characteristics	Categories	n	%
Sex	Male	83	38.1
	Female	135	61.9
Age (years) [mean ± SD: 81.45 ± 9.06]	65-79	87	39.9
	≥80	131	60.1

Marital Status	Married	117	53.7
	Single/Divorced/Widowed	101	46.3
Family Status (Having Children)	Yes	186	85.3
	No	32	14.7
Living Alone	Yes	63	28.9
	No	155	71.1
Educational Level	Illiterate	83	38.1
	Primary	110	50.5
	Secondary/Tertiary	25	11.5
Annual Individual Income (Euros)	<5.269	130	59.6
	>5.269	88	40.4
Chronic Diagnosed Diseases (number)	0	45	20.6
	1	39	17.9
	2	72	33.0
	≥3	62	28.4
Homebound Status	Non-Homebound	114	52.3
	Semi-Homebound	58	26.6
	Homebound	46	21.1
Frailty (TFI) [mean ± SD: 5.95 ± 3.07]	Physical Frailty (Yes)	125	57.3
	Psychological Frailty (Yes)	95	43.6
	Social Frailty (Yes)	59	27.1
	Total Frailty (Yes)	127	58.3
Social Isolation	Low	28	12.8
	Moderate	89	40.8
	High	101	46.3
Loneliness (UCLA-3) [mean ± SD: 45.76 ± 11.10]	Low	10	4.6
	Moderate	90	41.3
	High	118	54.1

Abbreviations: SD: standard deviation; TFI: Tilburg Frailty Indicator; UCLA-3: UCLA Loneliness Scale (Version-3). Notes: Data were given as actual numbers (n) and percentages (%); Annual individual income refers to the poverty threshold cut-off criterion; Chronic diagnosed diseases: it contains the most common chronic diseases according to participants' medical records. Homebound: refers to the ability to leave the home in the last month.

Frailty was identified in 58.3 % of the study participants (TFI mean ± SD: 5.95 ranging 0-13) and were categorized according to TFI domains as follows: physical frailty 57.3%, psychological frailty 43.6% and social frailty 27.1%. Higher levels of loneliness were identified in 54.1% with mean UCLA-3 scores of 45.76 ± 11 (range 20-80). Similarly, higher levels of social isolation were identified in 46.3% of our study sample.

Table 2 shows the associations between sociodemographic characteristics and high levels of loneliness. Loneliness was significantly more frequent in females (60% vs. 44.6%, p=0.038), in aged ≥80 (74.8% vs. 23%, p<0.001), in unmarried (37.6% vs. 73.3%, p<0.001), in Illiterate elders (74.7% vs. 28%, p<0.001), in participants with lower income (61.5% vs. 33.2%, p<0.001), in elders with multimorbidity (79% vs. 28.9%, p<0.001), in homebound (97.8% vs. 27.2%, p<0.001), in frail (82.7% vs. 14.3%, p<0.001) and, in socially isolated (76.2% vs. 35%, p<0.001).

Table 2. Associations between sociodemographic characteristics and higher feelings of loneliness (n=118).

Characteristics	Categories	Elderly with Higher loneliness symptoms / Total (%)	Test χ^2	p-value
Sex	Male	37/83 (44.6)	4.322	0.038
	Female	81/135 (60.0)		
Age (years)	65-79	20/87 (23.0)	54.474	<0.001
	≥80	98/131 (74.8)		
Marital Status	Married	44/117 (37.6)	26.345	<0.001
	Unmarried	74/101 (73.3)		
Having Children	Yes	100/186 (53.8)	0.005	0.945
	No	18/32 (56.3)		
Living Alone	Yes	45/63 (71.4)	9.723	0.002
	No	73/155 (47.1)		
Educational Level	Illiterate	62/83 (74.7)	25.087	<0.001
	Primary	49/110 (44.5)		
	Secondary/Tertiary	7/25 (28.0)		
Annual Individual Income	<5.269 Euros	80/130 (61.5)	6.402	0.011
	>5.269 Euros	38/88 (43.2)		
Number of Chronic Diseases	0	13/45 (28.9)	27.502	<0.001
	1	17/39 (43.6)		
	2	39/72 (54.2)		
	≥3	49/62 (79.0)		
Homebound Status	Non-Homebound	31/114 (27.2)	76.497	<0.001
	Semi-Homebound	42/58 (72.4)		
	Homebound	45/46 (97.8)		
Physical Frailty	Yes	100/125 (80.0)	76.564	<0.001
	No	18/93 (19.4)		
Psychological Frailty	Yes	79/95 (83.2)	55.092	<0.001
	No	39/123 (31.7)		
Social Frailty	Yes	46/59 (78.0)	17.220	<0.001
	No	72/159 (45.3)		
Total Frailty	Yes	105/127 (82.7)	97.132	<0.001
	No	13/91 (14.3)		
Social Isolation	Low/Moderate	41/117 (35.0)	35.408	<0.001
	High	77/101 (76.2)		

Notes: Data were given as actual numbers of elderly and percentages (%); Higher loneliness was identified in those with UCLA-3 mean value ≥43.

Table 3 shows the results of bivariate analysis and Pearson’s correlation coefficient. Particularly, participants with frailty experienced stronger feelings of loneliness across all TFI domains.

Table 3. Associations between Frailty (TFI) and Loneliness (UCLA-3).

TFI domains score	UCLA-3 Loneliness Scale score
Physical Frailty	0.719 *
Psychological Frailty	0.651 *
Social Frailty	0.547 *
Total Frailty	0.897 *

Notes: Methods: Bivariate Analysis, Pearson’s correlation coefficient. *Significant level $p<0.001$.

In Table 4 we present the impact of frailty on loneliness placing TFI domains as independent variables and socioeconomic factors as covariates and adjusting for potential confounding effects. A higher level of loneliness (UCLA-3 mean values) was observed in older adults with physical frailty (48.99 vs. 41.42, $p<0.001$), in those with psychological frailty (48.6 vs. 43.57, $p<0.001$), and those with social frailty (53.38 vs. 42.94, $p<0.001$) compared to non-frail elders. This association was also observed in frail older adults (total TFI: 49.27 vs. 40.87, $p<0.001$).

Table 4. Effect of frailty on high loneliness.

TFI domains	Marginal Means (95% C.I.)	F	p-value	η^2
Physical Frailty		23.672	<0.001	0.105
No	41.42 (39.48 - 43.37)			
Yes	48.99 (47.44 - 50.54)			
Psychological Frailty		25.117	<0.001	0.111
No	43.57 (42.37 - 44.77)			
Yes	48.60 (47.20 - 49.99)			
Social Frailty		27.431	<0.001	0.120
No	42.94 (41.59 - 44.29)			
Yes	53.38 (50.39 - 56.36)			
Total Frailty		28.594	<0.001	0.125
No	40.87 (38.89 - 42.86)			
Yes	49.27 (47.73 - 50.80)			

Abbreviations: C.I: confidence intervals. Notes: Method: analysis of covariance (ANCOVA); UCLA-3 score placed as dependent variable; frailty domains as independent variables; gender, age, marital status, family status, living status, educational level, annual income, chronic diseases, homebound status, and social isolation level as covariates.

4. Discussion

To our knowledge, this is the first study in Greece investigating the impact of frailty on loneliness in terms of socioeconomic status in community-dwelling older people in their homes. Upon analyzing the collected data, 58.3% of the study's participants were identified as frail, 54.1% experienced strong feelings of loneliness and 46.3% were characterized as highly socially isolated. Our data analysis revealed that participants with disadvantaged social status (marital, family, economic, social isolation and homebound status) experienced significantly higher levels of loneliness. Most importantly, higher levels of loneliness were observed in participants with frailty across all domains (physical, psychological and social).

The main finding of the present study was that frailty was significantly associated with high loneliness, suggesting that frail older adults (>80 years old) with disadvantaged social status experienced stronger feelings of loneliness. In agreement with our findings, recent longitudinal studies have shown that respondents with higher levels of loneliness had a higher frailty index score as did those with a higher level of social isolation, however, the associations remained significant when both loneliness and social isolation were included in a joint model [26]. Along the same line, recent longitudinal associations of loneliness and frailty with up to 20 years of follow-up, showed that frailty increased over time and that baseline loneliness predicted frailty progression, highlighting loneliness as a separate construct as included in the analysis of functional and structural aspects of social relationships [17]. In addition, results from a previous Longitudinal Aging Study Amsterdam showed that frailty is associated with poor social functioning, and with an increase in loneliness over time in community-dwelling older adults [30]. In our study, we recognized the impact of frailty on loneliness in an effect model after adjusting for social disadvantages (social, economic and homebound status). Possible explanations for this association could be that there are interdependencies between loneliness and frailty. For instance, the effect of prior frailty on subsequent loneliness may be larger than the effect of prior loneliness on subsequent frailty in older adults over time, and/or maybe there have been changes in loneliness and changes in frailty over time

according to the China Health and Retirement Longitudinal Study (4 years follow-up) [15]. This also may highlight the assumption of a two-way and mutually reinforcing connection between these two commonly concurrent conditions in old age [31].

We also found strong associations between sociodemographic characteristics and higher feelings of loneliness such as a growing intensity of loneliness with advancing age. The high frequency of loneliness in ageing may exist due to stereotypes [32]. Also, loneliness is largely frequent in ages (>80 years old) [33], which is in agreement with the findings of our study as 60.1% of the participants were 80 years or older. The higher levels of loneliness in those with a low educational level and poor family support, are demonstrated in our study and consistent with other international studies [2,32,34,35]. Finally, our finding that the high degree of social isolation may be considered a contributing factor to intense loneliness in the elderly, has also been identified in other research [35,36].

Furthermore, the number of chronic diseases that older people suffer from has been found to lead to a stronger feeling of loneliness, which links the poor health status and the impact it has on the daily life and functioning of older people with their emotional/psychological state [32]. The connection between the state of health with the level of loneliness is also established by the resulting high rate of loneliness in homebound older adults. Likewise, similar studies revealed the impact of reduced functionality that enhances social networks on elders' emotional needs, as this can be seen from the degree of loneliness they express [37,38].

Finally, loneliness proves to be an important, but often neglected, social determinant of quality of life for older people. World Health Organization addresses loneliness as a pressing public health and policy concern, while the context of the UN Decade of Healthy Aging (2021-2030) promotes actions to address it. Given the recognized high frequency of psychological and social frailty in the elderly as well as their association with adverse health and functional conditions, these two domains of frailty should be seriously taken into account and evaluated in the older population [39,40].

5. Future Implications

The findings of the present study highlight the importance of interventions tailored to strengthening physical functionality and social engagement will contribute to combatting loneliness among the elderly [41,42]. Additionally, the discovery that frailty encompasses not only the physical state of an individual but also incorporates psychological and social elements highlighting the necessity for a comprehensive evaluation and multidimensional care approach for elderly individuals. Remarkably, nurses can identify many causes and consequences of frailty focusing on the social and psychological domains, and, pointing to a holistic approach to both loneliness and frailty [43]. Hence, supporting the elderly's social network and enhancing the education of healthcare professionals especially community nurses [44,45] is crucially important.

6. Limitations

A potential limitation of the present study is our cross-sectional design because we cannot identify changes in variables over time, recognizing that longitudinal research may be undertaken for testing of changes in variables over time. We cannot also determine causality due to the observational nature and single-point data collection. For instance, to explain what caused those correlations. In addition, although, TFI and UCLA-3 have been validated for the Greek population, the responses of the participants consist of self-witnesses, which may not be accurate due to lack of self-awareness. Another potential limitation could be the low response rate that may bias our results. However, we applied analysis of covariance and controlled for interaction effects (covariates), which means that any bias from a low response rate is eliminated [46]. Also, this study was conducted during the COVID-19 pandemic and therefore, participants' responses might have been impacted by the lockdown consequences. Nevertheless, examining these factors during this particular timeframe can yield valuable insights into understanding the physical and psychosocial well-being of seniors in challenging pandemic conditions.

7. Conclusions

Our study confirms that frail older adults experience stronger feelings of loneliness across all domains (physical, psychological and social). It also illustrates that interventions targeting the social vulnerabilities of older adults can be effective in supporting their functional status. Thus, it is crucially important for health professionals caring for older people to pay more attention to social disadvantages in designing effective interventions to enhance the well-being of older adults.

Supplementary Materials: The following supporting information can be downloaded at the website of this paper posted on Preprints.org.

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Conflicts of Interest: The authors declare no conflict of interest.

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