



Original Article

The impact of loneliness and social isolation on the benefits of an exercise program with hospitalised older adults



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ABSTRACT

Objectives: This study aimed to assess the prevalence and impact of loneliness (De Jong Gierveld scale) and isolation (Lubben scale) on the effects of a hospital-based exercise programme.

Design: Secondary analysis of a randomised clinical trial.

Setting: Acute Geriatric Unit of a tertiary hospital in Spain.

Participants: 103 hospitalised older adults.

Intervention: Individualised multicomponent exercise program (20-minute sessions twice a day for 3 consecutive days).

Results: Among the 103 randomised patients included in the analysis (both arms included), 58.3% were male, and their mean age was 87.3 (4.5) years. According to the Lubben scale, 15.8% of patients were at risk of isolation, while 62.7% were in a situation of severe or moderate loneliness according to the De Jong Gierveld scale. In the non-isolated group, training showed a substantial positive impact on Geriatric Depression Scale ($B = -1.25$, 95% CI = -0.24 to -0.27). In the isolated group, all outcomes improved, but only the Quality of Life showed significant changes ($B = 35$, 95% CI = 4.96 – 35.8). The SPPB test ($B = 1.62$, 95% CI = 0.19 – 3.04) and Quality of Life, ($B = 17.1$, 95% CI = 1.84 – 32.3) showed a significant improvement in the non-loneliness exercise group while no differences were found in the loneliness group.

Conclusion: Despite the high prevalence of loneliness and social isolation, individualised exercise programs provide significant benefits to hospitalised patients, especially in quality of life.

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1. Introduction

The aging population is projected to increase substantially in the coming decades, which will increase the demand for medical resources, including hospitalisation. In the United States, 42% of hospitalised individuals are over 65 years of age, and this proportion is expected to increase [1]. Hospitalisations in older adults confer higher risks of cognitive impairment, delirium, mortality, and medical complications, potentially prolonging hospital stays and increasing costs [2,3].

Loneliness is associated with frailty, mortality, and disability [4–6], and strongly predicts the development of pain, fatigue, and depression, even without a specific diagnosis. The mortality risk is higher in frail older

adults who are lonely or isolated [7]. Loneliness may also negatively impact the trajectories of hospitalised older adults [8]. However, the relationship between social isolation, loneliness, and hospital-associated disability (HAD) remains inconclusive. Suggested strategies for HAD include promoting mobility and individualised exercise programs [9,10]. Exercise improves both physical and cognitive function, [11] and reduces the risk of disability in hospitalised older adults. It also enables social interaction, potentially reducing loneliness. This finding suggests that engaging in regular physical activity can potentially improve social interactions, which may in turn reduce feelings of loneliness. Conversely, loneliness may lead to decreased participation in social and physical activities, which can negatively impact health and quality of life [12].

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Despite a substantial body of evidence linking loneliness to poor health outcomes, few studies have explored its impact during hospitalisation. Addressing loneliness in this context could help to evaluate this knowledge gap. Moreover, the degree of loneliness experienced by hospitalised older adults may affect their response to exercise programs; lonely individuals are less likely to participate in and adhere to these programs. Tailored interventions that address loneliness may be necessary to prevent disability and promote favourable healthcare trajectories for older adults. Given the growing concern about social isolation during the COVID-19 pandemic, it is essential to examine the relationship between isolation and healthcare trajectories of older adults [13,14].

The primary objective of this study was to investigate the prevalence of loneliness and social isolation in hospitalised older adults, while simultaneously examining the effects of these factors on the functional, cognitive and mood outcomes of a tailored exercise program. We hypothesised that hospitalised older adults experiencing high levels of social isolation would be less likely to derive benefits from exercise due to the absence of social interaction and support.

2. Material and methods

2.1. Design and participants

This study was a secondary analysis of a multicentre randomised clinical trial (RCT) that provided evidence of the functional benefits of individualised exercise interventions in hospitalised older adults [15]. In contrast to the previous analysis, this study analysed specific loneliness and social isolation measures. The RCT was conducted in the Acute Geriatric Unit (AGU) of the Hospital Universitario de Navarra (Pamplona, Spain) from July 2018 to March 2020. This department has 40 beds allocated, and its staff comprise 16 geriatricians (distributed in the AGU, orthogeriatrics, and outpatient consultations). Most admissions at AGU stem from emergencies, and the main causes of admission are heart failure and infectious diseases. Patients who met the inclusion criteria were randomly

assigned to the intervention or control (usual care) group within the first 48 h of admission. The usual care was offered to patients by geriatricians and consisted of standard physiotherapy focused on walking exercises to restore functionality conditioned by potentially reversible pathologies.

A trained research assistant conducted a screening interview to determine whether potentially eligible patients met the following inclusion criteria: age ≥ 75 years, Barthel Index ≥ 60 points, and ability to ambulate (with/without assistance) and to communicate and collaborate with the research team. The exclusion criteria were an expected length of stay of < 6 days, very severe cognitive decline, terminal illness, uncontrolled arrhythmias, acute pulmonary embolism, myocardial infarction, or extremity bone fracture in the past 3 months. After the baseline assessment, the participants were randomly assigned in a 1:1 ratio without restrictions. A simple randomisation sequence was generated by a statistician who was not involved in the RCT, using an online system (www.randomizer.org). The assessment staff were blinded to the main study design and group allocation. It was not possible to blind the participants; therefore, they were explicitly informed and reminded not to discuss their randomisation assignment with the assessment staff.

This study followed the principles of the Declaration of Helsinki (World Medical Association) and was endorsed by the Navarra Clinical Research Ethics Committee on May 9th, 2018 (Pyto2018/7). All participants or their authorised representatives provided written informed consent. This trial was registered at ClinicalTrials.gov with the identifier: (NCT04600453).

2.2. Intervention

The intervention group received two daily 20-minute sessions of exercise over three consecutive days, while the control group received usual hospital care. The exercise program was adapted from the Vivifrail program, which is a multicomponent exercise program designed specifically for older adults [16]. The morning sessions for the intervention group included individualised supervised progressive

Table 1
Baseline characteristics.

Variable	Total (n = 103)	Control Group (n = 53)	Intervention group (n = 50)	p-value
Age	87.3 (4.5)	88.4 (4.6)	86.1 (4.1)	0.007 ¹
Gender				0.727 ²
Men	60 (58.3%)	30 (56.6%)	30 (60.0%)	
Women	43 (41.7%)	23 (43.4%)	20 (40.0%)	
BMI	26.6 (5.2)	26.3 (5.3)	26.8 (4.9)	0.418 ¹
CIRS	13.1 (5.9)	13.1 (5.9)	13.1 (5.9)	0.992 ¹
Cause of hospitalisation				0.992 ³
Cardiovascular	28 (27.5%)	14 (26.9%)	14 (28.0%)	
Infectious	43 (42.2%)	21 (40.4%)	22 (44.0%)	
Pulmonary	4 (3.9%)	2 (3.8%)	2 (4.0%)	
Gastrointestinal	12 (11.8%)	7 (13.5%)	5 (10.0%)	
Neurological	2 (2.0%)	1 (1.9%)	1 (2.0%)	
Other	13 (12.7%)	7 (13.5%)	6 (12.0%)	
SPPB	4.8 (2.8)	4.6 (2.8)	5.0 (3.0)	0.250 ¹
Barthel index	74.8 (20.6)	76.0 (19.9)	73.5 (21.9)	0.267 ¹
MMSE	22.4 (4.6)	22.7 (4.3)	22.0 (5.0)	0.255 ¹
GDS	2.9 (2.6)	3.1 (2.8)	2.7 (2.4)	0.234 ¹
Handgrip	16.3 (6.5)	16.2 (6.4)	16.4 (6.8)	0.453 ¹
QoL	71.2 (24.4)	70.2 (20.5)	73.4 (27.2)	0.181 ¹
Lubben scale, n (%)				
Not at risk of social isolation	85 (84.2%)	42 (80.8%)	43 (87.8%)	
Risk of social isolation	16 (15.8%)	10 (19.2%)	6 (12.2%)	
JG scale, n (%)				0.514 ³
Not alone	38 (37.3%)	22 (41.5%)	16 (32.7%)	
Moderate loneliness	61 (59.8%)	29 (54.7%)	32 (65.3%)	
Severe loneliness	3 (2.9%)	2 (3.8%)	1 (2.0%)	

Data are presented as mean (standard deviation) unless otherwise indicated. BMI: Body Mass Index; CIRS: Cumulative Illness Rating Scale; SPPB: Short Performance Physical Battery; MMSE: Mini-mental State Evaluation; GDS: Geriatric Depression Scale; QoL: Quality of life; JG: De Jong Gierveld scale.

¹ Student's t-test.

² Chi square test.

³ Fisher's exact test.

resistance, balance, and walking training exercises. Resistance exercises were tailored to the individual's functional capacity using variable resistance training machines with two to three sets of eight to ten repetitions with a load equivalent to 40%–60% of the 1-repetition maximum at a fast intentional velocity. The balance and gait retraining exercises gradually progressed with increasing difficulty. In the evening session, the intervention group performed functional unsupervised exercises using light loads, such as knee extension and flexion hip abduction using ankle cuffs, and daily walking in the corridor.

2.3. Endpoints

2.3.1. Primary endpoint: Loneliness and social isolation

To examine loneliness, the Lubben scale was used as a criterion for isolation, qualifying isolated patients who scored less than 12 points on admission [17]. This scale is a self-report measure of social engagement including family and friends. The Lubben Scale provides a standardized way to quantify an older adult's level of social connectedness, allowing healthcare providers to efficiently screen for and identify those who may be experiencing problematic social isolation. To quantify the degree of loneliness, the De Jong Gierveld (JG) scale was used and classified as moderate or severe loneliness with values greater than or equal to 3 on

admission [18]. In this 6-item scale, three statements are made about 'emotional loneliness' and three about 'social loneliness'. The widespread use of the JG Loneliness Scale as a criterion for identifying loneliness makes it a valuable tool in clinical and research settings focused on the well-being of older adults and other populations at risk of social isolation and loneliness.

2.3.2. Secondary endpoints

Medical records were reviewed and a comprehensive geriatric assessment was performed at the time of enrolment and at the end of the 3-day intervention or control period. Collected variables included functional status (Barthel Index) [19], Short Physical Performance Battery (SPPB) [20], quality of life (EuroQol Scale-5D) [21], depression (Yesavage Geriatric Depression Scale- GDS) [22], and cognition through the Mini-Mental State Evaluation (MMSE) [23].

2.4. Statistical analysis

Baseline demographic and clinical characteristics were presented and categorised by the intervention group while considering loneliness and social isolation status. Categorical variables are described using frequencies and percentages, whereas continuous variables are expressed

Table 2
Baseline characteristics according to social isolation or loneliness.

Endpoint	Not isolated (Lubben) n = 85	Isolated (Lubben) n = 16	p-value
Age	87.1 (4.5)	88.1 (4.8)	0.427 ¹
Gender			0.494 ²
Men	51 (60.0%)	9 (56.3%)	
Women	34 (40.0%)	7 (43.8%)	
BMI	26.4 (4.7)	27.5 (7.0)	0.419 ¹
CIRS	13.2 (6.0)	13.2 (6.0)	0.981 ¹
Cause of hospitalisation			0.187 ³
Cardiovascular	25 (29.8%)	3 (18.8%)	
Infectious	32 (38.1%)	9 (56.3%)	
Pulmonary	3 (3.6%)	1 (6.3%)	
Gastrointestinal	10 (11.9%)	2 (12.5%)	
Neurological	1 (1.2%)	1 (6.3%)	
Other	13 (15.5%)	0 (0.0%)	
SPPB	5.1 (2.9)	3.7 (2.1)	0.041 ¹
Barthel Index	77.0 (19.4)	62.8 (24.5)	0.006 ¹
MMSE	22.4 (4.6)	22.4 (4.6)	0.497 ¹
GDS	2.7 (2.6)	4.1 (2.6)	0.031 ¹
Handgrip	16.6 (6.6)	14.6 (6.3)	0.151 ¹
QoL	70.6 (24.7)	79.2 (16.1)	0.113 ¹

Endpoint	Not alone (JG) n = 38	Moderate or severe loneliness (JG) n = 64	p-value
Age	88.4 (4.8)	86.8 (4.1)	0.049 ¹
Gender			0.002 ³
Men	15 (39.5%)	45 (70.3%)	
Women	23 (60.5%)	19 (29.7%)	
BMI	25.3 (5.5)	27.4 (4.9)	0.030 ¹
CIRS	11.7 (4.6)	14.1 (6.4)	0.017 ¹
Cause of hospitalisation			0.609 ³
Cardiovascular	12 (32.4%)	16 (25.0%)	
Infectious	12 (32.4%)	31 (48.4%)	
Pulmonary	1 (2.7%)	3 (4.7%)	
Gastrointestinal	5 (13.5%)	7 (10.9%)	
Neurological	1 (2.7%)	1 (1.6%)	
Other	6 (16.2%)	6 (9.4%)	
SPPB	5.0 (3.0)	4.6 (2.8)	0.262 ¹
Barthel Index	77.6 (16.7)	73.4 (22.7)	0.164 ¹
MMSE	23.0 (4.1)	22.0 (4.9)	0.149 ¹
GDS	2.2 (1.9)	3.3 (2.8)	0.013 ¹
Handgrip	14.3 (5.5)	17.3 (6.9)	0.017 ¹
QoL	75.0 (22.6)	70.0 (14.0)	0.157 ¹

Lubben scale qualified isolation if <12. Loneliness was measured using the De Jong Gierveld scale, indicating moderate or severe loneliness if ≥3. BMI: Body Mass Index; CIRS: Cumulative Illness Rating Scale; SPPB: Short Performance Physical Battery; MMSE: Mini-mental State Evaluation; GDS: Geriatric Depression Scale; QoL: Quality of life; JG: De Jong Gierveld scale.

¹ Student's t-test.

² Chi square test.

³ Fisher's exact test.

as means and standard deviations. The effects of the exercise intervention on each loneliness or social isolation group and between-group differences were estimated using ANCOVA models. For each outcome, we included the post-intervention value as the independent variable and the pre-intervention value, randomisation group, loneliness, or social isolation group and the interaction between the two group variables as dependent variables, and it was also adjusted for age, sex, CIRS and reason for hospitalisation. All comparisons were 2-sided, with a significance level of 0.05. All statistical analyses were conducted using SPSS, version 28.0 (IBM Corp) and R, version 4.2.1 (R Foundation) software.

3. Results

3.1. Patient characteristics

Baseline characteristics of the study participants are presented in [Table 1](#). Of the 103 patients included in the analysis, 58.3% were men and the mean age was 87.3 (4.5) years (range 75–101). They were very frail according to the SPPB and handgrip values and had low to moderate functional and cognitive impairment. The values for the risks of isolation and loneliness differed. According to the Lubben scale, 15.8% of patients are at risk of isolation, while 62.7% are at risk of severe or moderate loneliness according to the JG scale.

3.2. Baseline characteristics according to social isolation or loneliness

Baseline characteristics according to social isolation or loneliness are shown in [Table 2](#). According to the Lubben scale, patients who were isolated had lower SPPB (3.7 points vs. 5.1, $p = 0.041$), Barthel scale (62.8 vs. 77.0, $p = 0.006$), and higher GDS (4.1 points vs. 2.7, $p = 0.031$) scores than those in the non-isolated group. No statistically significant differences were observed in MMSE or QoL. Considering the JG scale, higher GDS (3.3 vs. 2.2, $p = 0.013$) was observed in patients with moderate or severe loneliness.

3.3. Effect of the exercise program according to loneliness and social isolation status

3.3.1. Isolation

The non-isolated intervention group had some level of improvement, although some changes did not reach statistical significance ([Table 3](#)).

Training had a significant positive impact on GDS ($B = -1.25$, 95% CI $-0.24-0.27$). Also in the isolated group all outcomes improved, but significant changes were observed only in QoL, with a difference between the intervention and control groups of 41 points (95% CI = 5.38–39.5). A significant difference was observed between the two groups for QoL, indicating better results in the isolated group (30.4 points, 95% CI = 3.96–56.9) than in the non-isolated patients.

3.3.2. Loneliness

The results of the study ([Table 3](#)) demonstrated significant improvements in the SPPB test, with a mean increase of 1.62 points (95% CI = 0.19–3.04) in the non-loneliness exercise group, compared to the control group. Additionally, the non-loneliness exercise group showed significant enhancements in QoL, with a mean increase of 17.1 points (95% CI = 1.84, 32.3) compared to the control group. No differences were found in the moderate-severe loneliness group or in the between-group analysis.

4. Discussion

This research provides significant insights into the impact of loneliness and social isolation on the health and well-being of hospitalised elderly individuals as well as the efficacy of exercise training in improving functional capacity and quality of life for socially isolated or lonely older adults. Our results suggest that the benefits of exercise are not influenced by patients' degree of isolation or loneliness.

Loneliness and isolation are common and increasingly important issues for hospitalised older adults. We found a high prevalence of isolation (12.2%–19.2%) and moderate-to-severe loneliness (58.5%–67.3%), which is somewhat higher than that reported in previous studies due to advanced age, complexity, and frailty in our patients [24]. These situations significantly affect the functional, emotional, and quality of life status of hospitalised older adults, particularly their emotional wellbeing. There is growing recognition of the negative consequences of isolation and loneliness in older adults associated with adverse outcomes. While loneliness is a subjective perception of social deficits, isolation is an objective measure of lack of social contact [25]. Therefore, it is important to consider these entities separately because they involve different aspects of social relationships. In either case, an active and individualised approach is required, given the clear impact of quality on hospitalised older adults, likely both short- and long-term.

Table 3
Effect of exercise training considering loneliness and social isolation.

Endpoint	Non isolated (Lubben) n = 85 Intervention vs. control Beta (IC95%)	Isolated (Lubben) n = 16 Intervention vs. control Beta (IC95%)	Difference between non isolated and isolated Beta (IC95%)	p-value
SPPB	0.92 (−0.10, 1.94)	1.89 (−0.41, 4.20)	0.98 (−1.54, 3.50)	0.441
Barthel Index	4.56 (−4.34, 13.5)	8.61 (−11.3, 28.5)	4.05 (−17.5, 25.6)	0.709
MMSE	0.62 (−1.13, 2.37)	1.01 (−2.58, 4.61)	0.39 (−3.64, 4.42)	0.848
GDS	−1.25 (−0.24, −0.27)	0.34 (−1.74, 2.41)	1.59 (−0.71, 3.88)	0.172
Handgrip	1.04 (−0.70, 2.78)	0.85 (−3.32, 4.75)	−0.33 (−4.67, 4.02)	0.881
QoL	10.5 (−0.01, 21.1)	41.0 (5.38, 39.5)	30.4 (3.96, 56.9)	0.025
Endpoint	Not alone (JG) n = 38 Intervention vs. control Beta (IC95%)	Moderate or severe loneliness (JG) n = 64 Intervention vs. control Beta (IC95%)	Difference between not alone and moderate-severe loneliness Beta (IC95%)	p-value
SPPB	1.62 (0.19, 3.04)	0.78 (−0.36, 1.92)	−0.83 (−2.63, 0.96)	0.354
Barthel Index	5.07 (−7.26, 17.4)	4.85 (−5.13, 14.8)	−0.22 (−15.7, 15.3)	0.977
MMSE	1.88 (−0.51, 4.28)	0.05 (−1.86, 1.95)	−1.84 (−4.79, 1.12)	0.220
GDS	−1.11 (−2.52, 0.30)	−0.77 (−1.89, 0.36)	0.34 (−1.42, 2.10)	0.701
Handgrip	2.62 (−0.59, 3.81)	0.24 (−1.72, 2.20)	−2.38 (−5.49, 0.73)	0.132
QoL	17.1 (1.84, 32.3)	15.2 (−10.5, 16.5)	−1.89 (−21.1, 17.3)	0.845

SPPB: Short Performance Physical Battery; JG: De Jong Gierveld scale; MMSE: Mini-mental State Evaluation; QoL: Quality of life; GDS: Geriatric Depression Scale. In the two tables, the first column shows the training effect (intervention/control) in the non-isolated/non-alone group. The second column shows the training effect in the isolated/alone group. The third column and the p-value are the differences between the two previous columns, that is, the difference in the training effect between isolated and non-isolated (alone/not alone). Results are adjusted for age, sex, CIRS and cause of hospitalisation.

Bold entry: statistical significance.

To our knowledge, no previous study has combined both definitions to address exercise intervention responses among hospitalised older adults. Given the significant impact of loneliness and isolation on the quality of life, active individualised approaches are warranted.

Available evidence indicates that social support and physical activity are closely linked in older adults, and those receiving greater support for activity are more likely to engage in leisure-time exercise [26]. Conversely, loneliness and isolation have detrimental health effects, and interventions that activate lonely older adults can help reverse these [27]. Among community-dwelling older adults, exercise improves psychological well-being, social connectedness [28], and decreases loneliness and isolation [29]. Psychosocial group rehabilitation is also associated with lower mortality and healthcare utilisation [27] and the potential negative impacts of isolation on health are comparable to those of smoking 15 cigarettes per day [6]. Although exercise has numerous benefits and can reduce loneliness [30], few trials have investigated these potential benefits during hospitalisation [31]. Our RCT is the first to examine the effects of isolation and loneliness on individualised in-hospital exercise for delirium prevention, filling an important gap. Our findings suggest that the program can significantly improve the quality of life of isolated individuals, which is an important consideration given rising social isolation. Previous meta-analytic evidence highlighted multicomponent interventions including physical exercise as one of the most effective therapeutic strategies to reduce loneliness and social isolation in older adults [31]. Our findings also suggest that individualised exercise programs may be an effective strategy not only for preventing HAD but also for improving the health and well-being of isolated or lonely older adults.

This study has several limitations. First, the sample size was small, and the intervention duration was relatively brief on three consecutive days. Additionally, our single-hospital source limited the generalisability of the results to other settings. Furthermore, substantial heterogeneity exists in quantifying loneliness and social degrees across literature, hampering comparisons between studies and interventions. However, the randomised clinical trial design effectively underscores the role of loneliness and isolation in exercise response and highlights the importance of preventing HAD during acute geriatric unit admission.

5. Conclusion

In summary, this study revealed that hospitalised older adults grappling with elevated levels of social isolation and loneliness could benefit from engaging in physical exercise to avert both functional and emotional deterioration. Exercise may also enhance the quality of life of older adults. Additional research should explore the potential of exercise to mitigate isolation during hospitalisation. Training programs aimed at preventing functional decline in hospitalised older adults should incorporate exercises that encourage patient-provider and patient-patient relationships, as these are likely to have reciprocal positive effects on physical and social well-being.

Author contributions

Study concept and design: NMV, FZF, MI, JYL.
Acquisition of subjects and/or data NMV, IME.
Analysis and interpretation of data: MLSA, AG.
Preparation of manuscript NMV, MLSA, FZF, MCF, MI.
Final approval of the manuscript NMV, MLSA, FZF, AG, IME, MCF, JYL, MI.

Sponsor's role

None.

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Conflict of interest

The authors declare no conflicts of interest.

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"Y algunas veces suelo recostar/Mi cabeza en el hombro de la luna/Y le hablo de esa amante inoportuna/Que se llama soledad".

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