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Original Article

Frailty associations with socioeconomic status, healthcare utilisation and quality of life among older women residing in regional Australia

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Abstract

Objectives: The health and well-being of older women may be influenced by frailty and low socioeconomic status (SES). This study examined the association between frailty and SES, healthcare utilisation and quality of life (QOL) among older women in regional Australia. **Methods**: Cross-sectional analysis of the Geelong Osteoporosis Study was conducted on 360 women (ages ≥60yr) in the 15-year follow up. Frailty was identified using modified Fried's phenotype. Individual SES measures and healthcare utilisation were documented by questionnaire. Area-based SES was determined by cross-referencing residential addresses with the Australian Bureau of Statistics Index of Relative Socio-economic Advantage and Disadvantage (IRSAD). QOL was measured using the Australian World Health Organisation Quality of Life Instrument (WHOQoL-Bref). Multinomial logistic regression was conducted with frailty groupings as outcome. **Results**: Sixty-two (17.2%) participants were frail, 199 (55.3%) pre-frail and 99 (27.5%) robust. Frail participants were older with higher body mass index. Frailty was associated with lower education but not marital status, occupation or IRSAD. Strong associations with frailty were demonstrated for all WHOQoL-Bref domains. Frailty was associated with more primary care doctor visits ($p<0.001$). **Conclusions**: This population-based study highlights the significant impact of frailty on older women, indicating reduced QOL and increased primary care doctor visits.

Keywords: Frailty, Healthcare utilisation, Older women, SES, QOL

Introduction

It is well recognised that older women live longer lives and are at increased risk of frailty as they age[1,2]. The health and well-being of older women may be influenced by frailty and their SES in life[1,3,4].

Frailty is regarded as a multi-dimensional concept that encompasses physical, psychological and social frailty[3]. Through a complex interplay of factors, frailty can increase the risk of adverse health outcomes such as falls, disability, hospitalisation and death[3,5]. The increased burden of multiple diseases, medical conditions and functional impairment with frailty also raises important implications for healthcare utilisation and costs[3,6].

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Socioeconomic inequalities can contribute to significant disparities in health[7,8]. People with lower SES are at greater risk of poor health, have higher rates of illness, disability and live shorter lives than people with higher SES[7,8].

Socioeconomic factors may also contribute to disparities in frailty[9]. Some studies have reported frailty associations with SES measures such as education, income and living in deprived neighbourhoods[9-12]. Nevertheless, the strength of the association might vary for different geographical locations, across urban and rural settings[13,14].

In Australia, socioeconomic disadvantages and poor access to healthcare and social services are significant challenges facing older people living in outer regional, rural and remote areas[15-17]. Additionally, women are considered more vulnerable in their economic position than men as caring roles are often undertaken by the women which can result in them having less personal income and greater reliance upon other family members or their partners[18].

QOL is a broad concept that can be affected by an individual's physical health, personal beliefs and psychological well-being, social relationships and the living environment[19]. Several studies have reported lower QOL for older people with frailty[20,21]. Risk of social isolation, declining mobility and health are some of the challenges to maintaining QOL[22,23]. Nevertheless, there is considerable heterogeneity amongst older individuals who respond to challenges with different levels of resilience[24].

Therefore, the aim of the present study was to examine the interrelationships between frailty and socioeconomic status, healthcare utilisation and quality of life, with the focus on older women living in regional south-eastern Australia.

Materials and Methods

Study Design

This is a cross-sectional secondary analysis of sociodemographic data, SES and QOL measures from the Geelong Osteoporosis Study (GOS)[25].

GOS is an ongoing population-based cohort study involving more than 3200 age-stratified and randomly selected participants (approximately 98% Caucasian) from the Barwon Statistical Division (BSD)[25].

Study Region

The BSD is described by the Australian Bureau of Statistics and situated in South-Eastern Australia[25]. The BSD region comprises the Australian Electoral Commission Divisions of Corio, Corangamite (part) and Lalor (part)[25].

There are approximately 280 000 people living in the BSD region and nearly 16% of the residents are aged ≥65 years[26]. Since the 1990s, this region has undergone significant economic transformation from an industrial port into a major service centre for health and education[27]. Full details of the study have been published elsewhere[25].

Study Participants

A listing on the Australian electoral roll as a resident of the BSD fulfilled inclusion criterion for the study. Persons who were resident for <6 months and those unable to provide written informed consent were excluded from the study.

Data collected from 360 older women aged 60 to 96 years who participated in the 15-year follow-up of the GOS study were used for the current analysis. At the 15-year follow up, participants underwent anthropometry, tests of functional mobility and completed self-reported questionnaires on SES measures, lifestyle factors, healthcare utilisation and QOL.

This study was approved by the Barwon Health Human Research Ethics Committee.

Definition of Frailty used in this study

A modified version of Fried's phenotype was used. According to Fried's phenotype, frailty is the presence of ≥3 of 5 criteria: unintentional weight loss of ≥10 lbs (approximately 4.5 kg) in the preceding year; weak handgrip strength; slow walking speed; self-reported exhaustion; low physical activity[1]. In this study, unintentional weight loss, low physical activity and exhaustion were self-reported[28].

A validated physical activity questionnaire for the elderly was used[25,28]. Participants were asked to report habitual physical activities performed in the preceding year. Scores were assigned for activity type (housework, sports or leisure), intensity and duration. Low physical activity was determined by calculating the overall score[29].

Weakness was determined using handgrip strength (HGS) that was measured with a hand-held Jamar dynamometer[25,28]. Weight and height were measured using electronic scales and a Harpenden stadiometer, respectively, and body mass index (BMI) calculated as weight/height^2 (kg/m^2)[25]. Weakness corresponded to HGS values below cut-off points as used in the Fried's phenotype, equivalent to the lowest 20% stratified by BMI[28]. Walking speed was measured using timed up & go (TUG) test over 3 metres[28]. A score ≥10 seconds was considered as slow[28].

Participants were stratified into 3 categories: frail (3 or more criteria present); pre-frail (1-2 criteria present); robust (0 criteria present).

SES measures

Individual SES measures used in this study were marital status, highest education level attained, longest occupation held; area-based SES was also determined.

The Australian Bureau of Statistics (ABS) Index of Relative Socio-economic Advantage and Disadvantage (IRSAD) was used to determine area-based SES of participants. Socio-economic Indexes for Areas (SEIFA) values using 2011 ABS census data were determined using ABS software (these rank areas in Australia according to relative socioeconomic advantage and disadvantage), which were ranked in quintiles[25,28]. The

Characteristics	All participants (N=360)	Frailty groups			
		Robust (N=99)	Pre-frail (N=199)	Frail (N=62)	Comparison between groups (p-value)
Age: median (IQR), yr	71.8 (8.0)	69.0 (6.3)	71.6 (7.8)	76.8 (8.6)	0.002
BMI					
Mean (SD), kg/m^2	29.0 (6.0)	27.8 (5.2)	29.3 (5.9)	29.9 (6.9)	0.026
Marital status					
Single/Never married	10 (2.8)	1 (1.0)	7 (3.5)	2 (3.2)	0.008
Married/Living with partner	225 (62.5)	75 (75.8)	120 (60.3)	30 (48.4)	
Separated/ Widowed	125 (34.7)	23 (23.2)	72 (36.2)	30 (48.4)	
Highest education level					
Did not complete secondary education	239 (66.8)	58 (59.2)	129 (65.2)	52 (83.9)	0.015
Completed secondary education	55 (15.4)	21 (21.4)	29 (14.7)	5 (8.1)	
Completed tertiary education	64 (17.9)	19 (19.4)	40 (20.2)	5 (8.1)	
Longest occupation held					
Skilled/ Professional	106 (30.1)	32 (32.7)	63 (32.5)	11 (18.3)	0.307
Low-skilled/Non-professional	185 (52.6)	49 (50.0)	99 (51.0)	37 (61.7)	
Housewife/Unemployed	61 (17.3)	17 (17.4)	32 (16.5)	12 (20.0)	
IRSAD					
Most Disadvantaged	111 (30.8)	24 (24.3)	66 (33.2)	20 (40.8)	0.072
Intermediate	142 (39.5)	41 (41.3)	74 (37.2)	20 (40.8)	
Most Advantaged	107 (29.7)	34 (34.4)	59 (29.7)	9 (18.4)	
Healthcare Utilisation					
Primary care doctor visits					
None	146 (40.6)	52 (52.5)	80 (40.2)	14 (22.6)	<0.001
1-2	192 (53.3)	47 (47.5)	107 (53.8)	38 (61.3)	
≥3	22 (6.1)	0 (0)	12 (6.0)	10 (16.1)	
Hospital Presentations					
None	337 (94.1)	92 (93.9)	189 (95.0)	56 (91.8)	0.556
≥1	21 (5.9)	6 (6.1)	10 (5.0)	5 (8.2)	

Abbreviations: SD= standard deviation; IQR = interquartile range (25th percentile, 75th percentile); BMI= body mass index; IRSAD = Index of Relative Socio-economic Advantage and Disadvantage.

Table 1. Characteristics of participants by frailty status.

quintiles were further collapsed into three groupings of most disadvantaged (quintiles 1 and 2), intermediate (quintile 3) and most advantaged (quintiles 4 and 5).

Highest education level attained, longest occupation held and marital status were self-reported. Characteristics of each variable were divided into three broad categories. Highest education level attained was categorised as "did not complete secondary education"; "completed secondary school education"; and "completed tertiary education". Longest occupation held was categorised as "skilled/professional"; "low-skilled/non-professional"; and "housewife/unemployed". Marital status was categorised as "single/not married"; "married/living with partner"; and "separated/widowed".

Frequency of Healthcare Utilisation

Frequency of primary care doctor visits or hospital presentations over a 4-week period were self-reported and divided into 3 levels: "none"; "1-2 presentations"; and "≥3 presentations".

Characteristics	Pre-frail (N=199)		Frail (N=62)	
	Comparison with robust group		Comparison with robust group	
	OR unadjusted (95% CI) [p-value]	OR adjusted (95% CI)* [p-value]	OR unadjusted (95% CI) [p-value]	OR adjusted (95% CI)* [p-value]
Age, yr	1.05(1.02-1.09) [p=0.003]	1.04 (1.01-1.08) [p=0.025]	1.14 (1.09-1.19) [p<0.001]	1.15 (1.08-1.21) [p<0.001]
BMI, kg/m^2	1.05 (1.00-1.10) [p=0.035]	1.07 (1.02-1.12) [p=0.009]	1.07 (1.01-1.13) [p=0.027]	1.10 (1.03-1.18) [p=0.007]
Marital status				
Married/Living with partner	Reference	Reference	Reference	Reference
Single/Never married	4.37 (0.53-36.38) [p=0.172]	3.69 (0.33-41.04) [p=0.288]	5.00 (0.44-57.42) [p=0.196]	4.07 (0.32-52.32) [p=0.282]
Separated/Widowed	1.96 (1.13-3.40) [p=0.017]	1.62 (0.89-2.94) [p=0.112]	3.26 (1.64-6.50) [p=0.001]	1.50 (0.63-3.56) [p=0.357]

*Abbreviations: BMI = body mass index; OR = odds ratio; CI = confidence interval. *Adjusted for age, BMI as continuous variable, marital status, highest education attained, longest occupation held and IRSAD.*

Table 2. Multinomial logistic regression model comparing Age, BMI and Marital Status between Pre-frail and Frail vs Robust Group.

QOL measure

The Australian World Health Organisation QOL questionnaire (WHOQoL-Bref) was used[25,30]. It consists of 26 items that measure overall QOL and four specific QOL domains: physical health, psychological, social relationships and environment. Using a 5-point scale, participants were asked to rate their score based on their experiences over the previous 2 weeks. Higher scores indicate better QOL[30,31].

Statistical methods

Stata Statistical Package (StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC.) was used. Continuous data were summarised using means with standard deviations or medians with interquartile range (IQR 25th and 75th percentiles) for skewed data. Categorical data were reported using frequencies and percentages.

Multinomial logistic regression (with frailty group as dependent variable) was used to investigate the association between frailty and participant characteristics. Estimates from both the unadjusted and adjusted models were reported. The latter were adjusted for age, BMI, marital status, education, occupation and IRSAD.

The association between primary care doctor visits and frailty was examined using multinomial logistic regression (with health service use as dependent variable), while binary logistic regression was used for hospital presentations vs frailty. Results were then reported as odds ratios (OR) with 95% confidence intervals (CI).

Associations between QOL and frailty were examined using linear regression models (with QOL as the dependent variable) and age, BMI, marital status, highest education attained, longest occupation held and IRSAD were added to the models to obtained adjusted estimates. Results were presented as differences between mean estimate for robust group (referred to as the 'reference' category) and mean estimate for either pre-frail or frail subgroups, together with the 95% confidence interval for the difference.

Results

Baseline characteristics of the study participants are summarised in Table 1. From a total of 360 participants, there were 99 robust (27.5%), 199 pre-frail (55.3%) and 62 frail (17.2%). Median age of participants was 71.8 years. Participants who were frail were older. Age was associated with frailty, independent of all other characteristics (Table 2).

Mean BMI of participants was 29.0 kg/m^2. Frail participants had higher mean BMI than those in the pre-frail or robust groups. As shown in Table 2, mean BMI was associated with frailty, even after adjustment for other characteristics.

There was no association between marital status and frailty. Although the proportion of women who were widowed or separated was higher in the frail group than in the pre-frail and robust groups, results were not statistically significant after adjusting for other variables (Table 2).

Association with SES measures

As shown in Table 1, approximately two thirds of all participants did not complete secondary school education. More participants in the robust group completed secondary school or tertiary education compared to the pre-frail and

Characteristics	Pre-frail (N=199)		Frail (N=62)	
	Comparison with robust group		Comparison with robust group	
	OR unadjusted (95% CI) [p-value]	OR adjusted (95% CI)* [p-value]	OR unadjusted (95% CI) [p-value]	OR adjusted (95% CI)* [p-value]
Highest education level				
Did not complete secondary education	Reference	Reference	Reference	Reference
Completed secondary education	0.62 (0.33-1.18) [p=0.146]	0.66 (0.34-1.27) [p=0.211]	0.27 (0.09-0.76) [p=0.013]	0.20 (0.05-0.72) [p=0.014]
Completed tertiary education	0.95 (0.50-1.78) [p=0.864]	1.06 (0.50-2.25) [p=0.883]	0.29 (0.10-0.84) [p=0.023]	0.55 (0.16-1.97) [p=0.361]
Longest occupation held				
Skilled/ Professional	Reference	Reference	Reference	Reference
Low-skilled/Non-professional	1.03 (0.59-1.77) [p=0.926]	0.98 (0.51-1.87) [p=0.954]	2.20 (0.98-4.93) [p=0.056]	1.39 (0.52-3.69) [p=0.512]
Housewife/Unemployed	0.96 (0.46-1.98) [p=0.904]	0.96 (0.43-2.14) [p=0.921]	2.05 (0.75-5.63) [p=0.162]	1.56 (0.48-5.07) [p=0.460]
IRSAD				
Most Disadvantaged	Reference	Reference	Reference	Reference
Intermediate	0.66 (0.36-1.20) [p=0.172]	0.61 (0.31-1.21) [p=0.157]	0.75 (0.35-1.61) [p=0.465]	0.56 (0.23-1.37) [p=0.202]
Most Advantaged	0.63 (0.34-1.19) [p=0.152]	0.70 (0.34-1.43) [p=0.328]	0.47 (0.20-1.11) [p=0.084]	0.70 (0.25-1.94) [p=0.496]

*Abbreviation: OR = odds ratio; CI = confidence interval; IRSAD = Index of Socio-economic Advantage and Disadvantage. *Adjusted for age, BMI as continuous variable, marital status, highest education attained, longest occupation held and IRSAD.*

Table 3. Multinomial logistic regression model comparing Highest Education Level, Occupation, IRSAD between Pre-frail and Frail vs Robust Group.

frail groups. Lower education was associated with frailty, even after adjustment for other characteristics (Table 3). No association with frailty was demonstrated for occupation and IRSAD ranking of socioeconomic disadvantage.

Association with QOL

Table 4 shows comparison of WHOQoL-Bref scores across frailty groups. Frailty is associated with each of the four WHOQoL-Bref domains with the strongest correlations demonstrated for physical health and psychological domains. For physical health, adjusted mean differences were – 28.9 (95% CI -34.7 to -23.1, p<0.001) for frail participants and -11.6 (95% CI -14.8 to -8.3, p<0.001) for pre-frail participants, compared with robust participants, respectively. Likewise, for psychological well-being, adjusted mean differences were -17.2 (95% CI -22.6 to -11.8, p<0.001) and -8.9 (95% CI -12.5 to -5.4, p<0.001) compared with robust participants, respectively.

Association with Frequency of Healthcare Utilisation

The number of primary care doctor visits and hospital presentations over a 4-week period were compared across frailty groups (Table 1).

During this period, 16.1% of participants from the frail group (10 out of 62 frail individuals) had three or more primary care doctor visits compared with only 6% of participants from the pre-frail group (12 out of 199 pre-frail individuals) (OR=4.76; 95% CI 1.73-13.14) and none from the robust group. The number of primary care doctor visits was associated with frailty even after adjusting for other characteristics.

Although the proportion of frail participants who were hospitalised in the 4 weeks prior to assessment was slightly higher than in the robust (OR=1.37; 95% CI 0.40-4.70) or pre-frail groups (OR=1.69; 95% CI 0.55-5.15), there was no statistically significant association between numbers of hospital presentations and frailty even after accounting for possible confounding.

Discussion

Results of this study confirmed that older age is associated with frailty. The proportion of frailty in the sample was 17.2% which is comparable to prevalence figures reported in other studies[32,33]. Frail participants had

WHOQoL-Bref Domains	Data summary	Comparison across Groups			
		Unadjusted		Adjusted*	
	Mean (SD)	Difference (95% CI)	p-value	Difference (95% CI)	p-value
Physical health					
All participants	67.7 (17.8)				
Robust	80.6 (12.0)	Reference		Reference	
Pre-frail	66.7 (14.9)	- 13.8 (-17.0, -10.6)	<0.001	-11.6 (-14.8, -8.3)	<0.001
Frail	49.4 (17.6)	-31.2 (-36.2, -26.1)	<0.001	-28.9 (-34.7, -23.1)	<0.001
Psychological					
All participants	67.9 (16.2)				
Robust	76.6 (13.4)	Reference		Reference	
Pre-frail	66.5 (15.6)	-10.0 (-13.5, -6.6)	<0.001	-8.9 (-12.5, -5.4)	<0.001
Frail	58.0 (15.4)	-18.6 (-23.3, -13.9)	<0.001	-17.2 (-22.6, -11.8)	<0.001
Social relationships					
All participants	72.5 (18.6)				
Robust	78.1 (19.1)	Reference		Reference	
Pre-frail	71.2 (17.5)	-7.0 (-11.5, -2.4)	0.003	-5.9 (-10.5, -1.3)	0.012
Frail	67.3 (19.1)	-10.9 (-17.1, -4.7)	0.001	-8.4 (-15.4, -1.5)	0.017
Environment					
All participants	78.9 (13.2)				
Robust	85.1 (11.6)	Reference		Reference	
Pre-frail	78.1 (13.0)	-7.1 (-10.0, -4.1)	<0.001	-5.3 (-8.3, -2.3)	0.001
Frail	71.8 (12.3)	-13.3 (-17.2, -9.4)	<0.001	-10.1 (-14.4, -5.9)	<0.001

Abbreviations: SD = standard deviation; CI = confidence interval. *Adjusted for age, BMI, marital status, highest education attained, longest occupation held and IRSAD.

Table 4. Comparison of WHOQoL-BREF scores across Frailty Groups.

higher mean BMI than pre-frail or robust participants. Whilst this may seem counterintuitive to the concept of frailty as a wasting disorder, the results are consistent with other studies, suggesting that obesity is linked to frailty[4,34,35].

This study demonstrated an association between lower education and frailty. Marital status, occupation and IRSAD were not associated with frailty. Unlike some studies, data on household income were unavailable.

An inverse relationship between frailty and SES was demonstrated in a number of international cohort studies[9,10,36,37]. Higher odds of frailty were demonstrated for older women who were less educated and living on lower income[1,4,9,36,37]. Nevertheless, higher education may not protect against frailty progression when other factors such as income and chronic disease burden are taken into account[11].

Low-skilled or manual occupation was associated with greater frailty risk compared to higher-skilled, white-collar occupation[36-39]. However, some studies reported different findings[40,41]. One study found that the association between manual occupation and frailty in older women was partly mediated by lifestyle factors such as low physical activity and obesity[40]. Another older population study in Spain found no association between frailty prevalence and occupation type[41].

According to the Australian Longitudinal Study of Women's Health, women who struggled to manage on their income in later life were three times more likely to be frail than those on more stable income[10]. In contrast, education and occupation were mitigated over time, suggesting that socioeconomic disadvantages in early-life and mid-life have less influence on frailty risk[10].

In the current study, occupation was ascertained as "the longest occupation held" and participants who had never been gainfully employed were assigned to the "housewife/unemployed" category. Given the older age of participants,

it is likely that a high proportion were already retirees. Other factors such as retirement income, lifestyle changes and health status might have moderated any influence of occupation over frailty. However, more research is required to examine this.

Neighbourhood socioeconomic disadvantages can influence frailty risk[12,14]. An English study found that poor older people who lived in deprived neighbourhoods had the highest risk of being frail[12]. A deprived neighbourhood can have composite characteristics such as poor housing, low economic environment, high crime rates, low social cohesion, overcrowding, poor accessibility to walkways and other amenities[14,42].

Area-based SES according to IRSAD ranking was not associated with frailty in the current study but an association was detected in another study in Adelaide, South Australia[43]. Although there were fewer participants in the Adelaide study, there was a higher proportion of frail participants in the most disadvantaged socioeconomic group[43].

Partner status can contribute to disparities in frailty[13,38,44]. Findings from one meta-analysis showed that individuals who never married carried a greater risk of frailty than those who were married but the odds of the risk were lower than those who were widowed, divorced or separated[44].

Although the current study did not detect an association between frailty and marital status, frailty associations with marital status were reported to vary across different geographical locations[44]. More research is required to examine if these findings are influenced by differences in social norms and values.

Using the WHOQol-Bref instrument, the current study demonstrated that frailty was associated with lower self-rated QOL across all domains of physical health, psychological, environment and social well-being. Both frail and pre-frail groups experienced lower QOL compared to the robust group. In both groups, the strongest associations were seen for physical health and psychological well-being. This was followed by environment and social relationships respectively.

According to one Dutch study, QOL for older people included staying independent, being in good health, feeling good, having social relationships and living in a safe environment[22]. However, physical frailty can lead to loss of independence and the inability to adjust expectations or adapt to the physical decline, can be detrimental to the psychological well-being[22]. Priorities of the QOL domains were also observed to change over time[22]. As frailty increased, social relationships replaced physical health as the most important QOL domain[22].

It is well recognised that frailty is associated with multiple medical co-morbidities, polypharmacy, falls and disability[3,5,45]. Accordingly, some studies have reported increased use of healthcare services and increased healthcare expenses in frail older people[6,46-49].

The current study demonstrated greater frequency of primary care doctor visits with frailty which likely reflects the poorer health status and complex care needs of frail older people. There was no increase in the number of hospital presentations with frailty. However, there were only 21 hospital presentations during the 4-week study period so it is possible that the study was underpowered to detect an association. Nevertheless, other studies have reported increased presentations of frail older people to hospitals[48,49].

The study has the following limitations. Missing data for some participants might have resulted in differential bias. It might be that participants who were lost to follow up were frail, had poorer health status or lower socioeconomic position. The study may be underpowered to detect frailty associations with IRSAD and hospital presentations. Due to the cross-sectional design, we cannot infer causality. As the study population was predominantly Caucasian, the findings may not be generalisable to more culturally diverse populations.

Strengths of the study included utilisation of multiple individual and area-based SES measures. Participants were not selected on the basis of frailty. A random population-based sample with a wide age range was used.

Conclusions

In this population-based sample of older women, lower education was associated with frailty. No association with frailty was demonstrated for marital status, occupation or IRSAD. Frailty was associated with lower QOL and increased primary care doctor visits which highlights the significant impact on older women. Further research is needed to identify specific challenges to maintaining QOL for these women and to address whether increasing health literacy will improve their health outcomes.

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