Original Article

Multimorbidity and Depression Increase Prevalence of Frailty of Community-dwelling Indonesian Older Adults: Indonesia Care Networks Study

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Abstract

Background: Older adults with frailty have an increased risk of multiple negative health outcomes, such as disability, falls, and morbidity when exposed to physical stressors. The present study investigated the prevalence of frailty and associated risk factors among community-dwelling Indonesian older adults in several districts in Jakarta, Indonesia. **Methods:** This cross-sectional study was done in several urban villages in Jakarta, Indonesia. It involved community-dwelling Indonesian older adults aged 60 and over. Sociodemographic and multiple health data were assessed and measured by a trained interviewer. Frailty was evaluated using Fried's criteria. **Results:** The data analysis found a 14.7% prevalence of frailty among 518 participants. Multivariate analysis showed that frailty was independently associated with females (OR 3.62, 95% CI: 1.73–7.55), having multimorbidity (OR 2.01, 95% CI: 1.21–3.35), and clinical depression (OR 2.13, 95% CI: 1.24–3.65). **Conclusions:** Early interventions in younger older adults, especially women in their early 50s or 60s, might decrease frailty risk over age 60. Controlling chronic disease and better mental education and support to reduce depression risk could reduce frailty risk.

Keywords: *Depression, frailty, Indonesia, multimorbidity, older adults, risk factors*

Introduction

With the rapid increase in the aging population, the number of individuals with frailty is also rising. People with frailty have high dependency needs and require extra care, increasing the spending on community resources, hospitalization, and nursing homes.[1] These factors thus put high pressure—and increase the financial burden—on the family and healthcare systems.[2] Frailty is an age-related condition characterized by an increased vulnerability in physiological functioning. Older adults with frailty have an increased risk of multiple negative health outcomes, such as disability, falls, and morbidity when exposed to physical stressors.[2] Frailty has become a serious public health concern among the geriatric population. A meta-analysis by O'Caoimh *et al.*[3] showed that the pooled prevalence using physical frailty measures was 12% and 24% using the frailty index, whereas prefrailty has a 46%–49% pooled prevalence among the older population. The prevalence of frailty was highest in Africa (22%) and lowest in Europe (8%). In Indonesia, there are more than 26 million older adults (aged 60 and over), which contributed to more than 9% of the total Indonesian population in 2020. This number is projected to increase to 12.9% of the total population in 2030.[4]

Many different measurements have been used to establish frailty, but no gold standard measure has been established so far. Among those measurements, the Fried's frailty phenotype developed by Fried *et al.*[5] using data from the Cardiovascular Health Study (CHS) is one of the most widely used methods to assess frailty. This instrument incorporated five indicators included unintentional weight loss, exhaustion, handgrip weakness, slow walking speed, and low physical activity. Frailty measured by Fried's criteria has been shown to be associated with multiple negative health outcomes, such as disability, falls, hospitalization, and death with high human and economic costs.[1,2,4-8]

The first step in developing strategies to prevent frailty is identifying and

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exploring risk factors related to frailty. Multiple studies have analyzed factors associated with frailty, but the findings across these studies have been inconsistent.[9,10] These show that more research regarding associated or risk factors of frailty, especially in developing country is needed. In addition, previous data suggested that frailty of older adults in different countries show different associated risk and protective factors due to variations in sociodemographic, cultural, geographical, educational, and healthcare access characteristics. In addition, the number of studies exploring frailty-associated factors in Indonesia are still low.[11,12] A study by Setiati *et al.*[11] found that one in five Indonesian community-dwelling older adult was frail and that frailty was associated with functional dependence, being at risk of malnutrition or being malnourished, having depression, having a history of falls, hospitalization, and polypharmacy. Rizka *et al.*[12] found that the prevalence of frailty in Indonesian nursing homes was 46.5%, with physical frailty mostly associated with malnutrition. This research is different from previous research, particularly because this study also investigates multimorbidity as potential associated factors of frailty. This study aims to identify and explore associated risk factors for frailty among community-dwelling Indonesian older adults living in several districts in Jakarta, Indonesia. The potential factors included are sociodemographic, health indicators, and cognitive assessments.

Methods

Study design and participants

This analytical cross-sectional study included 518 older adults living in several urban village in West Jakarta, Indonesia. The sampling method was consecutive sampling. Participants were approached by cadres in each hamlet and the interviews were done in each neigbourhood community post by trained interviewers. Participants who were unable to walk were visited by the interviewer to be interviewed in the participant's home. The inclusion criteria were: individuals needed to be 60 years or older, who were willing to participate in the study and able to provide informed consent. Informed consent was obtained for all participants before study onset and ethical approval was given by Indonesian Institute of Sciences Research Ethical Clearance Commission for the study (Number: 1/klirens/VI/2020).

Data collection

Sociodemographic data collected included sex, age (in years), and marital status. Anthropometric data were taken using standard measurements (body weight and body height). We used medical weight scale for body weight measurement while using sliding caliper for measuring knee height. Knee height was defined as the distance from the sole of the foot to the most anterior surface of the femoral condyles with flexion of knee and ankle at 90° angle. Body height was estimated using knee height. Body mass index (BMI) was calculated using those data and then grouped based on the Asia Pacific Classification into normal (18.5–22.9), underweight (<18.5), and overweight/obese (≥23).[13] Frailty was assessed using Fried's scale phenotype of frailty, which consists of five items including shrinking or unintentional weight loss, self-reported exhaustion, weakness, slowness, and low physical activity.[5] Each item was scored zero or one (if present). The total scores were classified into robustness (score = 0), being prefrail (score = 1–2), or frail (score = 3–5). Shrinking was assessed using BMI <18.5. Self-reported exhaustion was assessed from items in the CES-D, "I felt everything that I did was an effort" and "I could not get going", which options ranged from (1) never or rarely to (4) most of the time.[14] Self-reported exhaustion was assigned if the answer on either question was "often" or "most of the time." Weakness was assessed based on handgrip strength using a dynamometer on each hand twice, and the dominant strength was used. Weakness was assigned if the handgrip strength was below 23.7. Slowness was assessed based on a 4-m timed walk and classified as slowness if time for the 4-m walk was below 4.78 min (mean). Low physical activity was assessed based on the IPAQ-S7S protocol.[15] IPAQ-S7S was self-reported based on the last 7 day recall physical activity.

The participants were also asked questions regarding smoking status and chronic disease as well as the 15-item Geriatric Depression Scale (GDS), Activity Daily Living (ADL) and Instrumental Activity Daily Living (IADL) questions measured by Barthel Index, and CERAD Neuropsychological Assessment.[16,17] The CERAD Neurophysiological Assessment contained several tools to assess cognitive function, including the Mini-Mental State Examinations (MMSE), Word List Memory, the Boston Naming Test (BNT), Verbal Fluency, Constructional Praxis, Word List Recall, and Word List Recognition. Chronic conditions included self-report on whether the participants had been diagnosed by a healthcare provider with heart disease, kidney disease, stroke, hypertension, diabetes, cancer, liver disease, and arthritis. According to WHO, multimorbidity is the coexistence of the two or more chronic conditions in the same individuals or this term also refers to people with multiple health conditions.[18] In this study, multimorbidity was defined as having more than one of the chronic condition listed. A score equal to or more than 5 from GDS was classified as depression.[19] Participants were defined as dependent on the ADL and IADL if the score from Bartel Index was lower than 20 and 9, respectively.[20] The MMSE was used to determine if the participants had dementia by scoring below 21.5.[21] Impairment measured by other CERAD neurophysiological assessments was defined if the participants had scores lower than 19 (Word List Memory), 14 (BNT), 16 (Verbal Fluency), 11 (Constructional Praxis), 7 (Word List Recall), and 10 (Word List Recognition) as per CERAD established cut-off scores for this older population in Jakarta, Indonesia.[17]

Statistical analysis

Binary logistic regression was used to evaluate individual characteristics between nonfrail (which included the prefrail) and frail groups. We conducted multivariate logistic regression to evaluate if significant frailty associations with existing independent variables remained. The analyzed data were presented with a *P* value (lower than 0.05 was considered significant) and 95% confidence interval (CI). All analyses were performed using IBM SPSS software version 22 (IBM, New York, USA).

Results

Characteristics of older adults

A total of 518 older adults were included in this study. Reasons for not participating were being unavailable at the time of interview, was not vaccinated (n = 52), or rejection of participation (n = 42). A total of 518 older adults were enrolled in the analysis. The prevalence of frailty assessed based on Fried's frailty criteria was 14.7% [Table 1]. The majority of the study participants were female (69.8%), most were aged between 60 and 69 years of age (60.2%), followed by those aged between 70 and 79 (35.7%). Half (51%) of the participants were either married or cohabitated. Among these older adults, 43.4% self-reported multimorbidity, 9.8 were smokers, and 23.4% had clinical depression. Dependency measured by ADL and IADL was found in 25.8% and 3.7% of the participants, respectively. Most of the participants (68.5%) were overweight as determined by BMI. Dementia measured by MMSE was found in 19.9% of participants. Of this sample, 69.5%, 44.8%, 56.8%, 23.9%, 74.5%, and 59.3% were found to be impaired in Word List Memory, Boston Naming Test, Verbal Fluency, Constructional Praxis, Word List Recall and Recognition, respectively.

Table 1: Study population characteristics

Variables	Categories	Frequency (*n*)	Percentage (%)
Sex	Male	157	30.3
	Female	361	69.7
Age	60–69	312	60.2
	70–79	185	35.7
	≥80	21	4.1
Marital Status	Not married, Divorced, or Widower	254	49
	Married, or Cohabitation	264	51
Frailty	Robust or Prefrail (Nonfrail)	442	85.3
	Frail	76	14.7
Multimorbidity	None or one	293	56.6
	More than one	225	43.4
ADL	Independent	384	74.1
	Dependent	134	25.8
IADL	Independent	499	96.3
	Dependent	19	3.7
Smoking	No	467	90.2
	Yes	51	9.8
MMSE	Normal	415	80.1
	Dementia	103	19.9
Word List Memory	Normal	158	30.5
	Impaired	360	69.5
Boston Naming Test	Normal	286	55.2
	Impaired	232	44.8
Verbal Fluency	Normal	224	43.2
	Impaired	295	56.8
Constructional Praxis	Normal	124	76.1
	Impaired	394	23.9
Word List Recall	Normal	132	25.5
	Impaired	386	74.5
Word List Recognition	Normal	211	40.7
	Impaired	307	59.3
GDS	Normal	397	76.6
	Depression	121	23.4
BMI	Normal	125	24.1
	Underweight	38	7.3
	Overweight/Obese	355	68.5

ADL, Activity Daily Living; BMI, Body Mass Index; GDS, Geriatric Depression Scale; IADL, Instrumental Activity Daily Living; MMSE, Mini-Mental State Examinations

Factors associated with frailty

Bivariate analyses showed that frailty was significantly associated with being female, having multimorbidity, dependency (measured by ADL and IADL), being curent smoker, dementia (measured by MMSE), impairment in constructional praxis, and having clinical depression (measured by GDS) [Table 2].

Multivariate analysis showed that women were 3.62 times (95% CI: 1.73–7.55) more likely to be frail than males [Table 2]. Having multimorbidity independently doubled the risk of frailty among older adults (AOR: 2.01, 95% CI: 1.21–3.35). Clinical depression also increased frailty risk independently by 2.13 (95% CI: 1.24–3.65).

Discussion

The prevalence of frailty in our study was 14.7%, which is similar to that found in other studies. Meta-analysis by He *et al.*[22] exploring studies from China showed that the prevalence of frailty ranged from 5.9% to 17.4%, with an overall frailty prevalence of 10% among community-dwelling Chinese older adults. Meta-analysis by O'Caoimh *et al.*[3] compromising studies from 62 countries showed a pooled prevalence of 12%–24% of frailty. Age was not associated with frailty, although age can be a risk factor due to general decline of the human physiological condition.

In our study, females had an independent increased risk for frailty, which is consistent with He *et al.*,[22] whose study involved a Chinese population sample. In contrast, an Australian study by Thompson *et al.*[23] showed that

Table 2: Prevalence of frailty and its associated factors

Variables	Categories	Frailty Status		Unadjusted Odd Ratio	*P*	Adjusted Odd Ratio	*P*
		Robust and Prefrail (Nonfrail)	Frail				
Sex	Male	148 (33.5)	9 (11.8)	Reference		Reference	
	Female	294 (66.5)	67 (88.2)	3.75 (1.82–7.73)	<0.001	3.62 (1.73–7.55)	0.001
Age	60–69	263 (59.5)	49 (64.5)	Reference			
	70–79	163 (36.9)	22 (28.9)	0.72 (0.42–1.24)	0.242		
	≥80	16 (3.6)	5 (6.6)	1.68 (0.59–4.49)	0.334		
Marital Status	Not married, Divorced, or Widower	214 (48.4)	40 (52.6)	Reference			
	Married, or Cohabitation	228 (51.6)	36 (47.4)	0.86 (0.52–1.38)	0.497		
Multimorbidity	None or one	261 (59)	32 (42.1)	Reference		Reference	
	More than one	181 (41)	44 (57.9)	1.98 (1.21–3.25)	0.007	2.01 (1.21–3.35)	0.007
ADL	Independent	335 (75.8)	49 (64.5)	Reference			
	Dependent	107 (24.2)	27 (35.5)	1.73 (1.03–2.9)	0.039		
IADL	Independent	430 (97.3)	69 (90.8)	Reference		Reference	
	Dependent	12 (2.7)	7 (9.2)	3.64 (1.38–9.55)	0.009	2.72 (0.99–7.41)	0.051
Smoking	No	393 (88.9)	74 (97.4)	Reference			
	Yes	49 (11.1)	2 (2.6)	0.22 (0.05–0.9)	0.037		
MMSE	Normal	225 (50.9)	26 (34.2)	Reference			
	Dementia	217 (49.1)	50 (65.8)	1.96 (1.14–3.39)	0.015		
Word List Memory	Normal	140 (31.7)	18 (23.7)	Reference			
	Impaired	302 (68.3)	58 (76.3)	1.5 (0.85–2.63)	0.164		
Boston Naming Test	Normal	250 (56.6)	36 (47.4)	Reference			
	Impaired	192 (43.4)	40 (52.6)	1.45 (0.89–2.36)	0.138		
Verbal Fluency	Normal	199 (45)	25 (32.9)	Reference			
	Impaired	243 (55)	51 (67.1)	1.67 (0.99–2.79)	0.05		
Constructional Praxis	Normal	113 (25.6)	11 (14.5)	Reference			
	Impaired	329 (74.4)	65 (85.5)	2.03 (1.04–3.98)	0.039		
Word List Recall	Normal	113 (25.6)	19 (25)	Reference			
	Impaired	329 (74.4)	57 (75)	1.03 (0.59–1.81)	0.917		
Word List Recognition	Normal	185 (41.9)	26 (34.2)	Reference			
	Impaired	257 (58.1)	50 (65.8)	1.38 (0.83–2.31)	0.212		
GDS	Normal	349 (79)	48 (63.2)	Reference		Reference	
	Depression	93 (21)	28 (36.8)	2.2 (1.3–3.68)	0.003	2.13 (1.24–3.65)	0.006
BMI	Normal	108 (24.4)	17 (22.4)	Reference			
	Underweight	29 (6.6)	9 (11.8)	1.97 (0.8–4.88)	0.142		
	Overweight/Obese	305 (69)	50 (65.8)	1.04 (0.58–1.88)	0.893		

ADL, Activity Daily Living; BMI, Body Mass Index; GDS, Geriatric Depression Scale; IADL, Instrumental Activity Daily Living; MMSE, Mini-Mental State Examinations

males were 3.91 times more likely to be frail than women. Male older adults may have a greater likelihood to die suddenly of for instance cardiovascular or lung disease, whereas women tend to live longer with a more steady physiological decline and poorer health status, which is associated with frailty. Differences between sexes in frailty might be explained by differences in biological and social factors. From a biological perspective, estrogen is thought to be protective against cardiovascular diseases and dementia in midlife, and higher morbidity and mortality is seen after menopause without hormone treatment.[24] Although some studies suggested that testosterone (but not estrogen) has a similar role in men, in one study, men with low testosterone were shown to live longer, between 14.4 and 19.1 years.[25] Females seem to have a more robust immune system compared with males before menopause. This could explain why males tend to experience more severe symptoms of infectious disease. From biosocial and behavioral factors, high testosterone in men is associated with risky behaviors and careers, with lower mental coping mechanisms.[26] Men are also less compliant with prescribed medication and medical advice, and tend to delay seeking medical help.[24] A study by Gordon *et al.*[27] showed that gender might be inherent in the prevalence of physical deficits. The present study demonstrated that males and females both have acquired new comorbidities with age, but females were shown to have acquired slightly more physical and mental deficits overall with age. Sex differences in occupation and health seeking and age-related biological factors (inflammation, sarcopenia,

genetics, adiposity, and cognitive impairment) and healthcare utilization and behaviors should be investigated further.

The term multimorbidity refers to the co-occurrence of two or more chronic diseases in the same individuals. Multimorbidity has become an entity in itself, which is not just the sum of diseases. Multimorbidity acts as a synergy of individual diseases that cause worse health outcomes and more complex management than a single morbidity. Meta-analysis by Vetrano *et al.*[28] showed that the prevalence of multimorbidity in frail older adults was 72% while frailty in multimorbid individuals was seen in 17%. The pooled odds ratio was 2.2, almost the same as our findings (AOR: 2.01). This suggests that only a small portion of those suffering from multimorbidity also have frailty but that most frail older people have multimorbidity. Multimorbidity becomes evident earlier, in the fifth decade of life and continues to increase as people age, whereas frailty usually becomes apparent later in life.[29] These temporal gaps might provide more chances to younger older adults to cope and improve their reduced risk for morbidity before it has a relevant impact on health, especially increasing risk for frailty. Frailty is a state of vulnerability to stressors, hence increasing the risk of negative health outcomes, because of the inability to recover homeostasis.[30] The negative health outcomes, in turn, could lead to an increased risk of morbidity and disability. At the same time, morbidity could lead to increased vulnerability and frailty. Cardiovascular diseases, one of the most common age-related morbidities, might greatly impact the prevalence of the prefrail and frail in the older adult population. Cardiovascular diseases and frailty have a bidirectional relationship. Frail people are at increased risk of cardiovascular disease and vice versa.[31] Prefrail and frail patients were more likely to have chronic heart failure, hypertension, coronary artery disease, diabetes, and even subclinical disease identified using imaging, it is also prevalent in nondependent older adults with heart failure and becomes a risk factor for early disability, long-term mortality, and readmission.[32] Prefrail and frail may also present the accumulated negative conditions and diseases in a lifetime, making the person more susceptible to cardiovascular diseases.

Our study did not show a significant association between dependency and BMI. BMI is associated with more proinflammatory markers, which can affect morbidity and frailty. However, in a study by Vorst *et al.*,[33] inflammaging markers (CRP, TNF-α, IL-6, and albumin) concentrations show similar levels for frailty and dependency. Dependency in other studies showed a significant association with frailty but the association of frailty and BMI was inconsistent between studies. A study by Lee *et al.*[34] showed that normal weight and underweight older adults had more frailty-related mortality, whereas overweight older people showed no increased risk. A study by Watanabe *et al.*[35] in the Japanese population showed a U-shaped relationship between frailty and BMI, with normal BMI being associated with reduced frailty. Similarly, both studies by Yuan *et al.*[36] showed that overweight and obesity posed as risk factors for frailty, but did not find that being the underweight posed increased risk.

The term cognitive frailty was defined by two international consensus groups, the International Academy on Nutrition and Aging (IANA) and the International Association of Gerontology and Geriatrics (IAGG). Cognitive frailty is a heterogeneous clinical syndrome with the evidence of physical frailty and cognitive impairment with the exclusion of a clinical diagnosis of Alzheimer's disease and other dementias.[37] In our study, cognitive impairment was not associated with frailty. The association between frailty and cognitive impairment was found previously where it was associated with proinflammatory markers and could be positively affected by resistance exercise training.[38] In a study by Canavelli *et al.*,[39] physical frailty was associated with an increased risk of developing non-Alzheimer's dementia. The significant association between these variables might be linked by complex and multifactorial conditions that overlaps and develops a positive feedback loop bidirectionally. It is more likely that frailty and dementia share common risk factors and biological mechanisms, such as chronic inflammation, mitochondrial dysfunction and oxidative stress, epigenetic changes associated with the aging process, and hypothalamic-pituitary-adrenal axis dysfunction. Due to possible common risk factors, there might be potential using common therapeutic targets for interventions to address both negative health outcomes. Cognitive impairment and frailty can exist synergistically. Lee *et al.*[40] found that frailty and cognitive impairment independently predict 3-year mortality in older adults with having both physical frailty and cognitive impairment demonstrating the highest risk of mortality. However, other cognitive measurement using CERAD neuropsychological assessment also did not have significant associations with frailty in our study.

Depression was significantly associated with frailty in our studies, consistent with other studies.[41] In the Vaughan *et al.*'s[41] study, depressive symptoms in frail individuals ranged from 20.7% to 53.8% among 14 cross-sectional studies. A large longitudinal study, the Women's Health Initiative (WHI), has linked depressive symptoms to current frailty and new-onset frailty in older adults, with an OR of 2.2, which was almost the same as our findings (AOR: 2.13).[41,42] Among depressed individuals, antidepressant users were shown to have 3.63 times increased frailty risk than nonusers (OR: 2.05). A caveat is that frailty defined by Fried was established based on three out of five indicators that included symptoms of depression from CES-D (Center for Epidemiologic Studies Depression Scale) and as such has overlapping symptoms but depression might still be considered to be a distinct construct, with 60% shared variance and a 0.23 correlation with frailty.[5,41]

Our study provide better understanding regarding frailty, multimorbidity, and other associated factors, especially in Indonesian older adults, because only few studied this topic in Indonesia. However, there were limitations to this study. Our cross-sectional models only provided associations between factors. Therefore, interpretation of risk factors should be made with caution, especially due to high drop-out rate (15.4%) and nonrandom sampling method. Multimorbidity was assessed based on self-reported data, which should be diagnosed with objective or validated measurements. However, we lacked resources to rediagnose the chronic morbidity. Therefore, the multimorbidity status might be different if more proper measurement were utilized. Future research in a longitudinal model involving Indonesian older adults with objective morbidity assessment might provide better predictors of frailty. Future research should investigate whether various interventions based on identified modifying factors targeting older adults might decrease the risk of developing frailty in later life, especially in Indonesia.

Conclusion

Our study showed that being women, having morbidity and clinical depression significantly increased the risk of frailty in Indonesian older adults. Early interventions in younger older adults, especially in their early 50s or 60s, including resistance exercise might provide benefit in decreasing the risk of frailty. Controlling chronic disease and better mental education and support to prevent and treat depression might further provide protection against frailty.

Ethics approval and consent to participate

This research protocol and conduct were reviewed and approved by the Indonesian Institute of Sciences Research Ethical Clearance Commission in Jakarta, Indonesia (referal number: 1/klirens/VI/2020). Informed consent was obtained from all study participants before the interview began.

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Conflicts of interest

There are no conflicts of interest.

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