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Prevalence and Associated Factors of Cognitive Frailty in Indonesian Community-Dwelling Older Adults

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ABSTRACT

Objective
To provide insights into the prevalence and associated factors of cognitive frailty among older adults in Bekasi, Indonesia.

Methods
A total of 308 community-dwelling older adults in Bekasi, Indonesia participated in this cross-sectional study. Demographic data and various measurement tools, including the Mini Nutritional Assessment (MNA), Barthel Index, Lawton Instrumental Activities of Daily Living (IADL) Score, and World Health

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Organization Quality of Life (WHOQOL) assessment, were employed to evaluate health status. Binary logistic regression analysis was used to identify the cognitive frailty-associated factors.

Results

The prevalence of cognitive frailty in Indonesia was found to be 8.44%. Factors significantly associated with cognitive frailty in this Indonesian cohort included marital status, lifestyle choices, the presence of comorbid conditions, history of serious illness, fall incidents, reduced physical performance, nutritional status, levels of depression, and self-reported quality of life.

Conclusion

To our knowledge, this represents the first investigation into cognitive frailty within this population. The findings are significant, offering empirical evidence regarding the prevalence of cognitive frailty within the Indonesian population.

Background

The global aging population presents challenges for healthcare sustainability, particularly as the prevalence of degenerative conditions, including frailty, has escalated among older adults. In Indonesia, the pooled prevalence rates for frailty and prefrailty among older adults are reported to be 26.8% and 55.5%, respectively, while in community settings, these rates stand at 21.1% for frailty and 59.6% for prefrailty (Pradana *et al*., 2023). Frailty encompasses multiple dimensions in community-dwelling older adults, including physical, cognitive, social, and psychological aspects (Gobbens *et al*., 2010). The interrelationship between physical and cognitive frailty is significant, as evidence indicates that deterioration in one domain can adversely impact the other, and vice versa (Arai, Satake, & Kozaki, 2018).

Cognitive frailty is a condition characterized by the coexistence of physical frailty and mild cognitive impairment (MCI) in older adults, classified into two subtypes: potentially reversible cognitive frailty (associated with physical frailty and MCI) and reversible cognitive frailty (linked to physical frailty and subjective cognitive decline prior to MCI) (Panza *et al*., 2018). The overall prevalence of cognitive frailty in community settings is relatively low, with a pooled rate of 9% among community-dwelling older adults (Qiu *et al*., 2022). Prevalence rates for cognitive frailty exhibit considerable variability across different regions; for instance, in some Asian countries Japan and Singapore indicate even lower pooled prevalence rates of 2.7% and 1.6%, respectively (Chye *et al*., 2018; Shimada *et al*., 2013).

Cognitive frailty is recognized as a significant contributor to elevated rates of disability, diminished quality of life, increased incidence of dementia, and higher mortality among older adults (Arai, Satake, & Kozaki, 2018). The relationship between cognitive frailty and dementia is notably strong, as evidenced by the symptoms of mild cognitive impairment, which are

characteristic of cognitive frailty and serve as a primary precursor to dementia (Panza *et al*., 2018). Longitudinal studies have indicated that cognitive frailty is associated with an increased likelihood of hospitalization, neurocognitive disorders, and a greater risk of falls (Panza *et al*., 2018). The substantial health risks associated with cognitive frailty can lead to considerable strain on healthcare services for older populations.

Indonesia, as a developing nation, exhibits a relatively low rate of basic education completion compared to its regional counterparts. The low levels of educational attainment and insufficient literacy skills can increase the risk of cognitive decline in old age (Rentería *et al*., 2019). Investigating cognitive decline in older adults in Indonesia is vital given the substantial risks it poses. Consequently, comprehending cognitive frailty is imperative in this context.

Bekasi, as one of the satellite cities of the national capital Jakarta, is undergoing a substantial demographic transformation driven by ongoing urbanization and a concomitant increase in its aging population (Kurnia, Rustiadi, & Pravitasari, 2020). The considerable sociodemographic pressures inherent to highly urbanized settings may serve to accelerate both cognitive and physical decline among older residents. Consequently, investigations pertaining to geriatric studies are deemed essential in this region, as they can provide a foundational evidence base for the subsequent formulation and implementation of comprehensive health policies.

Frailty, particularly cognitive frailty, remains an under-addressed topic in Indonesia. To date, there has been a lack of research specifically addressing cognitive frailty in Indonesia. To the best of our knowledge, this study represents the first attempt to establish the prevalence of cognitive frailty within the Indonesian population, thereby providing a baseline for future investigations in this field. Therefore, this study aims to provide insights into the prevalence and associated factors of cognitive frailty among older adults in Indonesia.

Methods

This study employed a cross-sectional design to analyze the prevalence and factors associated with cognitive frailty among Indonesian older adults. The study populations consisted of older adults living in the community in Bekasi, Indonesia. The inclusion criteria in this study include a) >60 years old, b) able to walk independently, c) agree to become a participant and fill the informed consent, and d) they are able to understand and speak Indonesian. If they were unable to communicate or answer questions or have a disease that would interfere with our assessment, then they were excluded. The sample size was calculated based on the recommendations of Streiner, Norman, and Cairney (2015), who suggested a sample size of 5 to 20 participants per questionnaire item, the calculated minimum sample size ranged from 25 to 100 based on 5 items of Fried Frailty Phenotype. A total of 397 older adults were contacted to participate in the study. Among them, 59 (14.86%) declined to participate, 22 (5.54%) were excluded due to medical conditions that could interfere with the study results, and 8 (2.02%) did not respond (Figure 1). Consequently, this study recruited a convenience sample of 308 community-dwelling older individuals from the community health centre recommendations, the response rate was 77.58%.

Data were collected on various basic characteristics of the older adults, including age; gender; employment status; body mass index (BMI), calculated from objectively recorded height and weight; marital status; level of education; monthly income categorized by local minimum wage standards; healthy lifestyle status; number of comorbidities; experienced serious illness during the past year; and fall incidents in the past 1 year. To assess cognitive frailty in older adults, the FFP was used to evaluate physical frailty (Fried *et al.,* 2001), while the Montreal Cognitive Assessment (MoCA) was used to assess mild cognitive impairment (Nasreddine *et al*., 2005). Cognitive frailty was defined as the co-existence of both conditions. Additionally, a series of health-related questionnaires were administered to the older adults during data collection, such as Short Physical

Performance Battery (SPPB) (Guralnik *et al*., 1994), the Mini Nutritional Assessment (MNA) (Vellas *et al*., 1999), the Geriatric Depression Scale (GDS) (Burke, Roccaforte, & Wengel, 1991), the Barthel Index (Collin *et al*., 1988), the Lawton IADL scale (Graf, 2008), and the World Health Organization Quality of Life (WHOQOL-OLD) (Power *et al*., 2005).

Fried frailty phenotype (FFP)

The FFP became the potential standardized for frailty using 5 criteria including unintentional weight loss, weakness, exhaustion, slowness, and low physical activity levels (Fried *et al*., 2001). The FFP scoring system assigns a score of 1 for each of the five criteria that is present (and 0 for each that is absent), the total score of FFP was 5 with older adults who fulfilled 3-5 are classified as frail, one or two as prefrail, and those exhibiting none are classified as robust.

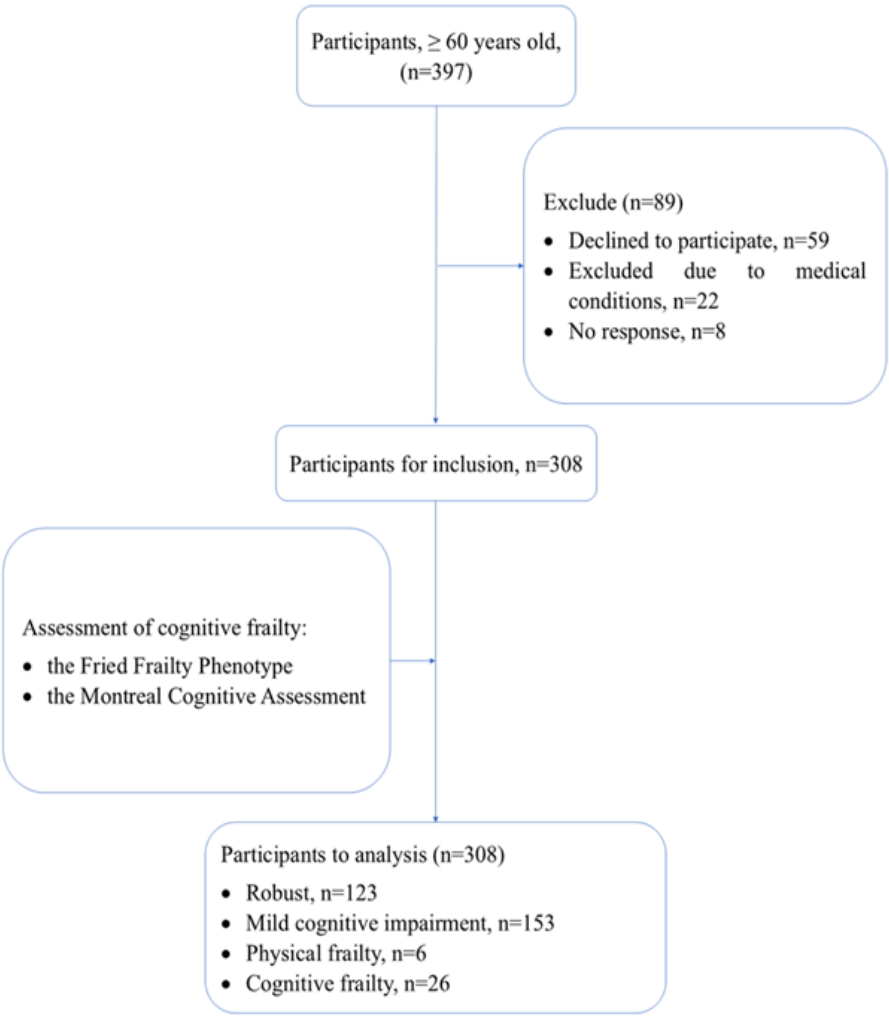

Figure 1. Selection of Respondents

The Montreal Cognitive Assessment (MoCA)

The MoCA is designed to assess mild cognitive impairment (MCI) by evaluating multiple cognitive domains with criterion validity (r = 0.72–0.75) (Nasreddine *et al*., 2005). The MoCA is scored by assigning points for correct responses across its 16 tasks, with a maximum total of 30 points, where 1 point is added for education ≤12 years and a score of ≥26 is considered normal, while lower scores indicate varying degrees of cognitive impairment. Scored out of 30, performance is categorised as follows: scores below 10 indicate severe cognitive impairment,

10–17 denote moderate impairment, 18–25 suggest mild impairment, and scores ≥26 reflect robust cognitive function (Wittich *et al*., 2010). The MoCA shows a a high sensitivity (80%–90%) and a very good reliability with a Cronbach's alpha of 0.83 (Wittich *et al*., 2010).

The Short Physical Performance Battery (SPPB)

The SPPB was used to assess physical performance like standing balance, walking speed, and chair stand tests with 5 domains of questions in total. The SPPB is scored by summing the points from its three component tests—standing balance (0–4 points), 4-meter walk (0–4 points), and five repeated chair stands (0–4 points). The maximum score for SPPB is 12 points, someone who got score more than 6 are categorized as high physical performance (Guralnik *et al*., 1994). The SPPB has excellent reliability, with a Cronbach's alpha of 0.86 (Guralnik *et al*., 1994).

The Mini Nutritional Assessment (MNA)

The MNA was employed to evaluate the nutritional status of older adults. The full 18-item MNA is bifurcated into a two-step process to maximize clinical efficiency: a 6-item Screening Section (Items A–F) and a subsequent 12-item Assessment Section (Items G–R). Each item consists of 0 to 2 points, with a total of 30 points. The MNA classifications include adequate nutritional status (total score ≥24), protein calorie malnutrition (<17), and at risk of malnutrition (17- 23.5) (Vellas *et al*., 1999). The MNA demonstrates high sensitivity (97.9%), specificity (100%), and a very good reliability with a Cronbach's alpha of 0.83 (Vellas *et al*., 1999).

The 15 Items Geriatric Depression Scale (GDS-15)

The GDS-15 was developed to provide a concise and efficient screening tool, a validated instrument for older adults with high sensitivity (84%–92%), specificity (70%–89%), particularly suited for use in medically ill or cognitively impaired populations, where longer assessments may be impractical (Burke, Roccaforte, & Wengel, 1991). GDS-15 consisted of 15 items. Each item consists of "yes" and "no" answer, with range of score 0-1. Respondents who got 0-4 score is considered robust, 5-9 as mild, and >10 interpreted as moderate to severe depression. The GDS-15 shows excellent reliability with Cronbach's alpha of 0.86 (Burke, Roccaforte, & Wengel, 1991).

The Barthel Index (BI)

The BI is a reliable clinical tool for evaluating mobility and activities of daily living (ADL), which exhibits high construct validity and strong convergent validity with other disability scales (r = 0.75–0.87) (Collin *et al*., 1988). The original and standard Barthel Index consists of 10 items, each representing a fundamental daily self-care or mobility task. The scoring ranges from 0 to 15 for each item. The total score for BI is 100 and interpreted as independent, 91-99; interpreted as moderate, 61-90; severe, and <60 considered as total dependent (Cook *et al*., 2019). The BI shows an excellent reliability with Cronbach's alpha ranged 0.90 (Collin *et al*., 1988).

The Lawton Instrumental Activity of Daily Living Scale (IADL)

The Lawton IADL scale is used to assess higher-level functional abilities in individuals across several tasks. The summary score ranges from 0 (low function) to 8 (high function). A total score of 8 indicates high function and independence for women, while a score of 5 is used for men, as food preparation, housekeeping, and laundering are excluded from their assessment (Graf, 2008). The Lawton IADL Scale shows a strong convergent validity with cognitive and motor measures (r = 0.65–0.78), and very good reliability with Cronbach's alpha of 0.84 (Graf, 2008).

The World Health Organization Quality of Life (WHOQOL-OLD)

The WHOQOL-OLD is a validated instrument designed to assess the quality of life in older adults by the WHO (Power *et al*., 2005). This tool demonstrates robust psychometric properties across diverse cultural contexts. WHOQOL-OLD comprises 24 items structured evenly across

6 distinct domains, with a good convergent validity with general QoL measures. Each domain consists of 4 question items that must be scored based on a 5-point Likert scale format, with a total score varying between 0-100 (Power *et al*., 2005). The WHOQOL-OLD shows very good reliability with Cronbach's alpha of 0.84 (Peel, Bartlett, and Marshall, 2007).

Data collection was conducted from June to August 2023. Each respondent required approximately 45 to 60 minutes to complete the full battery of questionnaires. Participants were recruited from a list provided by 6 local healthcare centres in the Bekasi region. Data analysis was performed using SPSS version 21 (IBM Corp, Armonk, NY). Descriptive statistics included the presentation of statistical units (n), mean, standard deviation (SD), and percentage (%). Statistical significance level was fixed at $p<0.05$ for all tests. Binary logistic regression analysis was used to identify the cognitive frailty-associated factors. Model 1 is the unadjusted model included all the demographic and health outcomes variables, and finally, in model II we adjusted the demographic data including gender, age, employment status, body mass index, marital status, level of education, and income. The study was approved by Taipei Medical University Institutional Review Board (TMU-IRB) (No. N202306036) and Bani Saleh University ethics committee (No. EC.194/KEPK/STKBS/VI/2023).

Results

The mean age of the participants was 65.5±5.7 years, with the majority (92.2%) categorised as young-old (≤74 years). The cohort comprised 61% females, and 60.7% were either unemployed or retired. The average BMI was 23.11±3.31, with 67.9% falling within the normal BMI range. In terms of sociodemographic characteristics Among them, the prevalence of the cognitive frailty, mild cognitive impairment, and physical frailty in Indonesia was 8.44%, 49.68%, and 1.95%, respectively.

The overall mean age of the participants with cognitive frailty was 66.6 ± 5.9 years. Among them, 65.4% were female, and 76.92% were unemployed or retired. The mean BMI was 22.4 ± 3, with 69.23% classified as having a normal BMI. More comprehensive data are summarized in Table 1. Regarding health metrics, 92.31% exhibited low physical performance, and 53.85% were at risk of malnutrition, with the same percentage showing suggestive signs of depression. In terms of daily living activities, 65.38% were classified as slightly dependent for basic activities, whereas 80.77% were independent in instrumental activities.

The means score of their quality of life was 55.85±9.93 (Figure 2). Figure 3 demonstrated quality of life' subdomains of the older adults with cognitive frailty, the mean score for was 60.58±21.27; 50.00±15.51; 53.61±10.78; 56.49±11.52; 57.93±21.18; 56.49±12.68 for the (1) sensory ability; (2) autonomy; (3) past, present, and future ability; (4) social participation; (5) death and dying; and (6) intimacy, respectively.

In Table 2, the crude analysis of factors associated with cognitive frailty revealed that being single was associated with 3 times higher in developing cognitive frailty (OR 3.029, 95% CI 1.341-6.841, p=0.008) compared to those who married. Older adults who felt unhealthy was associated with 16 times higher in developing cognitive frailty (OR 16.050, 95% CI 2.803-91.901, p=0.002) compared to those who felt healthy. Similarly, older adults with more than 3 comorbidities demonstrated a 16 times higher risk of cognitive frailty compared to those without comorbidities (OR 16.071, 95% CI 2.105-122.732, p=0.007). This finding aligns with results observed among older adults who experienced a serious illness in the past year, showing a 4 times higher risk (OR 4.376, 95% CI 1.735-11.040, p=0.002). and those who had more than 2 times fall history during a year had 23 times higher risk in cognitive frailty (OR 23.545, 95% CI 2.053-270.029, p=0.011).

Table 1. Demographic Characteristics and Health-Related Status of the Respondents (n=308)

Characteristics	Overall (n=308)	Robust (n=123)	MCI (n= 153)	Physical frailty (n= 6)	Cognitive frailty (n= 26)
Age (WHO Classification),					
Young-old (≤74)	284 (92.20)	117 (95.10)	137 (89.50)	6 (100.00)	24 (92.30)
Middle-old (75-84)	21 (6.80)	6 (4.90)	13 (8.50)	-	2 (7.70)
Very-old (>85)	3 (1.00)	-	3 (2.00)	-	-
Gender, n (%)					
Male	120 (39.00)	58 (47.20)	52 (34.00)	1 (16.70)	9 (34.60)
Female	188 (61.00)	65 (52.80)	101 (66.00)	5 (83.30)	17 (65.40)
Employment status, n (%)					
Employed	121 (39.30)	49 (39.84)	65 (42.48)	1 (16.70)	6 (23.08)
Unemployed/retired	187 (60.70)	74 (60.16)	88 (57.52)	5 (83.30)	20 (76.92)
Body Mass Index, n (%)					
Underweight	15 (4.90)	4 (3.25)	8 (5.23)	-	3 (11.54)
Normal	209 (67.90)	85 (69.11)	101 (66.01)	5 (83.30)	18 (69.23)
Overweight	66 (21.40)	27 (21.95)	34 (22.22)	1 (16.70)	4 (15.38)
Obese	18 (5.80)	7 (5.69)	10 (6.54)	-	1 (3.85)
Marital status, n (%)					
Married	225 (73.10)	101 (82.11)	107 (69.93)	4 (66.67)	13 (50.00)
Single	83 (26.90)	22 (17.89)	46 (30.07)	2 (33.33)	13 (50.00)
Level of education, n (%)					
None/Primary education	116 (37.70)	30 (24.39)	76 (49.67)	-	10 (38.46)
Secondary education (high school)	154 (50.00)	74 (60.16)	60 (39.22)	6 (100.00)	14 (53.85)
Higher education (University)	38 (12.30)	19 (15.45)	17 (11.11)	-	2 (7.69)
Monthly income (IDR), n (%)					
<2500000 (Low)	165 (53.60)	59 (47.97)	84 (54.90)	4 (66.67)	18 (69.23)
2500000-5000000 (Standard)	98 (31.80)	45 (36.59)	44 (28.76)	2 (33.33)	7 (26.92)
>5000000 (High)	45 (14.60)	19 (15.45)	25 (16.34)	-	1 (3.85)
Healthy lifestyle status, n (%)					
Unhealthy	7 (2.30)	3 (2.44)	1 (0.65)	-	3 (11.54)
Not healthy, not unhealthy	189 (61.40)	60 (48.78)	106 (69.28)	5 (71.43)	18 (69.23)
Healthy	112 (36.40)	60 (48.78)	46 (30.07)	1 (16.67)	5 (19.23)
Number of comorbidities, n (%)					
None	239 (77.60)	101 (82.11)	119 (77.78)	5 (71.43)	14 (53.85)
1	51 (16.60)	18 (14.63)	24 (15.69)	1 (16.67)	8 (30.77)
2	14 (4.50)	4 (3.25)	8 (5.23)	-	2 (7.69)
≥3	4 (1.30)	-	2 (1.31)	-	2 (7.69)
Experienced a serious illness yourself during the past year, n (%)					
No	274 (89.00)	111 (90.24)	139 (90.85)	6 (100.00)	18 (69.23)
Yes	34 (11.00)	12 (7.32)	14 (9.15)	-	8 (30.77)

Fall incidents in the past 1 year, *n* (%)					
None	281 (91.20)	115 (93.50)	138 (90.20)	6 (100.00)	22 (84.62)
≥1	27 (8.80)	8 (6.50)	14 (9.80)	-	4 (15.38)

Data are presented as number and percentage.

This study result revealed significant associations between various health outcomes with cognitive frailty in older adults. Older adult with low physical performance exhibited a higher risk 26.9 times higher (OR 26.897, 95% CI 6.219-116.333, p<0.001) compared those with high physical function. Similarly, those with depression was associated with a 3.5 times higher cognitive frailty condition (OR 3.467, 95% CI 1.532-7.845, p=0.003). Furthermore, moderate dependency contributed to a 2.5 times higher risk (OR: 2.492, 95% CI: 1.013–6.129, p = 0.047) of cognitive frailty, while malnutrition contributed 15.8 times higher risk (OR 15.833, 95% CI 3.716-67.465, p<0.001) of cognitive frailty. Conversely, higher quality of life in older adults was became a protective factor against cognitive frailty (OR: 0.927, 95% CI: 0.882–0.974, p = 0.002).

Figure 2. Health Metrics Among Respondents

After adjusted the demographic characteristic, being single demonstrated the strongest association with 79.5 times higher (AOR 79.552, 95% CI: 3.797-1,666.569, p=0.005), unhealthy

lifestyle was associated with 14.8 times higher (AOR 14.876, 95% CI: 2.134-103.699, p=0.006), having more than 3 comorbidities was associated with 34.7 times (AOR 34.756, 95% CI: 2.913-414.719, p=0.005), experienced a serious illness was associated with 4.6 times (AOR 4.693, 95% CI: 1.669-13.201, p=0.003), more than 2 fall history was associated with 62.8 times (AOR 62.853, 95% CI: 3.626-1,089.459, p=0.004) increase in the odds of cognitive frailty, respectively.

Health outcomes results demonstrated several variables were associated with increasing risk of cognitive frailty. Low physical performance was associated with 34.5 times (AOR 34.530, 95% CI: 7.496-159.055, p<0.001), depression was associated with 2.9 times (AOR 2.969, 95% CI: 1.209-7.292, p=0.018), malnutrition was associated with 18.5 times (AOR 18.582, 95% CI: 3.658-93.384, p<0.001) increase in the odds of cognitive frailty, respectively. While higher quality of life became a protective factor against cognitive frailty (OR: 0.915, 95% CI: 0.864-0.970, p=0.003).

Figure 3. WHOQOL Status of the Respondents

Table 2. Logistic Regression of the Factors Influencing Cognitive Frailty (n=308)

Variables	B	SE	Model 1		B	SE	Model 2	
			OR	***p-value***			**aOR**	***p-value***
Gender								
Male			Reference				Reference	
Female	0.204	0.430	1.226 (0.528-2.847)	0.635	-2.674	1.182	0.069 (0.007-0.699)	**0.024***
Age								
Young-old (≤74)			Reference				Reference	
Middle-old (75-84)	0.131	0.773	1.140 (0.250-5.192)	0.865	-5.983	2.304	0.003 (0.000-0.231)	**0.009***
Very-old (>85)	-18.820	23205.422	0.000	0.999	-23.464	22091.479	0.000	0.999
Employment status								
Employed			Reference				Reference	
Unemployed/ retired	0.831	0.481	2.295 (0.894-5.892)	0.084	2.575	1.062	13.137 (1.637-105.413)	**0.015***
Body Mass Index								
Underweight	0.976	0.691	2.653 (0.685-10.277)	0.158	-3.491	2.720	0.030 (0.000-6.302)	0.199
Normal			Reference				Reference	
Overweight	-0.379	0.572	0.685 (0.223-2.100)	0.507	-4.100	1.674	0.017 (0.001-0.441)	**0.014***
Obese	-0.471	1.058	0.624 (0.078-4.966)	0.656	-2.993	2.796	0.050 (0.000-12.030)	0.284
Marital status								
Married			Reference				Reference	
Single	1.108	0.416	3.029 (1.341-6.841)	**0.008***	4.376	1.552	79.552 (3.797-1666.569)	**0.005***
Level of education								
None/Primary education	0.588	0.779	1.800 (0.391-8.281)	0.450	-9.079	3.591	0.000 (0.000-0.130)	**0.011***
Secondary education (high school)	0.530	0.798	1.698 (0.355-8.118)	0.507	-5.242	2.671	0.005 (0.000-0.993)	**0.050***
Higher education (University)			Reference				Reference	
Monthly income (IDR)								
<2500000 (Low)	0.465	0.465	1.592 (0.640-3.960)	0.317	3.251	1.646	25.817 (1.024-650.583)	**0.048***
2500000-5000000 (Standard)			Reference				Reference	
>5000000 (High)	-1.219	1.085	0.295 (0.035-2.476)	0.261	-6.760	3.913	0.001 (0.000-2.482)	0.084
Healthy lifestyle status								
Unhealthy	2.776	0.890	16.050 (2.803-91.901)	**0.002***	2.700	0.991	14.876 (2.134-103.699)	**0.006***
Not healthy, not unhealthy	0.812	0.520	2.253 (0.812-6.246)	0.119	0.928	0.548	2.530 (0.865-7.405)	0.090
Healthy			Reference				Reference	

Number of comorbidities								
None			Reference				Reference	
1	1.905	0.473	2.990 (1.182-7.562)	**0.021***	1.372	0.525	3.944 (1.409-11.035)	**0.009***
2	0.985	0.812	2.679 (0.546-13.152)	0.225	0.910	0.914	2.484 (0.414-14.908)	0.320
≥3	2.777	1.037	16.071 (2.105-122.732)	**0.007***	3.548	1.265	34.756 (2.913-414.719)	**0.005***
Experienced a serious illness yourself during the past year								
No			Reference				Reference	
Yes	1.476	0.472	4.376 (1.735-11.040)	**0.002***	1.546	0.528	4.693 (1.669-13.201)	**0.003***
Fall								
None			Reference				Reference	
1	0.068	0.771	1.070 (0.236-4.852)	0.930	-0.169	0.812	0.845 (0.172-4.148)	0.835
≥2	3.159	1.245	23.545 (2.053-270.029)	**0.011***	4.141	1.455	62.853 (3.626-1089.459)	**0.004***
SPPB								
High physical performance			Reference				Reference	
Low physical performance	3.292	0.747	26.897 (6.219-116.333)	**<0.001***	3.542	0.779	34.530 (7.496-159.055)	**<0.001***
GDS								
Normal			Reference				Reference	
Suggestive of depressive	1.243	0.417	3.467 (1.532-7.845)	**0.003***	1.088	0.458	2.969 (1.209-7.292)	**0.018***
Barthel Index								
Slight Dependency			Reference				Reference	
Moderate Dependency	0.913	0.459	2.492 (1.013-6.129)	**0.047***	0.882	0.498	2.417 (0.910-6.416)	0.077
Severe Dependency	1.008	1.124	2.741 (0.303-24.808)	0.370	1.611	1.249	5.007 (0.433-57.895)	0.197
Lawton IADL								
High function, Independent			Reference				Reference	
Low function, Dependent	0.770	0.536	2.160 (0.755-6.175)	0.151	0.671	0.630	1.956 (0.569-6.720)	0.287
MNA								
Well nourished			Reference				Reference	
At risk of malnutrition	1.352	0.462	3.866 (1.564-9.559)	**0.003***	1.440	0.506	4.220 (1.564-11.386)	**0.004***
Malnourished	2.762	0.740	15.833 (3.716-67.465)	**<0.001***	2.922	0.829	18.582 (3.658-93.384)	**<0.001***
WHOQOL-OLD	-0.076	0.025	0.927 (0.882-0.974)	**0.002***	-0.088	0.029	0.915 (0.864-0.970)	**0.003***
Sensory Ability	-0.037	0.011	0.964 (0.943-0.985)	**0.001***	-0.044	0.013	0.957 (0.933-0.981)	**0.001***
Autonomy	-0.019	0.014	0.981 (0.955-1.007)	0.149	-0.023	0.015	0.977 (0.948-1.007)	0.126

Past, present, and future ability	-0.038	0.016	0.962 (0.933-0.993)	**0.016***	-0.044	0.019	0.957 (0.922-0.992)	**0.017***
Social participation	-0.044	0.017	0.957 (0.925-0.991)	**0.012***	-0.053	0.020	0.949 (0.912-0.987)	**0.009***
Death and dying	-0.002	0.009	0.998 (0.980-1.017)	0.860	0.000	0.010	1.000 (0.980-1.020)	0.973
Intimacy	-0.028	0.015	0.973 (0.944-1.002)	0.068	-0.019	0.016	0.981 (0.951-1.012)	0.224

SPPB: Short Physical Performance Battery; MNA: Mini Nutritional Assessment; GDS: Geriatric Depression Scale; WHO-QOL: World Health Organization-Quality of Life; *Significant values at p <0.005

Discussion

To our knowledge, this represents the first investigation into cognitive frailty within this population. The overall prevalence of cognitive frailty was found to be 8.44%. Factors associated with cognitive frailty in Indonesian older adults included gender, age, employment status, BMI, level of education, marital status, income, healthy lifestyle status, number of comorbidities, experienced serious illness during past year, fall history, physical functions, depression level, dependency level, nutritional status, and quality of life. The findings of this study align with several previous studies, a systematic review and meta-analysis indicated a cognitive frailty prevalence of 9% (8%-11%) (Qiu *et al*., 2022). Research conducted in neighbouring countries such as Malaysia and Singapore, the pooled prevalence of cognitive frailty was reported at 6.3% (Aravindhan *et al*., 2023) and 4.8% (Lee *et al*., 2023), respectively. This situation in Indonesia is driven by several factors, including a robust social capital structure and strong family support, whereby older adults are frequently involved in social activities that ultimately provide cognitive stimulation.

Gender

This study demonstrated that being a woman has a lower risk of experiencing cognitive frailty compared to men. A study conducted by Qiu *et al*. (2022) also stated that the prevalence of cognitive frailty in both genders is also high. The tendency for men to experience cognitive frailty is higher because men experience several conditions of age-related decline in physical function and androgen decline more often (Kaufman & Vermeulen, 2005), which can ultimately cause several symptoms such as social isolation (Gale, Westbury, & Cooper, 2018). Aging among Indonesian women presents distinct challenges, particularly within deeply rooted patrilineal social structures that frequently marginalize older females from various social activities.

Age

This study demonstrated that age is associated with cognitive frailty in older adults. Frailty is a condition of age-related decline in older adult capacity function (Fried *et al*., 2001). The older a person is, the higher the likelihood of developing cognitive frailty in the future. This is influenced by degenerative changes in organ function and various tissues in older adults that can result in shrinking size and volume (muscle and brain mass in cognitive frailty), such as atrophy in cerebral white matter, sensory receptors degenerate and the activities of synaptic connections and neurotransmitters decrease (Chang *et al*., 2022). This condition can result in functional disability, decreased quality of life, increased risk of degenerative diseases, and other neurocognitive disorders (Panza *et al*., 2018). In Indonesia, morbidity rates rise progressively with advancing age among older adults, serving as a primary driver for the increasing incidence of cognitive frailty.

Employment status

This study demonstrated that the probability for unemployed older adults to experience cognitive frailty is higher than those who are still working. This is influenced by the condition

of the cognitive reserve owned by older adults. The employment status of older adults is closely related to the cognitive reserve ability they have, the higher the cognitive reserve owned, the higher the cognitive functioning owned when entering old age (Stern, 2012). The use-it-or-lose-it theory is closely related to the high or low cognitive reserve in older adults. Cognitive reserve can reduce the risk of cognitive frailty in older adults, while those with cognitive frailty were about five times more likely to report low-motivations, risk of sickness absence and reduced work capacity (Palmer *et al*., 2017). The majority of older Indonesians face unemployment post-retirement, a metric that serves as a key indicator of the rising prevalence of cognitive frailty.

BMI

This study demonstrated that being overweight is one of the factors associated with the occurrence of cognitive frailty in older adults. This is influenced largely by overeating and sedentary life in middle age which are known to cause cognitive decline in older adults (Dominguez & Barbagallo, 2017). Overweight can cause various disorders in the body through the mechanisms of increased presence of adipokines, neuroendocrine disturbances, increased chance of hormonal abnormalities, enhanced proinflammatory markers, and increased risk of degenerative disease (cardiovascular and diabetes) which can increase the risk of cognitive impairment in old age (Deckers *et al*., 2017). The majority of older Indonesians are unaccustomed to vigorous physical activity and exhibit central obesity, a condition primarily driven by physical inactivity.

Level of education (Low)

This study demonstrated that low level of education obtained by older adults can be a factor that increases the risk of cognitive frailty. The education history of older adults is the main factor related to their cognitive reserve ability, the higher the cognitive reserve, the higher the cognitive functioning when entering old age (Stern, 2012). Older adults who have a high educational level can be said to have greater cognitive reserve and easier access to health resources (Brunner *et al*., 2018). The results of this study are like previous studies which found that high educational and literacy levels can be a protective factor against the risk of progressive cognitive frailty (Hou *et al*., 2024; Yuan, Xu, & Fang, 2022). Demographic data reveal that a significant proportion of older adults in Indonesia lack formal education or possess only a primary level of education.

Marital status

This study demonstrated that being single can lead to an increased risk of experiencing cognitive frailty compared to those who have a partner. This conclusion is corroborated by prior research indicating that marital status markedly influences cognitive frailty in older adults. Additionally, another previous study identified marital status as an independent risk factor associated with cognitive frailty, reporting an odds ratio of 3.709 (2.748–5.005) (Peng *et al*., 2023). Marital statuses are known significantly influenced health status and quality of life among older adults in Indonesia, respectively (Daely *et al*., 2021). Therefore, assessing health status and quality of life in conjunction with cognitive frailty can provide new insights into the relationships among these three variables.

Income

This study demonstrated that low monthly income (<2.5 million IDR) is closely related to the risk of cognitive frailty in older adults. The results of this study confirms other studies explaining that higher household consumption per capita means more cognitive reserve and access to more abundant and easily obtainable health resources (Brunner *et al*., 2018). In addition, Hou *et al*. (2024) also explained that family income and household consumption are factors that influence cognitive function in older adults. Data on older Indonesians indicate that the majority live below or near the poverty line, a demographic reality that places them at high risk for developing cognitive frailty in the future.

Health perception

The concepts of healthy life status and self-perceived quality of life are interrelated; as an individual's health status improves, their quality of life also tends to enhance. Other studies indicate that older adults with higher quality of life scores are estimated to have a reduced likelihood of cognitive frailty (Das, 2022). Conversely, dissatisfaction with life among older adults may elevate the risk of cognitive frailty (Yuan, Xu, & Fang, 2022). In Indonesia, lower educational attainment among older adults correlates directly with poorer health perceptions.

Comorbidities

The number of comorbidities and the presence of serious illnesses are additional variables influencing cognitive frailty in older adults. The emergence of chronic diseases in this population can be a crucial factor in the transition from a robust state to cognitive frailty (Lu *et al*., 2021). Specifically, chronic diseases have been identified as risk factors for reversible cognitive frailty (OR 2.44; 2.15–2.77), and potentially reversible cognitive frailty (OR 2.62; 2.20–3.12) (Hou *et al*., 2024). The presence of multiple comorbidities increases the risk of cognitive frailty (OR 1.21-7.42) (Yuan, Xu, & Fang, 2022).

Furthermore, depression is a critical risk factor that is significantly associated with the severity of cognitive frailty (OR 1.20-3.39) (Das, 2022; Rivan *et al*., 2020; Yuan, Xu, & Fang, 2022). One study has identified depression as a risk factor for reversible cognitive frailty (OR 5.11; 4.61–5.66) and potentially reversible cognitive frailty (OR 6.85; 5.97–7.86) (Hou *et al*., 2024). Conversely, older adults experiencing cognitive frailty exhibit significantly higher rates of depression (OR 1.49-2.06) compared to their robust counterparts (Aravindhan *et al*., 2023).

Low physical function & Fall history

Cognitive frailty is closely linked to decreased functional mobility and low physical performance among older adults (Rivan *et al*., 2020). Additionally, a study found that the overall prevalence of falls in individuals with cognitive frailty was 36.3% (Guo *et al*., 2023). Older adults experiencing cognitive frailty face a significantly higher risk of falls compared to robust participants without cognitive impairment (Guo *et al*., 2023; Rivan *et al*., 2021). Low physical function, experienced by the majority of older Indonesians, acts as a precursor to multiple chronic health issues, whereby an elevated fall risk represents a major long-term effect.

Depression level

This study demonstrated that older adults with depression had a higher risk of developing cognitive frailty compared to those without depression. Cognitive frailty is related to social isolation experienced by older adults (Rivan *et al*., 2020), while for most older adults in Asia, the period of old age is often wrongly perceived by society as a phase that requires older adults to rest and not do heavy work, which can result in an increased risk of depression and social isolation in them. Depression in old age is known to be a major predictor of cognitive frailty (Hou *et al*., 2024; Rivan *et al*., 2020). In Indonesia, depression among older adults often goes unreported as it is widely considered a taboo subject by a large portion of society, a covert condition that could drive a surge in cognitive frailty rates.

Nutritional status

Nutritional status has long been associated with the prevalence of cognitive frailty in older adults. The findings of this study indicate that older adults at risk of malnutrition have a heightened likelihood of experiencing cognitive frailty. These results align with other research demonstrating that poor nutritional status plays a critical role in the transition from robust health to cognitive frailty (Das, 2022; Lu *et al*., 2021). Additionally, another study identified being underweight as a risk factor for reversible cognitive frailty (OR 1.27; 1.02–1.59) and potentially reversible cognitive frailty (OR 1.43; 1.10–1.88) (Hou *et al*., 2024).

Quality of life (Low)

This study demonstrated that older adults with poor quality of life are at higher risk of experiencing cognitive frailty compared to those with good quality of life (QoL). QoL in older adults is often used as both a cause and a consequence of a health condition they experience. Previous studies have shown that cognitive frailty is a cause of poor QoL in older adults (Arai, Satake, & Kozaki, 2018; Panza *et al*., 2018). Similar to other psychological constructs, QoL is not a topic openly discussed within Indonesian society, individuals with low QoL tend to withdraw and refrain from disclosing their condition publicly.

To ensure linguistic equivalence within the target context, the instrument was formally adapted into Indonesian by the authors. The adaptation protocol commenced with a forward-translation phase, wherein two independent (Nursing background and English language expert), bilingual native Indonesian speakers translated the original scale. Following synthesis of these preliminary drafts, two different independent native English speakers back-translated the unified Indonesian version into the source language to evaluate conceptual and semantic correspondence. Finally, the internal consistency of the adapted instrument was statistically verified utilizing Cronbach's alpha by using data from 308 respondents of the current study.

The FFP exhibited Cronbach's alpha of 0.71, while the validity test resulted between 0.69 to 0.77. Montreal Cognitive Assessment (MoCA-INA) showed good reliability at 0.80, consistent with prior validation studies, while the validity test resulted between 0.71 to 0.80. The SPPB achieved 0.83 in reliability test while the validity test resulted between 0.75 to 0.82. The MNA reached 0.81 in reliability test while the validity test resulted between 0.79 to 0.83. The GDS-15 attained 0.79 in reliability test while the validity test resulted between 0.60 to 0.76. Functional status measures demonstrated strong reliability, with the BI at 0.93 and the Lawton Instrumental Activities of Daily Living scale at 0.78. The validity test of BI is between 0.82 and 0.86, while the validity test of Lawton Instrumental Activities of Daily Living scale resulted between 0.71 and 0.78. The WHOQOL-OLD quality of life instrument also showed good internal consistency at 0.80 while the validity test resulted between 0.80 to 0.85.

This study presents several limitations. First, the relatively small sample size, which exclusively focuses on community-dwelling older adults in an urban setting, limits the generalizability of the findings to the broader population of older adults in Indonesia. Second, the cross-sectional design of the study restricts the ability to explore the deeper relationships between cognitive frailty, associated factors, and potential negative outcomes in older adults. Third, the convenience sampling is not robust enough to determine the prevalence rate, multicentre and larger population study are needed to generalized the prevalence rate. Fourth, while the forward-backward translation method ensured linguistic and conceptual equivalence, this study did not perform a rigorous structural validation, such as Confirmatory Factor Analysis. Consequently, the underlying factor structure of the original questionnaire was assumed to remain stable, though cross-cultural variations in the target population's construct perception may exist. Lastly, while cognitive function was assessed using the MoCA, alternative objective measures as utilized in previous research, were not employed. However, the use of MoCA has been validated in various studies, establishing it as a reliable and valid measurement tool.

Conclusion

This study findings shows prevalence of cognitive frailty was found to be 8.44%. Factors associated with cognitive frailty in Indonesian older adults included gender, age, employment status, BMI, level of education, marital status, income, healthy lifestyle status, number of comorbidities, experienced serious illness during past year, fall history, physical functions, depression level, dependency level, nutritional status, and quality of life, offering empirical evidence regarding the

prevalence of cognitive frailty within the Indonesian population. A longitudinal study could be particularly valuable for further investigating the causal relationships between cognitive frailty and its associated factors.

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