Original Article

The prevalence of cognitive frailty and pre-frailty among older people in Bangkok metropolitan area: a multicenter study of hospital-based outpatient clinics

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Abstract

Objectives: To identify the prevalence of, and factors associated with, cognitive frailty and prefrailty, and to investigate correlation between frailty tools. Methods: One hundred and ninety five older adults were recruited from the medical outpatient clinics of 3 tertiary hospitals in Bangkok metropolitan region. The data collected were demographic information, lifestyle factors, functional status, mood assessment, and cognitive and frailty assessments. The frailty tools used were Frailty Phenotype and FRAIL scale. Results: The prevalence of pre-frailty, frailty, mild cognitive impairment (MCI), cognitive pre-frailty and cognitive frailty was 57.4%, 15.9%, 26.2%, 14.4% and 6.7%, respectively. A multivariate analysis showed that age ≥ 70 years (OR 5.34; 95% CI 2.06-12.63), and education at primary school or under (OR 4.18; 95% CI 1.61-10.82) were associated with cognitive frailty and cognitive pre-frailty. The correlation between physical frailty rated by the Modified Fried Frailty Phenotype and the FRAIL scale was good (Kappa coefficient = 0.741). Conclusions: The prevalence of cognitive frailty is not uncommon which requires screening and interventions. Age and a low educational level were related to cognitive frailty/prefrailty. The FRAIL scale yielded a high correlation with Frailty phenotypes, implying its benefit in routine clinical use in primary care practice, where there is limited time and resources.

Keywords: Cognitive frailty, Dementia, Frailty, Mild cognitive impairment, Pre-frailty

Introduction

With the rapid transition to an aging society worldwide, the higher proportions of older people are leading to an increase in age-related diseases through multiple pathophysiological mechanisms. The aging process can be defined as a decline in reserve and deterioration of function across multiple systems, including the physical, cognitive, and psychosocial functions¹. A loss of homeostasis properties and decreased adaptability to stress concede increased vulnerability to disease, disability, and mortality in older people²,³. The term referring to this condition is frailty.

The definition of physical frailty was proposed by Fried et al. The criteria for diagnosis are composed of exhaustion, unintentional weight loss, low physical activity, reduced grip strength, and slow gait speed⁴. Physical frailty has been suggested as an earlier predictor of health status than the presence of disease⁵. While frailty in the physical domain has been acknowledged, the cognitive domain has not been given

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much attention. This is despite evidence demonstrating a link between frailty and cognitive performance that has been established through both cross-sectional and prospective cohort studies. Physical frailty can predict the occurrence of cognitive impairment or mild cognitive impairment (MCI). A recent meta-analysis found that the co-occurrence of physical frailty and cognitive impairment was associated with a higher hazard ratio of incident dementia than each

| Characteristics                      | Normal cognition (n = 137) | MCI (N = 51) | Dementia (N = 7) | Total (N = 195) | P-value |
|--------------------------------------|---------------------------|--------------|------------------|-----------------|---------|
| Age, years (mean ± SD)               | 66.5 ± 6.4               | 72.4 ± 6.3   | 74.3 ± 6.3       | 68.3 ± 6.7      | <0.001* |
| Female (n, %)                        | 93 (67.9)                | 35 (68.6)    | 5 (71.4)         | 133 (68.2)      | 0.978   |
| BMI, kg/m² (mean ± SD)               | 25.1 ± 4.6               | 23.9 ± 4.3   | 22.0 ± 4.3       | 24.7 ± 4.6      | 0.097   |
| Education level (n, %)               |                           |              |                  |                 |         |
| No education                         | 3 (2.2)                  | 6 (11.8)     | 1 (14.3)         | 10 (5.1)        | 0.003*  |
| Primary school                       | 70 (51.1)                | 38 (74.5)    | 6 (85.7)         | 114 (58.5)      |         |
| Secondary school                     | 13 (9.5)                 | 2 (3.9)      | 0 (0.0)          | 15 (7.7)        |         |
| High school                          | 29 (21.2)                | 4 (7.8)      | 0 (0.0)          | 33 (16.9)       |         |
| Vocational college                   | 6 (4.4)                  | 0 (0.0)      | 0 (0.0)          | 6 (3.1)         |         |
| University                           | 16 (11.7)                | 1 (2.0)      | 0 (0.0)          | 17 (8.7)        |         |
| Marital status (n, %)                |                           |              |                  |                 |         |
| Single                               | 17 (12.4)                | 4 (7.8)      | 0 (0.0)          | 21 (10.8)       | 0.595   |
| Married                              | 91 (66.4)                | 33 (64.7)    | 6 (85.7)         | 130 (66.7)      |         |
| Widowed/divorced/separated           | 29 (21.2)                | 14 (27.5)    | 1 (14.3)         | 44 (22.6)       |         |
| Self-reported income insufficiency (n, %) |                     |              |                  |                 |         |
| Sufficient                           | 120 (87.6)               | 40 (78.4)    | 7 (100.0)        | 167 (85.6)      | 0.146   |
| Insufficient                         | 11 (8.0)                 | 10 (19.6)    | 0 (0.0)          | 21 (10.8)       |         |
| Savings                              | 6 (4.4)                  | 1 (2.0)      | 0 (0.0)          | 7 (3.6)         |         |
| Underlying disease (n, %)            |                           |              |                  |                 |         |
| Hypertension                         | 93 (67.9)                | 40 (78.4)    | 5 (71.4)         | 138 (70.8)      | 0.368   |
| Diabetes                             | 44 (32.1)                | 15 (29.4)    | 3 (42.9)         | 62 (31.8)       | 0.765   |
| Dyslipidemia                         | 81 (59.1)                | 27 (52.9)    | 4 (57.1)         | 112 (57.4)      | 0.748   |
| Cancer                               | 4 (2.9)                  | 3 (5.9)      | 1 (14.3)         | 8 (4.1)         | 0.254   |
| Stroke                               | 7 (5.1)                  | 0 (0.0)      | 0 (0.0)          | 7 (3.6)         | 0.215   |
| Current alcohol drinker (n, %)       | 14 (10.2)                | 2 (3.9)      | 1 (14.3)         | 17 (8.7)        | 0.344   |
| Current smoker (n, %)                | 13 (9.5)                 | 4 (7.8)      | 0 (0.0)          | 17 (8.7)        | 0.664   |
| Hospital visit during preceding year (n, %) | 22 (16.1)               | 12 (23.5)    | 2 (28.6)         | 36 (18.5)       | 0.392   |
| Falling during preceding year (n, %) | 25 (18.2)                | 6 (11.8)     | 1 (14.3)         | 32 (16.4)       | 0.559   |
| Self-perceived health (n, %)         |                           |              |                  |                 |         |
| Good                                 | 61 (44.5)                | 15 (29.4)    | 2 (28.6)         | 78 (40.0)       | 0.167   |
| Moderate                             | 70 (51.1)                | 30 (58.8)    | 4 (57.1)         | 104 (53.3)      |         |
| Poor                                 | 6 (4.4)                  | 6 (11.8)     | 1 (14.3)         | 13 (6.7)        |         |
| Poor self-perceived memory (n, %)    | 82 (59.9)                | 34 (66.7)    | 3 (42.9)         | 119 (61.0)      | 0.420   |
| Poor self-perceived memory compared to other people of the same age (n, %) | 84 (61.3) | 28 (54.9) | 2 (28.6) | 114 (58.5) | 0.192   |

MCI = mild cognitive impairment; BMI = body mass index.

Table 1. Baseline characteristics. Characteristics of participants, according to their cognitive impairment category.
condition separately\(^6\). Therefore, early identification of this syndrome could lead to the secondary prevention of dementia and disability\(^9,10\).

The International Academy on Nutrition and Aging (IANA) and the International Association of Gerontology and Geriatrics (IAGG) proposed the identification of cognitive frailty through a combination of physical frailty (Fried et al.) and cognitive impairment (CDR=0.5)\(^11\). Despite the consensus group having clear definitions, most studies have alternative, and possibly conflicting, definitions. The prevalence of cognitive frailty in previous reports has ranged between 1.0% and 39.7%\(^10-13\). This wide range might be related to differences in the participants' characteristics, study settings (e.g., community, primary care, and academic hospital), and assessment tools\(^14\). More than 27 frailty measures that aim to diagnose this syndrome have been published\(^15\). The Fried frailty phenotype is the most frequently used methodology for frailty diagnosis (69% of published research)\(^16\). However, it is difficult to integrate into routine clinical practice in outpatient clinic settings, where there is typically limited time and human resources available.

A simpler frailty assessment method which is quick, easy, reliable, and accurate is needed for implementation in routine clinical service. Among the simple tools that have been used, the FRAIL scale is short, consisting of only 5 items\(^17\). It does not require measurements nor administration by trained professionals. Its validity has also been examined by comparing it with the Fried phenotype\(^18\), and it has recently been used as a frailty screening tool by several studies\(^18,19\). Nevertheless, it has not been utilized in an older outpatient population to test its convergent validity against the other standard tools.

This study aimed to examine the prevalence of cognitive frailty, the associated factors, and the correlation of the FRAIL scale with the Fried phenotype. It is imperative to estimate the magnitude of the problems and to help medical professionals endorse a strategy of screening older people who visit outpatient clinics in the Bangkok metropolitan region.

**Methods**

**Data collection**

Ethics approval was obtained from the Institutional Review Board and the Hospital Human Research Ethics Committee of the three studied hospitals. The physician who is a specialist in geriatric medicine (PW) was trained to use the instruments. The sample was taken by convenience sampling. The investigator screened participants according to the specified inclusion/exclusion criteria and introduced the study protocol. Informed consent was obtained from all participants.

**Participants**

Participants were required to be aged ≥60 years and to have visited the medical outpatient service at one of 3 tertiary hospitals. Two hospitals are located in Bangkok: Siriraj (a university hospital) and Lerdsin (a public hospital); the third hospital, Khrathum Baen, is in a neighboring province, Prathumtani.

Participants had to have good decision-making capacity and to be able to communicate in Thai. Participants were excluded if they could not complete frailty assessment via handgrip strength measurement, were unable to walk with or without gait aids independently, or had an unstable medical condition. The participants' baseline characteristics were summarized in Table 1.

**Measurements**

The researchers collected the subjects' characteristics, reviewed their medical histories, assessed their frailty and cognitive functions, determined their functional status, and explored the risk factors associated with cognitive frailty, as described below.

**Frailty**

**The Fried frailty phenotype**

In the context of local norms, the present study modified the 5 criteria of the Fried frailty phenotype\(^4\) to define frailty as follows:

1. **Exhaustion.** Evaluation of self-perception was assessed by a subject's answer to the question, “During the last week, how often have you felt any tension or fatigue?” using the Center of Epidemiologic Studies Depression scale (CES-D), Thai version\(^20\). If the answer was “tension or fatigue for at least 3 days/week”, the subject was grouped into “presence of exhaustion”.
2. **Unintentional weight loss.** This was defined as a decrease of 4.5 kg, or a loss of more than 5% of the baseline body weight, during the preceding year.
3. **Low physical activity.** The measurement was performed by requesting the participants to give a rating in response to the question, “How do you rate your physical activity level?” The possible responses were low, moderate, or high. A participant answer of “low” was interpreted as low physical activity. A previous investigation of this method among older Thais revealed a high correlation with the Global Physical Activity Questionnaire (kappa 0.721)\(^21\).
4. **Weakness.** This was measured by a handgrip dynamometer. The dominant hand was evaluated 3 times, and the average result was calculated\(^22\). The cut-off point was defined by gender and BMI, as follows\(^23\):

| BMI (kg/m\(^2\)) | Grip strength (kg) |
|------------------|--------------------|
| **Men**          |                    |
| ≤ 24             | ≤ 29               |
| 24.1-26           | ≤ 30               |
| 26.1-28           | ≤ 30               |
| > 28             | ≤ 32               |
| ≤ 23             | ≤ 17               |
| 24.1-26           | ≤ 17.3             |
| 26.1-29           | ≤ 18               |
| > 29             | ≤ 21               |
| **Women**        |                    |
| ≤ 23             | ≤ 17               |
| 24.1-26           | ≤ 17.3             |
| 26.1-29           | ≤ 18               |
| > 29             | ≤ 21               |

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5. **Slowness.** The assessment was done by asking the participants to walk a horizontal distance of 15 feet at their usual gait speed. The cut-off point was defined by gender and height, as follows:

|       | Men       | Women    |
|-------|-----------|----------|
| Height (cm) | Gait speed (sec) |
| ≤ 173 | ≥ 7       |           |
| > 173 | ≥ 6       |           |
| ≤ 159 | ≥ 7       |           |
| > 159 | ≥ 6       |           |

Participants who had at least 3 of the 5 symptoms were classified as “frail”. If they had 1-2 symptoms, they were categorized as “pre-frail”.

**FRAIL scale (Thai Version)**

The FRAIL scale consists of 5 questions; each requires a “yes” or “no” answer, with 1 point given to each affirmative response. The scale is entirely based on self-report. The total score was used to categorize each subject as frail (≥3 points), pre-frail (1 or 2 points), and robust (0 point). The FRAIL scale assesses the presence of fatigue, resistance, ambulation, illness, and loss of weight. The Thai version used in the current study was translated by Limpawattana et al.

The parameters are explained as follows.

1. **Fatigue.** This was evaluated by asking participants if they felt tired most of the time.
2. **Resistance.** This was measured by asking the participants about their capacity to climb a flight of stairs.
3. **Ambulation.** The parameter was evaluated by asking the participants to assess their capacity to walk a block independently.
4. **Illness.** This factor was defined by the presence of five or more of a total of 11 diseases (hypertension, diabetes mellitus, cancer [excluding basal cell carcinoma of the skin or equivalent], chronic obstructive pulmonary disease, coronary artery disease or myocardial infarction, congestive heart failure, asthma, arthritis, stroke, and chronic renal failure).
5. **Loss of weight.** This was defined as a decline of 5% or more during the preceding 6 months.

**Cognitive function**

The assessment of cognitive function was performed using the Thai Mental State Examination (TMSE) and Montreal Cognitive Assessment-Basic (MoCA-B), the latter of which was determined to be suitable for use with lower-educated older people. Participants who had a TMSE ≥24 out of 30 and an MoCA-B <25 out of 30 with no functional limitation were classified as “MCI”. If they had a TMSE <23 and an MoCA-B <25 with functional decline, they were categorized as “dementia”.

**Cognitive frailty/pre-frailty**

The definition of cognitive frailty was based on the presence of (1) a physical frailty of at least three or more points of the modified Fried frailty phenotype; and (2) MCI, which was defined by a TMSE ≥24 and an MoCA-B <25 without functional limitation. As there have been recent studies demonstrating an association between cognitive impairment and the pre-frail status (positive for 1-2 items of the Fried criteria), this study also investigated the combination of physical pre-frail status and MCI.

**Potential associated risk factors**

Reviews of patients’ medical records and face-to-face interviews were used to collect information on the baseline characteristics, socioeconomic factors, underlying diseases, body mass index (BMI), self-perceived health status, self-perceived memory impairment and decline, hospitalization and history of falling during the preceding year, alcohol/smoking consumption, and medication usage.

**Statistical analysis**

The baseline characteristics were analyzed using descriptive statistics. Quantitative data were compared using the t-test and Chi-square test, depending on the type of variable. Fisher’s exact test was used if the expected value was <5 in more than 20% of all cells. We compared the clinical characteristics, cognitive impairment, frailty, and cognitive frailty. To compare their characteristics, the participants were classified into 2 groups, according to the presence or absence of cognitive impairment and frailty syndrome. The two groups were Group 1: robust older persons with no evidence of physical frailty (0 point on the Fried criteria) and an absence of cognitive impairment (TMSE ≥24, MoCA-B ≥25); and Group 2: cognitive frailty/prefrailty individuals with at least one Fried criteria and with MCI (TMSE ≥24 and MoCA-B <25). Analytic statistics was used to investigate the factors associated with cognitive impairment and frailty. All statistically significant variables revealed by the univariate analysis were subjected to a multivariate analysis to analyze the predictors of cognitive frailty. The Kappa coefficient was estimated by comparing the physical frailty and the FRAIL scale. All data were performed using PASW Statistics for Windows (version 18.0; SPSS Inc., Chicago, IL, USA).

**Results**

A total of 195 older patients were recruited from Siriraj Hospital (n=65), Lerdsin Hospital (n=65), and Krathum Baen Hospital (n=65). The participants’ mean age was 68.3 years, and 68.2% were women. The prevalence of pre-frailty, frailty, MCI, and cognitive frailty was 57.4%, 15.9%, 26.2%, and 6.7%, respectively.

Table 1 details the baseline characteristics of the participants and comparisons among the groups of different cognitive functions. The 3 cognitive conditions (normal, MCI, and dementia) displayed differences in mean age and educational level, as tabulated in Table 1.

We compared the baseline characteristics among groups...
A significantly larger proportion of frail participants had cancer than the prefrail and robust participants (p=0.015). The demographic and health characteristics of the participants according to their physical frailty, combined with their cognitive impairments, are displayed in Table 3. There was a larger proportion of cognitive frailty/pre-frailty among the participants with an older age, income insufficiency,

![Table 2](image)

of physical frailty conditions in Table 2.
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hypertension, and poor self-perceived health status than for the healthy population with normal cognitive function. Logistic regression analyses were performed to evaluate all of the potential risk factors except income insufficiency; that parameter could not be compared between the groups as there was no participant with income insufficiency in the robust group with normal cognition.

Three risk factors were found to be associated with MCI

| Characteristics                                      | Normal cognition + robust (n = 41) | Frail/pre-frailty + MCI (n = 41) | P-value |
|------------------------------------------------------|-----------------------------------|----------------------------------|---------|
| Age, years (mean ± SD)                               | 65.9 ± 5.5                        | 72.9 ± 6.4                       | <0.001* |
| Female (n, %)                                        | 30 (73.2)                         | 28 (68.3)                        | 0.627   |
| BMI, kg/m² (mean ± SD)                               | 24.5 ± 3.4                        | 23.9 ± 4.3                       | 0.433   |
| Education level (n, %)                               |                                   |                                  |         |
| No education                                         | 0 (0.0)                           | 6 (14.6)                         | <0.001* |
| Primary school                                       | 14 (34.1)                         | 28 (68.3)                        |         |
| Secondary school                                     | 4 (9.8)                           | 2 (4.9)                          |         |
| High school                                          | 16 (39.0)                         | 4 (9.8)                          |         |
| Vocational college                                   | 2 (4.9)                           | 0 (0.0)                          |         |
| University                                           | 5 (12.2)                          | 1 (2.4)                          |         |
| Marital status (n, %)                                |                                   |                                  |         |
| Single                                               | 2 (4.9)                           | 3 (7.3)                          | 0.362   |
| Married                                              | 31 (75.6)                         | 25 (61.0)                        |         |
| Widowed/Divorced/Separated                           | 8 (19.5)                          | 13 (31.7)                        |         |
| Self-reported income insufficiency (n, %)            |                                   |                                  |         |
| Sufficient                                           | 40 (97.6)                         | 33 (80.5)                        | 0.022*  |
| Insufficient                                         | 0 (0.0)                           | 7 (17.1)                         |         |
| Savings                                              | 1 (2.4)                           | 1 (2.4)                          |         |
| Underlying disease (n, %)                            |                                   |                                  |         |
| Hypertension                                         | 22 (53.7)                         | 32 (78.0)                        | 0.020*  |
| Diabetes                                             | 7 (17.1)                          | 12 (29.3)                        | 0.191   |
| Dyslipidemia                                         | 17 (41.5)                         | 21 (51.2)                        | 0.376   |
| Cancer                                               | 0 (0.0)                           | 3 (7.3)                          | 0.241   |
| Stroke                                               | 1 (2.4)                           | 0 (0.0)                          | 1.000   |
| Current alcohol drinker (n, %)                       | 4 (9.8)                           | 3 (7.3)                          | 1.000   |
| Current smoker (n, %)                                | 5 (12.2)                          | 1 (2.4)                          | 0.201   |
| Hospital visit during preceding year (n, %)          | 4 (9.8)                           | 6 (14.6)                         | 0.500   |
| Fall during preceding year (n, %)                    | 4 (9.8)                           | 5 (12.2)                         | 1.000   |
| Self-perceived health (n, %)                         |                                   |                                  |         |
| Good                                                 | 22 (53.7)                         | 12 (29.3)                        | 0.028*  |
| Moderate                                             | 18 (43.9)                         | 23 (56.1)                        |         |
| Poor                                                 | 1 (2.4)                           | 6 (14.6)                         |         |
| Poor self-perceived memory (n, %)                    | 25 (61.0)                         | 30 (73.2)                        | 0.240   |
| Poor self-perceived memory compared to other people of the same age (n, %) | 25 (61.0) | 23 (56.1) | 0.654 |

MCI = mild cognitive impairment; BMI = body mass index

Table 3. Characteristics of participants, according to their cognitive frailty category.
and prefrailty/frailty: age, educational level, and poor self-perceived health. The odds ratio (OR) of age was 5.15 (95% confidence interval [CI] 2.46-10.74), of educational level was 3.45 (95% CI 1.44-8.28), and of poor self-perceived health was 4.71 (95% CI 1.35-16.49). Factors that remained significant in the multivariate analyses were age (OR 5.34; 95% CI 2.06-12.63) and low educational level (OR 4.18; 95% CI 1.61-10.82). Table 4 has the detailed results.

The correlation between physical frailty rated by Modified Fried Frailty Phenotype and FRAIL scale questionnaire was good (Kappa coefficient=0.741). The correlation was highest for the robust group (Kappa 0.921). The FRAIL scale yielded a nearly similar prevalence among the pre-frailty (59% vs 57.4%) and frailty (14.4% vs 15.9%) subgroups, as summarized in Table 5.

### Discussion

Our study demonstrated that the prevalence of frailty, MCI, and cognitive frailty was fairly high and associated with older age and low educational level. There was good correlation between physical frailty rated by Modified Fried Frailty Phenotype and FRAIL scale questionnaire.

The prevalence of frailty, MCI, and cognitive frailty was higher than the corresponding rates reported in studies by Feng et al., Shimada et al., and Roppolo et al. An explanation for this discrepancy may be that different diagnostic criteria were used to define cognitive impairment. In the current study, MoCA-B was applied; it has a higher sensitivity for the detection of cognitive impairment than the Mini Mental State Examination, which had been used by the other studies. The MoCA-B is also more accurate in identifying MCI which might otherwise go under-detected.

The prevalence of frailty in the work by Feng et al. was the lowest of the rates reported by the other studies. The research by Feng et al. was a three-year longitudinal study, which focused on a group of older community-dwelling adults. Their baseline characteristics indicated that they were healthier than the subjects investigated in the current study and the research by Shimada, Roppolo and colleagues.

The prevalence of frailty and cognitive frailty was lower than that reported by Delrieu et al., Fougère et al., and Jha et al. Delrieu et al. showed that the prevalence of frailty,
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MCI, and cognitive frailty was high, which might be a result of the older age of the participants in that study. In addition, Delrieu et al. determined frailty to be present if the subjects were positive to at least one of the five Fried frailty phenotype criteria, whereas the other studies commonly used ≥ three out of the five. Moreover, the participants in the work by Delrieu et al. had to have at least 1 of the following 3 clinical criteria (memory complaint, limitation in one instrumental activity of daily living, and slow gait speed), which could lead to subjects being more likely to have cognitive frailty. By comparison, Fougère et al. found that the prevalence of frailty, MCI, and cognitive frailty was higher than in the present study. A possible reason for the discrepancy is that their study recruited older patients, which is noticeably different from the much younger participants in our study. Finally, Jha et al. determined that the prevalence of cognitive frailty was the highest among all of the studies. However, this result follows from the patient population having end-stage, decompensated heart failure considered eligible for heart transplantation, which would make them extremely vulnerable to developing frailty.

Increasing age was associated with cognitive frailty/pre-frailty. This finding was similar to the evidence of Rivan et al. and Brigola et al. The mean age in the current study was very similar to those for the Rivan et al. study and the Brigola et al. study. The association between aging and cognitive frailty/pre-frailty is related to increased, multisystem, physiological impairments, and age-related changes may accelerate deterioration in multiple organ systems.

Our study found that a low educational level was associated with the cognitive frailty/pre-frailty participants. This result is comparable with that of the work by Brigola et al. The strengths of the association in both our work and that of Brigola et al. were high. Both studies indicated that a low educational level is a substantial risk factor that can be reflected by a high odds ratios. The cognitive reserve theory may explain the association. According to the theory, participants with a greater cognitive reserve, which indicates a relatively high level of educational attainment, require a more severe neuropathologic burden to reach the threshold for clinical symptoms of cognitive impairment. Conversely, participants with limited education require a lower burden before symptoms are displayed.

A significantly larger proportion of cognitive frailty/pre-frailty participants with income insufficiency was observed. If the number of participants had been sufficient, self-reported income insufficiency would have been compared by logistic regression. The impact of social problems - such as a poor quality of life and low social support - are important risk factors associated with cognitive frailty. Income insufficiency is possibly one of those socially-related risk factors.

Previous studies have shown that cognitive frailty is significantly correlated with depressive mood, a low level of activities of daily living, and malnutrition. In contrast, our study revealed no individuals with depression, functional dependence, or malnutrition. This negative finding might be explained by the recruitment method and assessment tools used by the present study.

Cognitive frailty was related to adverse outcomes with mortality, a greater risk of incident neurocognitive disorder, a higher risk for progression to dementia, and an increased incidence of functional disability. This study was a cross-sectional study, which means that causality cannot be inferred from the results. Cognitive frailty/pre-frailty individuals should be considered as the target group for secondary prevention from disability and dementia. Doing so may change their aging trajectories from a pathological aging pattern to successful aging.

A considerable strength of the present study is that it is the first to report cognitive frailty in an outpatient hospital setting. Moreover, the advantages of utilizing a multicenter-study approach include different locations, a more extensive range of characteristics, and the quality of hospital care, which increases generalizability. Several variables were confirmed using patients’ medical records to increase the accuracy of the study data.

This study has some limitations that should be mentioned. Firstly, as convenience sampling was applied, selection bias may be present, resulting in an overrepresentation of healthy people. However, participants with walking aids or wheelchairs were also included to reduce the gap, providing they met the selection criteria. Secondly, data was collected on several variables by questionnaire. The disadvantage of using a questionnaire is that the information is subject to recall and social desirability biases. For instance, participants with cognitive impairment might report inaccurate data. Nevertheless, several variables were confirmed through our review of the patients’ medical records to improve reliability. Lastly, there is a need for prospective cohort studies that will give more information on the adverse outcomes of cognitive frailty. In addition, as this study was conducted with 195 participants, the estimate of prevalence might be less precise. For a more precise analysis, a greater number of participants would be required.

Cognitive frailty was found in 6.7% of the study population. This prevalence is fairly high, and appropriate assessments and health care planning are necessary to prevent the development of adverse health outcomes. The FRAIL scale yielded a nearly similar prevalence among the pre-frailty and frailty subgroups and showed good correlation with Modified Fried Frailty Phenotype; therefore, it could be used as a screening tool in an OPD setting. The use of screening strategies for the early diagnosis of cognitive frailty in an OPD setting should therefore be fully considered.

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