A study on prevalence and associations of non-robustness in older adults aged 65 years and above attending a general practitioner clinic in Ang Mo Kio

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INTRODUCTION
In Singapore’s rapidly ageing society, the proportion of older adults aged above 65 years increased by 6% annually between 2015 and 2017.1,2 Frailty in older adults is associated with adverse health outcomes such as loss of independence, institutionalisation and mortality,3 thus increasing healthcare needs and costs. As pre-frail individuals are more likely to return to robustness, while frail individuals are more likely to remain frail,4,5 we should identify pre-frail individuals for timely interventions to prevent progression to frailty. Simultaneously, we need to plan and provide for the healthcare and socioeconomic needs of frail older adults.

As our ageing population is largely cared for by primary healthcare physicians, the latter are well-positioned to identify frailty syndrome and its accompanying medical and social issues. However, the prevalence of frailty and pre-fraility among older adults seeking medical consultations in general practice clinics in Singapore has not been studied. Prior local data was from population or hospital-based studies,6-7 while other Asian studies were conducted in low-income countries or rural settings with limited generalisability to Singapore.8,9 In this study, we aimed to assess the prevalence of frailty and pre-frailty and evaluate factors associated with them among older adults who visited a general practice clinic in a residential estate in Singapore.

METHODS
This was a cross-sectional observational study of participants aged 65 years and above who attended the Frontier Medical Associates (Ang Mo Kio) general practice clinic between October 2018 and January 2019. Individuals were excluded if they were unable to give informed consent, had a speech or hearing impairment that impaired their ability to respond to a telephone interview, or required emergency care in a hospital.

Eligible participants were enrolled after giving written informed consent and contacted by an interviewer via telephone within one week after enrolment. The interviewer was blinded to the participant’s past history and had no prior clinical contact. There were two interviewers who both received standardised training on conducting the telephone interviews. Telephone interviews were conducted in English, Mandarin or Hokkien. Enrolled participants who were uncontactable by telephone on two separate occasions within a week were considered to have withdrawn from the study. The study abided by the Declaration of Helsinki, and the protocol was approved by the St Luke’s Hospital Institutional Review Board (IRB-01-2018-07-12).

Participants’ demographic and medical comorbidity data were obtained through interviewer-administered questionnaires. Missing data was filled in by cross-checking the medical records of the participants as much as possible. Information collected included marital status, educational level, home ownership and type, employment status, and whether they stayed with their family or had a domestic helper.

In addition to documenting medical conditions, chronic disease burden was determined using the number of chronic medications (≥ 5) as a surrogate marker.10-13 Chronic pain was defined as pain that occurred at least four days in a week for three or more months.14 Basic activities of daily living (bADL) dependence was present if the patient had difficulty or required assistance in any of the six bADLs, namely bathing, toileting, dressing, eating, transferring and mobility.

The primary outcome was frailty and the secondary outcome was non-robustness (combining the frail and pre-frail groups). Although there is no consensus on a gold standard for measuring frailty, the most frequently used assessment tools are the Comprehensive Geriatric Assessment and Fried Frailty Phenotype.15-18 These tools are cumbersome and time-consuming, thus limiting their effective use in a busy primary care clinic. Instead, we used the five-point FRAIL (fatigue, resistance, ambulation, illnesses and weight loss) scale, developed by the International Association of Nutrition and Aging,19 to determine robust, pre-frail and frail states. This scale assesses the domains of fatigue, resistance, ambulation, illnesses and weight loss, with one point for each domain. Participants were then classified as robust (score 0), pre-frail (score 1–2) or frail (score 3–5). The FRAIL scale is widely validated in Asia, the United States, Europe and South America.20-24 Compared to other frailty instruments such as the Frailty Index,25 Cardiovascular Health Study frailty scale,26 and Study of Osteoporotic Fractures index,27 the FRAIL scale had the strongest predictive validity for new disability and mortality.28 Locally, the FRAIL scale predicted in-hospital adverse outcomes and was the best predictor of mortality in a local tertiary hospital when compared with the Tilburg Frailty Indicator and Clinical

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Frailty Scale, using the Frailty Index as the gold standard.\(^5\) Scoring of the FRAIL scale can be done quickly without need of expertise knowledge, physical measurement or special equipment, making it ideal for busy healthcare providers.

A sample size of 91 was required for a cross-sectional study to detect frailty prevalence, based on a precision error of 5%, Type I error of 5%, and an expected prevalence of 6.2% obtained from the local population-based HOPE study.\(^5\)

Categorical variables were presented as proportions, and continuous variables were summarised as median with interquartile range (25th–75th percentile). Pearson chi-square test or Fisher’s exact test was used to compare categorical variables and Mann-Whitney U test to compare ranks for non-normally distributed continuous variables. Binary logistic regression analysis (stepwise method) was used to calculate odds ratio (OR) and 95% confidence interval (CI) for factors associated with outcomes. Covariates were chosen if p-values were ≤ 0.05 on bivariate analysis. All analyses were two-tailed and p < 0.05 was considered statistically significant. Statistical analysis was performed using IBM SPSS Statistics version 25.0 (IBM Corp, Armonk, NY, USA).

RESULTS

A total of 241 participants were assessed for eligibility during the recruitment period between October 2018 and January 2019. 145 participants were enrolled after excluding 96, of whom ten did not meet the eligibility criteria and 86 did not consent to the study. 97 participants completed the telephone survey.

Table I shows the sociodemographic and clinical characteristics of the cohort. The median age was 71.7 years, and 53.6% were female. Most of the participants (74.2%) had a living spouse; 21 (21.6%) were widowed, while 3 (3.1%) were single. Half the participants had received either primary (n = 26, 26.8%) or secondary school education (n = 28, 28.9%), while 29 (29.9%) participants did not have any formal education. Common comorbid conditions were hypertension, hyperlipidaemia, diabetes mellitus, arthritis and osteoporosis. Few participants had dementia (n = 2, 2.1%); mental illness (n = 4, 4.1%); depression (n = 3, 3.1%); cardiac disease such as a previous heart attack (n = 6, 6.2%), angina (n = 3, 3.1%) and arrhythmia (n = 3, 3.1%); chronic kidney disease (n = 5, 5.2%); and previous stroke (n = 5, 5.2%). None had chronic liver disease or Parkinson’s disease.

Frailty was present in 10 (11.8%) participants, while 33 (38.8%) were pre-frail and 42 (49.4%) were robust. Weight loss data was imputed as having weight loss (instead of having none) found that the association between non-robustness and chronic pain persisted (adjusted OR 3.10, 95% CI 1.17–8.27; p = 0.02), while the association with living spouse was lost.

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Comparing the frail and the non-frail on bivariate analysis (Table II), those who were categorised as frail were more likely to be older (OR 1.12, 95% CI 1.03–1.23; p = 0.01). They were less likely to have a living spouse (OR 0.11, 95% CI 0.03–0.45; p = 0.002), stay with family (OR 0.11, 95% CI 0.03–0.51; p = 0.005) or own their homes (OR 0.05, 95% CI 0.01–0.30; p = 0.001). Chronic pain (OR 5.47, 95% CI 1.31–22.84; p = 0.02), bADL restriction (OR 7.2), Hypertension (OR 7.6, 95% CI 1.7–3.4; p = 0.001), and depression (OR 21.5, 95% CI 1.75–263.87; p = 0.02) were more frequent in the frail older adults.

Table III compares factors associated with non-robustness (both frail and pre-frail). Non-robust older adults were less likely to have a living spouse (OR 0.24, 95% CI 0.08–0.67; p = 0.007) and formal education (OR 0.34, 95% CI 0.13–0.84; p = 0.02), but more likely to be taking five or more chronic medications (OR 3.82, 95% CI 1.26–11.59; p = 0.018) and have chronic pain (OR 5.21, 95% CI 2.03–13.38; p = 0.001). Multivariable analysis of factors associated with non-robustness (Table IV), taking into account marital status, formal education, chronic medication burden and chronic pain, found that chronic pain and absence of a living spouse were independently associated with non-robustness. Sensitivity analysis of the scenario where missing values for weight loss data were imputed as having weight loss (instead of having none) found that the association between non-robustness and chronic pain persisted (adjusted OR 3.10, 95% CI 1.17–8.27; p = 0.02), while the association with living spouse was lost.
Table II. Comparison of frail and non-frail elderly.

| Characteristic               | No. (%)          | p-value |
|------------------------------|------------------|---------|
| Age* (yr)                    | Non-frail (n = 87) | Frail (n = 10) |
| Male gender                  | 41 (47.1)        | 4 (40.0) | 0.75   |
| Living married spouse        | 69 (80.2)        | 3 (30.0) | 0.002  |
| Body mass index* (kg/m²)     | 23.6 (21.7–26.1) | 23.8 (21.8–26.0) | 0.77   |
| Formal education             | 63 (72.4)        | 5 (50.0) | 0.16   |
| Home ownership               | 83 (95.4)        | 6 (60.0) | < 0.001|
| Stays with family            | 80 (93.0)        | 6 (60.0) | 0.01   |
| Domestic helper              | 21 (25.0)        | 4 (40.0) | 0.45   |
| Currently employed           | 23 (26.4)        | 1 (10.0) | 0.25   |
| ≥ 5 chronic medications      | 17 (20.0)        | 4 (40.0) | 0.22   |
| Chronic pain                 | 26 (29.9)        | 7 (70.0) | 0.03   |
| Depression                   | 1 (1.1)          | 2 (20.0) | 0.03   |
| bADL restriction             | 3 (3.5)          | 4 (44.4) | 0.001  |

Categorical variables expressed as no. (%) were compared using Pearson chi-square test or Fisher’s exact test, as appropriate. *Continuous variables expressed as median (interquartile range 25th–75th percentile) were compared using Mann-Whitney U test. †Percentages were calculated based on available values. bADL: basic activities of daily living (bathing, toileting, dressing, eating, transferring and mobility).

Table III. Comparison of robust and non-robust (frail and pre-frail) elderly.

| Characteristic               | No. (%)          | p-value |
|------------------------------|------------------|---------|
| Age* (yr)                    | Non-robust (n = 49) | Robust (n = 48) |
| Male                         | 18 (36.7)        | 27 (56.3) | 0.06   |
| Living married spouse        | 30 (62.5)        | 42 (87.5) | 0.005  |
| Body mass index* (kg/m²)     | 23.5 (21.8–26.5) | 23.7 (21.8–25.7) | 0.98   |
| Formal education             | 29 (59.2)        | 39 (81.3) | 0.02   |
| Home ownership               | 43 (87.8)        | 46 (95.8) | 0.10   |
| Stays with family            | 41 (85.4)        | 45 (93.8) | 0.18   |
| Domestic helper              | 15 (31.9)        | 10 (21.3) | 0.24   |
| Currently employed           | 11 (22.4)        | 13 (27.1) | 0.60   |
| ≥ 5 chronic medications      | 15 (31.3)        | 6 (12.8) | 0.03   |
| Chronic pain                 | 25 (51.0)        | 8 (16.7) | < 0.001|
| Depression                   | 3 (6.1)          | 0 (0)    | 0.24   |
| bADL restriction             | 6 (12.8)         | 1 (2.1)  | 0.06   |

Categorical variables expressed as no. (%) were compared using Pearson chi-square test or Fisher’s exact test, as appropriate. *Continuous variables expressed as median (interquartile range 25th–75th percentile) were compared using Mann-Whitney U test. bADL: basic activities of daily living (bathing, toileting, dressing, eating, transferring and mobility).

Table IV. Bivariate and multivariable analysis for factors associated with non-robustness.

| Factor                        | Unadjusted OR (95% CI) | Adjusted OR (95% CI) |
|-------------------------------|------------------------|----------------------|
| Absence of a living married spouse | 4.20 (1.49–11.83) | 3.64 (1.22–10.88) |
| Formal education              | 0.34 (0.13–0.84)       | –                    |
| ≥ 5 chronic medications       | 3.82 (1.26–11.59)      | –                    |
| Chronic pain                  | 5.21 (2.03–13.38)      | 4.48 (1.68–11.92)    |

Binary logistic regression analysis (stepwise method) was used to calculate OR and 95% CI for factors associated with outcomes. Covariates were chosen if p ≤ 0.05 on bivariate analysis. CI: confidence interval; OR: odds ratio.

DISCUSSION

The study confirmed that frailty and non-robustness were common among older adults who consulted at a general practice clinic. Frailty was present in about 12% of older adults at our general practice clinic. In contrast, among other local cohorts, the prevalence of frailty was higher among hospitalised older adults (50%) and lower in the general population (6.2%), using the same FRAIL scale. In our study, chronic pain and the absence of a living spouse were independently associated with non-robustness. Recent international studies have found similar associations between chronic pain and frailty.

Although an interacting mediator may be present, Tian et al showed that the association persisted after mediation analysis for depression.

The association between marital status and frailty syndrome has not been evaluated locally. A longitudinal study involving 515 community-dwelling adults aged 65 years and above in Brazil identified an inverse relationship between having a living spouse and frailty. It is possible that the lack of companionship may contribute to poorer health behaviours that lead to the onset of frailty syndrome.

The limitations of the present study included recall bias, as some questions in the FRAIL scale, such as chronic disease history and weight loss, were self-reported. Also, inter- and intra-interviewer variability could lead to potential bias. We attempted to minimise this with standardised training of the two interviewers involved. The association between cognitive impairment and frailty syndrome was not investigated due to the inherent nature of a telephone interview-based study. Our small sample size may also have limited the power to detect a statistically significant difference in factors that are weakly associated with frailty. Findings from a single-centre general practice clinic may not be generalisable to other cohorts with different socioeconomic demographics.

Despite these limitations, this study had a few strengths. It highlighted that frailty and pre-frailty were common among older individuals at a primary care clinic in Singapore. It also identified clinical and socio-economic factors that can alert the busy general practitioner to consider a formal frailty assessment and formulate management plans to treat or reverse frailty states.
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