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## Original Study

## Social Frailty Has a Stronger Impact on the Onset of Depressive Symptoms than Physical Frailty or Cognitive Impairment: A 4-Year Follow-up Longitudinal Cohort Study

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## A B S T R A C T

**Keywords:**  
Depressive symptoms  
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**Objectives:** To examine the association between each type of frailty status and the incidence rate of depressive symptoms among community-dwelling older adults.

**Design:** Prospective cohort study.

**Setting:** General communities in Japan.

**Participants:** Participants comprised 3538 older Japanese adults.

**Measurements:** We assessed our participants in terms of frailty status (physical frailty, cognitive impairment, and social frailty), depressive symptoms (geriatric depression scale  $\geq 6$ ), and other covariates, and excluded those who showed evidence of depression. Then, after a 4-year interval, we again assessed the participants for depressive symptoms. Physical frailty was defined by the Fried criteria, showing 1 or more of these were physical frailty. To screen for cognitive impairment, receiving a score below an age-education adjusted reference threshold in 1 or more tests was cognitive impairment. Finally, social frailty was defined using 5 questions, and those who answered positively to 1 or more of these were considered to have social frailty.

**Results:** After multiple imputations, the incidence rate of depressive symptoms after 4 years of follow-up was 7.2%. The incidence rates of depressive symptoms for each frailty status were as follows: 9.6% for physical frailty vs 4.6% without, 9.3% for cognitive impairment vs 6.5% without, and 12.0% for social frailty vs 5.1% without. Finally, through the application of multivariable logistic regression analysis, the incidence of depressive symptoms was found to have a significant association with social frailty (odds ratio 1.55; 95% confidence interval 1.10–2.20) but not with physical frailty or cognitive impairment.

**Conclusions:** This study revealed that social frailty, in comparison with physical frailty and cognitive impairment, is more strongly associated with incidences of depressive symptoms among elderly.

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Depressive symptoms and depression are one of the common geriatric syndromes among older adult populations,<sup>1,2</sup> and are associated with adverse health outcomes,<sup>3,4</sup> increased economic costs,<sup>5,6</sup> and an increased risk of developing more severe depression and other psychiatric disorders.<sup>7</sup> By 2038 depressive disorders are projected to be the second most common cause of disability-adjusted life years worldwide, and the leading cause in high-income countries.<sup>8</sup> Thus, to reduce this burden, it is critical to identify modifiable factors that can contribute to preventing and managing depression.

Frailty is also a common geriatric syndrome and a pervasive condition among older adults. Numerous studies examined impacts of frailty on adverse health outcomes, especially focusing on disability,<sup>9,10</sup> where frailty included not only physical factors but also cognitive<sup>11</sup> or social components.<sup>12</sup> With respect to the cognitive aspect of frailty, in 2013 an international consensus group for “cognitive frailty” was established, and this provided the first definition of cognitive frailty in older adults<sup>13</sup>; this field is important because older individuals with cognitive frailty have the highest risk of experiencing limitations on instrumental activities of daily living.<sup>11</sup> Recently, a systematic review showed that the approach to not only physical or cognitive aspects but also to social aspects of frailty has been emphasized for the health of older adults.<sup>14</sup> In fact, social frailty led to various health problems late in life. Quality of life in older adults is associated with social domain among frailty components.<sup>15</sup> Moreover, compared with those who do not possess social frailty, older adults with this condition have been found to have significantly lower physical and cognitive function<sup>16</sup> and a significantly higher risk of future disability incidence.<sup>12,17</sup>

A previously conducted systematic review demonstrated that a reciprocal interaction exists between depression and physical frailty in older adults and suggested that each condition is associated with an increased prevalence and incidence rate of the other, and that possessing 1 condition may constitute a risk factor for the development of the other.<sup>18</sup> However, it remains unclear as to which components of the frailty phenotype (eg, physical deficits, cognitive impairment, and low social engagement) are related to incidences of depressive symptoms. If an association can be identified in this regard, it may provide knowledge that can help medical professionals develop an appropriate approach for each frailty status. Consequently, the aim of the present study is to investigate the association between each frailty status (physical frailty, cognitive impairment, and social frailty) and incidences of depressive symptoms among community-dwelling older adults.

## Methods

### Participants

A total of 2430 participants completed both the baseline and follow-up of our study. The participants were community-dwelling older adults persons aged  $\geq 65$  years from Obu City, Japan; they were recruited using the National Center for Geriatrics and Gerontology (NCGG) Study of Geriatric Syndromes database (Figure 1).<sup>11,19</sup> Initially, we recruited 5104 older adults who had completed the NCGG Study of Geriatric Syndromes examinations between August 2011 and February 2012 and on whom follow-up examinations were performed between August 2015 and August 2016. For our selection process, the inclusion criteria related to residents of Obu who were aged  $\geq 65$  years at the time of the first examination (August 2011 to February 2012); meanwhile, the exclusion criteria were possessing health problems such as Alzheimer’s disease, Parkinson’s disease, depression; an inability to perform basic daily living tasks; a need for support or care as a result of disability; severe cognitive impairment (Mini-Mental State Examination<sup>20</sup> score of  $\leq 20$ ); and suffering from depressive symptoms [15-item Geriatric Depression Scale (GDS) score of  $\geq 6$ ].<sup>21</sup> Furthermore, persons

for whom data relating to the exclusion criteria were missing were also excluded. We also excluded those who could not be followed up, because of death or moving out of Obu City (Figure 1). All participants gave their informed consent before they were included in the study. The study protocol was approved by the Ethics Committee of the National Center for Geriatrics and Gerontology.

### Operationalization of Physical Frailty, Cognitive Impairment, and Social Frailty

We determined the presence of physical frailty by testing the participants for the presence of the 5 components suggested by Fried: slowness, weakness, exhaustion, low physical activity, and weight loss.<sup>22</sup> Participants showing 1 or more of these components were considered to be physically frail. Slowness was examined using a comfortable walking speed cutoff test ( $< 1.0$  m/s).<sup>23</sup> Next, weakness was defined through a sex-specific maximum-grip-strength cut-off test ( $< 26$  kg for men;  $< 18$  kg for women).<sup>24</sup> Meanwhile, exhaustion was considered present if the participant answered “yes” to the following question (sourced from the Kihon Checklist<sup>25</sup>): “In the last 2 weeks, have you felt tired for an unknown reason?” Then, we evaluated physical activity using the following questions: (1) “Do you engage in moderate levels of physical exercise or sports aimed at health?” and (2) “Do you engage in low levels of physical exercise with the aim of improving your health?” Participants who answered “no” to both of these questions were considered to engage in a low level of physical activity.<sup>23</sup> Finally, weight loss was examined using the question: “Have you lost 2 kg or more in the past 6 months?” (also sourced from the Kihon Checklist).<sup>25</sup>

Cognitive screening was conducted using the NCGG Functional Assessment Tool.<sup>26</sup> Specifically, this consists of 4 domains: Word List Memory (immediate recognition and delayed recall), Trail Making Test-part A, Trail Making Test-part B, and the Symbol Digit Substitution Test. High test-retest reliability and the moderate to high validity of the NCGG Functional Assessment Tool was confirmed for our sample.<sup>26</sup> All tests used in this study possessed established standardized thresholds for the definition of impairment in the corresponding domain [a score  $< 1.5$  standard deviation below the age- and education-specific means], and these were deemed suitable for a population-based cohort consisting of community-dwelling older adults.<sup>11</sup> In the present study, we considered cognitive impairment to be characterized under standardized thresholds in at least 1 domain of the tests.

Finally, social frailty was examined using 5 questions, including going out less frequently compared with last year (“yes”), visiting friends sometimes (“no”), feeling helpful to friends or family (“no”), living alone (yes), and talking with someone everyday (“no”). Participants showing none of these components were considered not to have social frailty, those showing 1 component were considered to have presocial-frailty, and those showing 2 or more components were considered to have fully developed social frailty.<sup>12</sup> In the present study, individuals with presocial-frailty and fully developed social frailty were classed as having social frailty.

### Depressive Symptoms

Depressive symptoms were assessed at baseline and during the follow-up examination using the 15-item GDS.<sup>21</sup> The GDS is unique in that it has been specifically developed for use with geriatric patients. The participants responded “yes” or “no” to each item, and those who scored 6 or higher on the GDS (score range, 0–15) were considered to have depression symptoms.<sup>21</sup>

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