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Prevalence of frailty in Japan: A systematic review and meta-analysis

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ABSTRACT

Japan's population is aging more rapidly than that of any other country. Frailty has recently been recognized as an important priority. Understanding the basic epidemiology of frailty in Japan, which is an example of a rapidly aging society, will be beneficial for Japan as well as other countries expecting an aging population. A systematic literature search of 11 electronic databases was conducted in March 2016 using a comprehensive set of Medical Subject Heading and text terms for any studies published in 2000 or later that report the prevalence of frailty among Japanese community-dwelling older people aged 65 years or older. A total of 1529 studies were identified in the systematic search, of which five studies were included in this review. The pooled prevalence of frailty, prefrailty, and robustness was 7.4% (95% confidence interval [CI], 6.1%–9.0%), 48.1% (95% CI, 41.6%–54.8%), and 44.4% (95% CI, 37.2%–51.7%), respectively. A significant degree of heterogeneity was observed. There was no evidence of publication bias. Age-stratified meta-analyses of four studies showed the pooled prevalence of frailty was 1.9%, 3.8%, 10.0%, 20.4%, and 35.1% for those aged 65–69, 70–74, 75–79, 80–84, and ≥85 years, respectively. Pooled prevalence of frailty was 8.1% for women and 7.6% for men. This review showed an overall pooled prevalence of frailty among Japanese community-dwelling older people of 7.4%. The age-stratified analysis suggested that Japanese older people are less frail before their late 70's but frailer in later life than older people in other countries. These findings provide important basic information for all parties involved in Japanese frailty research.

1. Introduction

Because Japan has the world's highest life expectancy and a persistently low birth rate, Japan's population is aging more rapidly than that of any other country.[1] The proportion of people aged 65 years and older was approximately 10% in 1985. This proportion doubled to 21% in 2007, making Japan a hyper-aged society.[2,3] The latest governmental provisional estimates report that as much as 26.7% of the Japanese population were over 65 years old in 2015.[4] This rate is much higher than in other developed countries: 17% in the United Kingdom, 14% in the United States, 9% in China, 21% in Germany, 19% in France, 22% in Italy, and 16% in Canada.[3] By 2060, Japan is expected to far exceed the current understanding of a hyper-aged society, when 40% of the entire population will be aged 65 years or over.[5] With the increasing number of older people in Japan, there is expected to be a substantial increase in health care and social security costs.

The Japanese government has already begun to prepare for this challenging issue.[6] It has started to attempt to adapt society in order to maximize older people's health and to facilitate healthy aging via maintaining their functional capacity and preventing disability and dependence.[7] One of the campaign targets is frailty.[8] Frailty is a state of vulnerability to poor resolution of homeostasis when exposed to a stressor event as a consequence of age-related cumulative deficits across multiple physiological systems.[9] It is considered a pre-disability state and is associated with various negative health outcomes, including falls, hospitalization,

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institutionalization, fracture, disability, dementia, lower quality of life, and mortality.[9–16] The most widely used definition of frailty is the frailty phenotype proposed by Fried et al. using data from the Cardiovascular Health Study.[17] They recognized frailty as a distinct clinical syndrome using a set of five physical phenotypic components: unintentional weight loss, exhaustion, weakness, slow walking speed, and low physical activity with an underlying biological basis.[17] In the Fried criteria, an individual is classified as frail, prefrail, and robust when they meet ≥3, 1–2, and 0 of the components, respectively.[17]

Given the detrimental physical and psychological impact of frailty on older people, as well as its potential reversibility,[18,19] frailty may be a promising target of interventions.[9] Frail older people, who are not highly fit but not completely disabled, are the population likely to benefit most from such interventions.[20] In this regard, frailty can be an important outcome, for which it is worth exploring the modifiable risk factors or predictors to be addressed for prevention.[21] Therefore, understanding the basic epidemiology of frailty in older people is essential for clinicians, researchers, and policymakers to further pursue frailty research and support.[22,23]

According to previous systematic reviews,[24,25] the prevalence of frailty based on the Fried criteria among community-dwelling people aged 65 years and older ranged from 4% in a United States study[26] to 27.3% in a Spanish study.[27] One of these reviews performed a meta-analysis using data from 15 studies and showed that the weighted prevalence of physical frailty was 9.9%.[24]

In other selected populations, the prevalence of frailty has been reported to be much higher, such as in patients with cancer (range, 6–28%; based on the Fried criteria)[28] and nursing home patients (pooled prevalence 46.9%; 95% confidence interval [CI], 27.7%–66.6%; based on the Fried criteria).[29] Japanese studies were not included in the aforementioned reviews, and the evidence regarding the prevalence of frailty among the Japanese population is scarce in the literature. Understanding the current frailty status in Japan as an example of a rapidly aging society will be beneficial for research and health policy for Japan as well as any other countries experiencing rapid population aging.

The purposes of this systematic review and meta-analysis study were two-fold: to systematically search the literature for available evidence on the prevalence of physical frailty among Japanese community-dwelling older people, and to conduct a meta-analysis to synthesize the pooled prevalence of frailty.

In general, people become frailer with age and females are more likely to be frailer than their male counterparts.[24] However, since Japan is unique in its longevity,[30] universal health insurance system, healthy Japanese food, enhanced awareness about healthy aging among the general public, and the so-called Japanese smoking paradox (Japanese people smoke more but develop less lung cancer than people in Western countries), Japanese people may have different courses and patterns of frailty status than other populations. In addition, merely pooling the prevalence of frailty without taking into consideration the cohort characteristics, such as mean age or female proportion, may obscure important subgroup differences. Therefore, we also performed meta-analyses stratified according to age and gender.

2. Methods

2.1. Protocol

A protocol was developed according to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) statement[31] and has been published elsewhere.[32]

2.2. Data sources and search strategy

A systematic search of the literature was conducted in March 2015 for studies published in 2000 or later by two investigators (GK and YT) using ten electronic databases: Scopus, Web of Science, Embase, MEDLINE, LILACS, CINAHL Plus, PsycINFO, Cochrane Library, AMED, and ICHUSHI Web, with explosion function if available and without language restriction. The search terms used for the databases, except those for ICHUSHI Web, are as follows: [(Frailty) OR (Frailty syndrome (Medical Subject Heading (MeSH)))] AND [(Japan*) OR (Japan (MeSH))]. ICHUSHI Web is a Japanese bibliographic database containing mainly Japanese articles and both English and Japanese terms can be used for searching. The search terms for ICHUSHI Web included (Frailty) and Japanese MeSH and text terms corresponding to frailty, and the studies were limited to original articles involving people aged 65 years or older, excluding case reports or case series. Other data sources included the manual search of bibliographies of the relevant articles, personal inquiries to experts in this field, and a search of another Japanese electronic database, Japan Science and Technology Information Aggregator, Electronic (J-STAGE), using a search strategy similar to the one for ICHUSHI Web. Corresponding and/or last authors were contacted for additional data necessary for a meta-analysis. Ethics approval was not required, as this study did not involve human subjects.

2.3. Study selection and methodological quality assessment

Any studies providing or potentially capable of providing cross-sectional data regarding prevalence of frailty status defined using the Fried criteria or its modified versions among Japanese community-dwelling people aged 65 years and older in Japan were eligible. Studies were excluded if they used selected samples, such as people with certain diseases or conditions, or were a randomized controlled trial, review article, editorial, or comment. Gray literature, such as conference abstracts, was also considered. When multiple studies used the same cohort, the study with the largest sample size was included. A clinician researcher with an internal medicine and geriatric medicine background (GK) assessed the identified studies via screening titles, abstracts, and full texts. The studies considered as eligible were further assessed for methodological quality using six items from a tool for critically appraising studies of prevalence or incidence of a health problem developed by Loney et al.[33] Studies meeting three or more of the six items were considered to have adequate methodological quality and were included in the meta-analysis.

2.4. Data extraction

The data collected directly from the included studies or provided by the authors upon request were first author's name, cohort name if any, publication year, prefecture where the participants were recruited from, sample size, age (mean and range), proportion of female participants, percentage and the number of participants according to frailty categories (frail, prefrail, and robust), and cohort characteristics.

2.5. Statistical analysis

The numbers of the entire cohort, as well as those classified frail, prefrail, and robust, were used for analysis. Heterogeneity across the studies was assessed using Cochran's Q test, and heterogeneity was considered to be present when $p < 0.05$. The degree of heterogeneity was assessed using the I^2 statistic. The I^2 values of 25%, 50%, and 75% were considered as low, moderate,

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