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Original Study

Ability of Self-Reported Frailty Components to Predict Incident Disability, Falls, and All-Cause Mortality: Results From a Population-Based Study of Older British Men

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A B S T R A C T

Background: Frailty is a state of increased vulnerability to disability, falls, and mortality. The Fried frailty phenotype includes assessments of grip strength and gait speed, which are complex or require objective measurements and are challenging in routine primary care practice. In this study, we aimed to develop a simple assessment tool based on self-reported information on the 5 Fried frailty components to identify older people at risk of incident disability, falls, and mortality.

Methods: Analyses are based on a prospective cohort comprising older British men aged 71–92 years in 2010–2012. A follow-up questionnaire was completed in 2014. The discriminatory power for incident disability and falls was compared with the Fried frailty phenotype using receiver operating characteristic-area under the curve (ROC-AUC); for incident falls it was additionally compared with the FRAIL scale (fatigue, resistance, ambulation, illnesses, and loss of weight). Predictive ability for mortality was assessed using age-adjusted Cox proportional hazard models.

Results: A model including self-reported measures of slow walking speed, low physical activity, and exhaustion had a significantly increased ROC-AUC [0.68, 95% confidence interval (CI) 0.63–0.72] for incident disability compared with the Fried frailty phenotype (0.63, 95% CI 0.59–0.68; P value of $\Delta AUC = .003$). A second model including self-reported measures of slow walking speed, low physical activity, and weight loss had a higher ROC-AUC (0.64, 95% CI 0.59–0.68) for incident falls compared with the Fried frailty phenotype (0.57, 95% CI 0.53–0.61; P value of $\Delta AUC < .001$) and the FRAIL scale (0.56, 95% CI 0.52–0.61; P value of $\Delta AUC = .001$). This model was also associated with an increased risk of mortality (Harrell's C = 0.73, Somer's D = 0.45; linear trend $P < .001$) compared with the Fried phenotype (Harrell's C = 0.71; Somer's D = 0.42; linear trend $P < .001$) and the FRAIL scale (Harrell's C = 0.71, Somer's D = 0.42; linear trend $P < .001$).

Conclusions: Self-reported information on the Fried frailty components had superior discriminatory and predictive ability compared with the Fried frailty phenotype for all the adverse outcomes considered and with the FRAIL scale for incident falls and mortality. These findings have important implications for developing interventions and health care policies as they offer a simple way to identify older people at risk of adverse outcomes associated with frailty.

Following a demographic shift observed in several countries, including the United Kingdom, the projected number of people aged ≥65 years is expected to rise by over 40% in the next 17 years.[1] From a public health perspective, one of the major challenges of population aging is to reduce the morbidity and disability associated with increasing age. In the United Kingdom alone, 40% of those aged

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65 years and older have a limiting longstanding illness,[1] and 28%-35% experience falls every year.[2]

One of the most commonly recognized risk states for adverse outcomes in the older population is frailty, a clinical condition of increased vulnerability resulting from age-related declines in multiple physiological systems.[3] Numerous prospective studies and meta-analyses have demonstrated significant associations between frailty status and increased risk of disability,[4,5] falls,[6] and mortality.[4,7–12] It is, therefore, recognized as one of the greatest challenges for health care professionals in countries with aging populations such as the United Kingdom.[13] Frailty also offers potential for preventive management because it has been shown to be preventable or at least amenable to prevention of progression.[3,14] A review suggested that prescreening for frailty could serve as a 2-step approach to identify individuals who would benefit from further assessments, such as the comprehensive geriatric assessment (CGA).[15] The CGA is a recommended component in the care of older patients and includes a detailed evaluation of the individual's functional status, physical health, psychological status including cognitive and affective status, and socioenvironmental factors.[16] However, the CGA is time-consuming and, therefore, difficult to implement in routine community care. Consequently, there is a need to develop simple screening tools to identify old people who would benefit from a further detailed assessment followed by appropriate management to prevent adverse outcomes of frailty.[15]

Two models of frailty, the frailty phenotype and the frailty index, have provided the conceptual basis to measure frailty. The Fried frailty phenotype comprises weight loss, physical inactivity, slow walking speed, low grip strength, and exhaustion.[7] The frailty index is a cumulative score of a number of symptoms, signs, disease, abnormal laboratory results, and disability.[17] Currently, more than 27 indices aiming to screen for frailty status have been described in the literature.[12–14,18,19] The majority of these scales are extensive, for example the 25-item Tilburg Frailty Indicator,[20] the 15-item Groningen frailty indicator,[21] the 70-item frailty index,[22,23] and the 11-item Edmonton Frail scale.[24,25] Commonly, they also necessitate objective measures of grip strength and/or gait speed (eg, the Fried frailty component[7] or the Survey of health, ageing, and retirement in Europe-frailty instrument [SHARE-FI][26]), and are, therefore, challenging in routine primary care practice. Attempts to develop a simple screening tool for frailty, such as the 5-item FRAIL scale, comprising Fatigue, Resistance, Ambulation, Illnesses, and Loss of weight,[14,27–29] have shown promising results in terms of their ability to detect frailty among middle-aged and older populations and to predict incident functional loss and mortality.[27,30]

This study in a community-dwelling cohort of older British men aimed to investigate the ability of simple self-reported measures of the Fried frailty components, including weight loss, physical inactivity, slow walking speed, low grip strength, and exhaustion to predict incident disability, falls, and mortality over a 3-year follow-up period. The discriminative and predictive ability of models including up to 3 subjective measures was compared with that of the Fried frailty phenotype and with the simpler FRAIL scale.

Methods

Data for this study are based on the British Regional Heart Study (BRHS), a prospective cohort study comprising a socially and geographically representative sample of 7735 men aged 40–59 years from 1 general practice in each of 24 towns representing all major British regions and who were initially examined in 1978–1980.[31] Surviving study members aged 71–92 years (n = 3137) were invited to attend a 30-year reexamination in 2010–2012, of whom 2137 completed a questionnaire (68% response rate), and 1722 attended a physical examination (55% response rate).[32] In 2014, a follow-up postal questionnaire was sent to the cohort and was completed by 1655 participants (64% response rate). In total, 1198 study participants had complete data during the 30-year reexamination and the follow-up questionnaire. Ethical approval was provided by the relevant research ethics committees. All men provided written informed consent to the investigations, which were carried out in accordance with the Declaration of Helsinki.

Physical examination of participants at age 71–92 years involved anthropometric (height, weight) and physical performance (gait speed, grip strength) assessments, as well as a lung function test. Height was measured with a Harpenden stadiometer to the last complete 0.1 cm and weight with a Tanita MA-418-BC body composition analyzer (Tanita, Tokyo, Japan). Body mass index was calculated as weight/(height)^2 (kg/m^2). Grip strength (in kilograms) was measured with a Jamar hydraulic hand dynamometer (Model J00105, Lafayette Instrument Europe, Leicester, UK). Walking speed was defined as the time taken, in seconds, to walk 3 meters at normal walking pace. If walking speed was unavailable, self-reported information of slow walking pace ("being unable to walk more than a few steps or <200 yards or difficulty walking across a room") was used. Three measurements were taken for each hand, and the best of 6 readings was used for the analysis. Forced expiratory volume in 1 second and forced vital capacity were measured using a Vitalograph compact II spirometer (Vitalograph Ltd, Buckingham, UK) with the participant seated.

Subjective assessments of walking speed, grip strength, weight loss, exhaustion, and physical activity were derived from the questionnaire completed in 2010–2012. They included single-item questions on self-reported (1) inability to grip with hands (eg, opening a jam jar); (2) decrease of weight in the last 4 years; (3) slow walking pace; (4) not feeling full of energy; and (5) being less or much less active compared with a man who spends 2 hours on most days on activities such as walking, gardening, household chores, or do-it-yourself projects.

Additional baseline sample characteristics considered included social class, smoking status, and alcohol consumption. For alcohol intake, the men were classified into 5 groups—none, occasional, light, moderate, and heavy. Heavy drinking was defined as drinking >6 units (1 UK unit = 10 g) of alcohol daily or on most days. Men were also classified in 4 groups according to their smoking habits as current smokers, ex-smokers who gave up smoking before or after 1983, and those who never smoked.

Frailty and prefrailty status based on the Fried frailty phenotype and the FRAIL scale was derived for participants attending the 30-year reexamination of the BRHS using information drawn from the questionnaire and the physical examination.[33] The Fried frailty phenotype components included (1) unintentional weight loss defined as ≥ 5% decrease in self- reported weight, which was reported to be unintentional; (2) weakness defined as being in the lowest quintile of the distribution for grip strength; (3) low physical activity was assessed using self-report questions on being less or much less active than an average man, or participating in active sport and endurance activities; (4) exhaustion was defined as participants reporting not to be feeling full of energy; and (5) slow walking speed was defined as being in the lowest quintile of the distribution of walking speed. Scores on the FRAIL scale were computed using information on exhaustion, resistance, ambulation, illnesses, and weight loss. Measurements of exhaustion and weight loss were the same for the Fried frailty phenotype and the FRAIL scale. Ambulation was computed using information on the ability to walk more than 200 yards. Resistance was based on information on the ability to climb a flight of 12 stairs. Participants were considered to have multiple illnesses when they reported having a history of at least 5 out of 11 total illnesses, including hypertension, diabetes, cancer, chronic lung disease, heart attack, heart failure, angina, asthma, arthritis, stroke, and kidney disease. Participants were considered to have a positive history of chronic lung disease when they reported being prescribed bronchodilators (British