Association Between Self-Rated Health and Frailty in Community-Dwelling Older Adults: The Moderating Role of Apathy (Postprint)

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Abstract

Background Self-rated health is negatively correlated with frailty; the better the self-rated health status, the lower the degree of frailty. The relationship between the two may differ among apathetic populations. Objective To investigate the moderating effect of apathy on the relationship between self-rated health and frailty among community-dwelling older adults. Methods Using convenience sampling, 384 community-dwelling older adults were surveyed using a general information questionnaire, the Frailty Assessment Scale (Fried Frailty Phenotype, FFP), the Apathy Scale (Geriatric Depression Scale, GDS-3), and the Self-Rated Health (SRH) item. Results Apathy moderated the strength of the association between self-rated health and frailty (standardized B = -0.355, t = -3.074, P < 0.002), enhancing the negative effect of self-rated health on frailty. Conclusion Self-rated health is negatively correlated with frailty, and apathy exerts a positive moderating effect, further strengthening the negative association between self-rated health and frailty.

Full Text

Preamble

The Relationship Between Self-Rated Health and Frailty in Community-Dwelling Older Adults: The Moderating Role of Apathy

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Abstract

Background: Self-rated health is negatively associated with frailty, such that better self-rated health corresponds to lower frailty levels. However, this relationship may differ among individuals with apathy.

Objective: To explore the moderating effect of apathy on the relationship between self-rated health and frailty among community-dwelling older adults.

Methods: Using convenience sampling, 384 community-dwelling older adults were surveyed using a general information questionnaire, the Fried Frailty Phenotype (FFP), the Geriatric Depression Scale (GDS-3) for apathy, and a self-rated health (SRH) item.

Results: Apathy moderated the strength of the association between self-rated health and frailty (standardized B = -0.355, t = -3.074, $P < 0.002$), enhancing the negative effect of self-rated health on frailty.

Conclusion: Self-rated health is negatively correlated with frailty, and apathy plays a positive moderating role that further strengthens this negative association.

Keywords: Older adults; Frailty; Apathy; Self-Rated Health

Introduction

Frailty refers to an individual' s inability to maintain physiological homeostasis when facing external stressors, which increases the risk of adverse outcomes such as falls and mortality. Due to its serious consequences for older adults, frailty has garnered widespread attention. Timely identification of high-risk

frailty populations and early intervention are crucial measures for reducing adverse outcomes in older adults. Self-rated health is a widely used measure of self-perceived health status that reflects overall physical condition and predicts health-related mortality. Recent studies have found that self-rated health status can predict frailty in community-dwelling older adults. Nicolas' s follow-up study found that individuals with poor self-rated health had a higher likelihood of frailty, while Pilleron' s cohort study demonstrated that self-rated health was closely associated with frailty-related gait speed changes. Consequently, self-rated health is often considered an independent risk factor for frailty and serves as a simple method for early identification of frail older adults.

However, the relationship between self-rated health and frailty may be moderated by apathy. Apathy, one of the most common neuropsychiatric symptoms in older adults, refers to a motivational disorder that affects behavior, cognition, and emotion. Research indicates that individuals with apathy are less concerned about their health problems and exhibit poor health behaviors such as low activity participation and poor medication adherence, which may worsen the negative relationship between self-rated health and frailty. Nevertheless, few studies have explored the moderating effect of apathy on the self-rated health-frailty relationship. This study investigates the moderating role of apathy in the relationship between self-rated health and frailty, hypothesizing that apathy positively moderates this negative relationship—that is, apathy may strengthen the inverse association between self-rated health and frailty.

Methods

Study Design and Participants

In 2021, we conveniently selected 384 community-dwelling older adults from Nanjing and Lianyungang cities. **Inclusion criteria:** (1) age $\geq$ 60 years; (2) informed consent and voluntary participation; (3) ability to complete the questionnaire independently or with researcher assistance. **Exclusion criteria:** (1) comatose or in terminal illness; (2) obvious consciousness or mental disorders; (3) severe language or hearing impairments preventing questionnaire completion. This study was approved by the Nanjing Medical University Ethics Committee (Approval No.: NMU Ethics Review [2020] 513).

Sample Size Estimation

Based on previous research experience and multivariate analysis requirements, the sample size should be 5–10 times the number of variables. This study included 9 variables: 6 items in the general information survey, 1 item in the apathy scale, 1 item in the frailty scale, and 1 self-rated health item, requiring 45–90 participants. Considering a non-response rate of 10%–20%, the total sample size needed was 50–108. We distributed 384 questionnaires and recovered

384 valid questionnaires (100% valid response rate), which met the sample size requirements.

Measures

General Information Survey Based on literature review and participants' actual conditions, we designed a demographic questionnaire including six items: gender, age, education status, marital status, monthly income, and number of comorbidities.

Frailty Assessment The Fried Frailty Phenotype (FFP), developed by Fried et al. in 2001, aligns with frailty clinical manifestations and includes five items: unintentional weight loss, decreased grip strength, exhaustion, slow gait speed, and low physical activity. Each item scores 1 point, with total scores ranging from 0 to 5. A score of 0 indicates robust health, 1–2 indicates pre-frailty, and $ $3 indicates frailty. The 2017 Chinese Frailty Guidelines published Chinese versions of FFP items and scoring criteria, making it suitable for frailty assessment in Chinese older adults.

Apathy Assessment This study used the GDS-3 (Geriatric Depression Scale) to measure apathy. The GDS-3 includes three items: "Have you dropped many of your activities and interests?" "Do you prefer to stay at home rather than going out and doing new things?" and "Do you feel full of energy?" Each item is scored yes/no with 1 point per item. A score of $ $2 indicates apathy. The GDS-3 is widely used internationally to measure apathy in community-dwelling older adults. In China, Zhou Ying validated the GDS-3 in community-dwelling older adults, demonstrating high sensitivity and specificity, making it suitable for large-scale epidemiological surveys or community apathy assessment.

Self-Rated Health Assessment We measured self-rated health using a single item: "How would you rate your health?" Response options were "excellent, very good, good, fair, poor," corresponding to scores of 1–5, with higher scores indicating worse health. For analysis, we reverse-coded this variable such that 1 = poor, 2 = fair, 3 = good, 4 = very good, and 5 = excellent, with higher scores indicating better health status.

Data Collection Procedure

We used a uniformly designed questionnaire. Before data collection, investigators received standardized training on terminology, communication protocols, and instrument use (dynamometer and stopwatch). During data collection, investigators explained the study purpose and obtained consent before distributing questionnaires. Investigators remained present throughout to answer questions, and all questionnaires were collected on-site with verification of ambiguous responses. After collection, data were double-entered and checked for consistency.

We distributed 384 questionnaires, recovering 384 valid questionnaires (100% valid response rate).

Statistical Analysis

We used SPSS 26.0 and the Process 3.3 macro for data analysis. Normally distributed continuous variables were described using means and standard deviations, non-normally distributed continuous variables using median (quartiles) [M (Q1, Q3)], and categorical variables using frequencies and percentages. Frailty, gender, age, education status, marital status, monthly income, and number of comorbidities were not normally distributed, so we used rank-sum tests to compare frailty scores across groups. Reverse-coded self-rated health scores (higher = better) were analyzed as continuous variables. We used linear regression to examine the association between frailty and self-rated health, and Hayes' s SPSS Process macro Model 1 to analyze the moderating effect of apathy. In the model, self-rated health and frailty were continuous variables, while apathy was dichotomized (apathy vs. no apathy) based on cutoff scores. Covariates included age, monthly income, and number of comorbidities as continuous variables, and gender, education status, and marital status as dichotomous variables. To reduce multicollinearity and improve interpretability, we centered the self-rated health variable. We visualized the moderating effect by plotting the interaction and standardized data to compare variables with different units. Statistical significance was set at $\alpha = 0.05$ (two-tailed), with $P < 0.05$ considered significant.

Results

Participant Characteristics and Frailty Prevalence

We recruited 384 community-dwelling older adults. The prevalence of pre-frailty was 43.5% and frailty was 12.8%. The sample included 171 males (44.5%) and 213 females (55.5%). Age distribution was: 60–70 years (196 cases, 51.0%), 71–80 years (149 cases, 38.8%), and $ $81 years (39 cases, 10.2%). Additional demographic characteristics are shown in .

Correlation Between Self-Rated Health and Frailty

After controlling for confounding variables (gender, age, education status, marital status, monthly income, and number of comorbidities), self-rated health was negatively correlated with frailty (standardized B = -0.250, t = -4.936, $P < 0.001$). No multicollinearity was detected among variables (see).

Moderating Effect of Apathy

Using Hayes's (2012) Process macro Model 1 and controlling for six confounding variables (gender, age, education, marital status, monthly income, and number

of comorbidities), we tested the moderation model. The interaction term between apathy and self-rated health significantly predicted frailty (standardized B = -0.355, t = -3.074, P < 0.002), indicating that apathy moderated the relationship between self-rated health and frailty (see). Simple slopes analysis revealed: for the non-apathetic group, simple slope = -0.100, t = -1.209, P > 0.05; for the apathetic group, simple slope = -0.455, t = -5.205, P < 0.001. These results show that self-rated health was not significantly associated with frailty in the non-apathetic group but was significantly negatively correlated in the apathetic group, confirming that apathy positively moderates the negative relationship between self-rated health and frailty. This finding is visually represented in [Figure 1: see original paper].

Discussion

Frailty Severity in Community-Dwelling Older Adults

Frailty reduces physiological reserve and involves pathophysiological changes across multiple systems (muscle, nerve, immune), increasing risks of falls, cognitive impairment, and mortality. Our study found a pre-frailty prevalence of 43.5% and frailty prevalence of 12.8%, consistent with literature indicating high frailty rates among Chinese older adults. Frailty is reversible—Thomas et al. followed 754 adults aged $ $70 and found that 434 experienced at least one transition between frailty states. However, frailty progression is more common than improvement, with low probability of transitioning from frailty to robust health. This underscores the need for timely community screening to identify frail older adults and explore influencing factors to provide evidence for frailty reversal interventions.

Frailty is associated with multiple demographic factors. Our findings identified age, education, marital status, monthly income, and number of comorbidities as frailty risk factors, consistent with previous research. Age and comorbidities correlate with frailty, as increased age and disease burden reduce physiological function. Educated older adults show lower frailty risk, possibly because they acquire and apply more health information to maintain health status. Married individuals and those with higher income demonstrate lower frailty scores, likely because marriage and higher income provide greater social support, facilitating access to health resources and promoting healthy lifestyles. We found no gender difference in frailty, contrasting with international studies showing higher frailty in women, possibly due to our sample' s similar health behaviors and lifestyles and lack of consideration for complex interactions with other factors like age. These findings suggest targeted community assessment and intervention for high-risk demographic groups (e.g., advanced age, multiple comorbidities).

Relationship Between Self-Rated Health and Frailty

After controlling for confounders, self-rated health negatively correlated with frailty (standardized B = -0.250, t = -4.936, P < 0.001), indicating that self-rated health can independently identify high-risk frailty populations. This aligns with Zhu' s research using self-rated health to predict frailty. Self-rated health likely encompasses comprehensive assessments of physical activity capacity, chronic diseases, and inflammatory markers like C-reactive protein—all critical components of frailty. Thus, self-rated health has potential for frailty assessment and screening. Compared to instrument-based physical tests (e.g., grip strength, gait speed) or multi-item scales like the Fried phenotype or Frailty Index, this single-item assessment requires no instruments, is simple to implement, reduces healthcare burden, and offers advantages for large-scale community screening.

Moderating Effect of Apathy on the Self-Rated Health-Frailty Relationship

Our results show that apathy moderates the self-rated health-frailty relationship (standardized B = -0.355, t = -3.074, P < 0.002). In the apathetic group, self-rated health significantly negatively predicted frailty (simple slope = -0.455, t = -5.205, P < 0.001). This may reflect reduced physical function in apathetic individuals, strengthening the negative relationship. The mechanism likely involves diminished health management motivation. First, apathetic individuals lack initiative for self-health management, failing to maintain physical activity and thus reducing physical function. Second, reduced motivation and emotional engagement lead to disinterest in health problems, with less proactive problem-solving despite age-related multimorbidity, further impairing physical function. Third, apathy reduces interest and social participation, potentially decreasing perceived social support, which is associated with health status. Additionally, apathy is closely related to cognitive impairment in older adults, potentially causing memory decline that affects medication adherence and impairs physical function. These explanations align with our finding that apathetic individuals show a correlation between self-rated health and frailty while non-apathetic individuals maintain better health status. Our findings suggest that apathy strengthens the negative self-rated health-frailty relationship, making self-rated health particularly valuable for screening frailty risk in apathetic older adults. Future research should compare self-rated health against frailty assessment tools specifically in apathetic older adults to evaluate screening effectiveness.

Limitations and Future Directions

Frailty is a key health concern for national healthy aging initiatives. Our study demonstrates that self-rated health is negatively associated with frailty and serves as a simple, comprehensive indicator of physical function that predicts mortality and morbidity, making it valuable for large-scale community screening.

Apathy significantly strengthens this negative relationship, enhancing self-rated health' s ability to identify frailty.

However, limitations exist. First, this cross-sectional design cannot examine temporal changes in apathy' s moderating effect; longitudinal studies are needed to explore this dynamic relationship and inform community assessment strategies for apathetic older adults. Second, we did not control for variables like pain and sleep quality, which may affect the primary relationships; future studies should include more covariates. Finally, this convenience sample was relatively small; multi-center studies with larger samples are needed to validate our findings.

Author Contributions

TAO Lu, NIE Zuoting, LI Sha, and YANG Rumei contributed to study design, implementation, and manuscript writing. TAO Lu collected data and performed statistical analysis. YANG Rumei, DING Yaping, ZONG Qianxing, CHEN Long, GAO Shiying, and WU Yan contributed to quality control and manuscript review. TAO Lu, LI Sha, and YANG Rumei supervised the project.

Conflict of Interest: The authors declare no conflicts of interest.

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Note: Figure translations are in progress. See original paper for figures.