Postprint: Analysis of Factors Influencing Vulnerability in Chronic Disease Self-Management Systems among Community-Dwelling Elderly in Shandong Province

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Abstract

Background Chronic diseases are characterized by prolonged course and persistent nature, and their rising incidence poses a serious threat to people's physical and mental health. At present, although researchers have investigated the influencing factors of chronic disease onset, there are relatively few studies focusing on the influencing factors of self-management of chronic diseases among the elderly. Objective To investigate the influencing factors of vulnerability in the chronic disease self-management system among community-dwelling elderly in Shandong Province, and to provide a theoretical basis for enhancing the level of chronic disease self-management among community elderly. Methods Using a multi-stage stratified random sampling method, 2,650 community-dwelling elderly individuals aged 65 years and above were selected in Shandong Province for a questionnaire survey. Main influencing factors were identified through integrated univariate analysis and multiple stepwise regression analysis. Results Under the sensitivity dimension, influencing factors including personal characteristics, occupational type, and economic status of community elderly showed statistical significance. Under the coping capacity dimension, influencing factors such as self-monitoring, self-cognition, and self-restraint showed statistical significance. Conclusion The vulnerability of the chronic disease self-management system among community elderly is influenced by multiple factors. Targeted measures can be implemented to reduce this vulnerability, including: strengthening community health education activities to transform elderly individuals' health concepts; promoting activities of respecting and caring for the elderly to foster a favorable atmosphere for elderly care; and enhancing community service capacity to provide more accurate health services.

Full Text

Analysis of Factors Influencing the Vulnerability of Chronic Disease Self-Management Systems Among Community-Dwelling Older Adults in Shandong Province

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Abstract

Background: Chronic diseases are characterized by prolonged duration and persistent progression, and their rising incidence poses a serious threat to physical and mental health. While previous research has explored factors influencing chronic disease onset, few studies have examined factors affecting self-management of chronic diseases among older adults.

Objective: To identify factors influencing the vulnerability of chronic disease self-management systems among community-dwelling older adults in Shandong Province, providing a theoretical basis for improving self-management capabilities.

Methods: A multistage stratified random sampling approach was employed to survey 2,650 community residents aged 65 and older in Shandong Province. Comprehensive univariate analysis and multiple stepwise regression were used to identify key influencing factors.

Results: In the sensitivity dimension, statistically significant factors included personal characteristics, occupational type, and economic status. In the coping capacity dimension, significant factors comprised self-monitoring, self-awareness, and self-discipline.

Conclusion: The vulnerability of chronic disease self-management systems among community-dwelling older adults is influenced by multiple factors. Targeted interventions—including strengthening community health education to transform health perceptions, promoting elder-respect activities to foster supportive environments, and enhancing community service capacity to deliver more precise healthcare—can reduce system vulnerability.

Keywords: Chronic Disease; Self-Management; Elderly; Vulnerability; Influencing Factors

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Introduction

Chronic disease health management represents a core function of primary healthcare institutions and serves as a powerful guarantee for prevention and control efforts. During self-management of chronic conditions, older adults' personal capacities and external conditions collectively influence management outcomes, potentially exposing them to harm. Therefore, investigating vulnerability factors in chronic disease self-management systems is essential for enhancing positive impacts on older adults. Current vulnerability research primarily focuses on public safety systems, rural doctors, and populations affected by public health emergencies, with limited attention to vulnerability in older adults' chronic disease self-management systems.

Our research team previously proposed, based on systems management theory, that elderly community chronic disease management systems comprise four subsystems: government, community, community health service institutions, and elderly residents. This study examines the elderly resident subsystem. Integrating vulnerability concepts, we define vulnerability of the chronic disease self-management system as the degree to which older adults' health management falls into crisis when the system is disturbed by internal/external environmental changes and random factors, reflecting both sensitivity to these changes and weakness in coping capacity. This vulnerability concept facilitates dynamic management of elderly chronic disease patients and real-time adjustment of community management policies. This article therefore examines the self-management level of community-dwelling older adults to identify vulnerability factors and provide reference for adjusting intervention pathways and enhancing community chronic disease management capacity.

Methods

1.1 Study Population We employed multistage stratified random sampling. **Stage 1:** Based on 2019 GDP rankings, Shandong Province cities were stratified into high, medium, and low economic tiers, selecting one city from each tier (City A: high; City B: medium; City C: low). **Stage 2:** Using proportional sampling, we selected 4 districts/counties from City A (12 total), 3 from City B (8 total), and 2 from City C (6 total). **Stage 3:** Three communities were randomly selected from each district/county, yielding 27 total communities. The survey was administered to 2,650 community-dwelling older adults during October–November 2020 and March 2021.

Inclusion criteria: (1) Age $ $65 years; (2) Ability to independently complete questionnaires/scales; (3) Informed consent from participants and families.

Exclusion criteria: (1) Non-local permanent residents; (2) Psychiatric conditions preventing survey completion; (3) Communication barriers or unwillingness to participate.

1.2 Survey Instrument Drawing on the concept of chronic disease self-management systems and expert consultation, we constructed a vulnerability assessment index system with two dimensions: **sensitivity** (personal characteristics, behavioral patterns, health status; 11 indicators) and **coping capacity** (internal and external support; 6 indicators). Based on this system, we developed the "Community Elderly Chronic Disease Self-Management System Vulnerability Influencing Factors Questionnaire," comprising three sections: (1) Basic demographics (gender, age, marital status); (2) Sensitivity assessment (education, economic status, occupation, living environment, nutrition/diet, health behaviors, health literacy, self-management, activities of daily living, mental health, disease count); (3) Coping capacity assessment (healthcare accessibility, self-monitoring, self-awareness, self-discipline, eldercare service points, emotional support, medical insurance, pension insurance, community management, community environment).

In the sensitivity dimension, higher scores on education, economic status, and occupation indicate greater sensitivity and lower vulnerability. In the coping capacity dimension, higher scores on self-monitoring, self-awareness, self-discipline, and medical security indicate stronger coping capacity and lower vulnerability. The questionnaire demonstrated good reliability (Cronbach' s α=0.83). The detailed index system is presented in .

1.3 Scoring Methods Health Behavior: Assessed via 28 items covering nutrition, psychological well-being, exercise, and health responsibility. Scoring: "Almost no confidence" =0, "Slight confidence" =1, "Moderate confidence" =2, "Considerable confidence"=3, "Complete confidence"=4 (range: 0-112). Median split created low/high groups.

Health Literacy: 15 items covering health knowledge, reading/comprehension, numeracy, and communication. Correct answers=1, incorrect=0 (range: 0-15). Groups: 0-5=low, 6-10=medium, 11-15=high.

Activities of Daily Living (ADL): Median split created low/high groups.

Quality of Life: Assessed using EQ-5D, with scoring identical to health literacy grouping.

Mental Health: Evaluated using Kessler-10 scale. Groups: 30-50=poor, 22-29=fair, 16-21=good, 10-15=excellent.

1.4 Quality Control Surveyors received standardized training. One-on-one interviews ensured quality, with on-site review and immediate correction of problematic questionnaires. Data entry staff were uniformly trained; data were entered strictly according to requirements with immediate resolution of issues. Of 2,800 distributed questionnaires, 2,650 were collected (94.64% response rate).

1.5 Statistical Analysis Data were entered using EpiData 3.0 and analyzed with SPSS 19.0. Categorical data were described as frequencies (N) and percent-

ages (%). Continuous data were tested for normality (all normally distributed) and described as means and standard deviations (SD). Univariate analysis employed t-tests and ANOVA; multivariate analysis used multiple linear stepwise regression. Significance level was set at α=0.05.

Results

2.1 General Characteristics The study surveyed 2,650 older adults across 27 communities in 9 districts/counties of three Shandong cities. Gender distribution: 1,231 males (46.45%) and 1,419 females (53.55%). Marital status: 2,193 married (82.75%) and 425 widowed (18.31%). Education levels were generally low, with 58% having no schooling or only primary education. Over 95% had medical and pension insurance, with <5% uninsured. Details are shown in .

2.2 Univariate Analysis of System Vulnerability Using sensitivity scores as the dependent variable, univariate analysis examined marital status, education, occupation, economic status, living environment, nutrition/diet, health behaviors, health literacy, self-management, ADL, mental health, and disease count—all showing statistically significant differences (P<0.05). Using coping capacity scores as the dependent variable, analysis of self-monitoring, self-awareness, self-discipline, emotional support, medical insurance, and pension insurance also revealed significant differences (P<0.05). Results are presented in through .

2.3 Multiple Linear Stepwise Regression Analysis Multicollinearity was assessed (tolerance <0.1 and VIF >10 indicate problematic multicollinearity). Our results showed tolerance >0.1 and VIF <6, indicating no multicollinearity. Gender, occupation, nutrition/diet, health behaviors, ADL, self-monitoring, self-awareness, eldercare service points, medical insurance, and pension insurance were binary or unordered categorical variables requiring no linear trend testing. Scatterplot analysis confirmed adequate linearity for remaining variables.

2.3.1 Sensitivity Dimension Influencing Factors With sensitivity scores as the dependent variable, multiple linear stepwise regression (entry α=0.05, removal α=0.10) identified education, economic status, occupation, living environment, nutrition/diet, health behaviors, health literacy, ADL, mental health, and disease count as significant influencing factors (P<0.05). Details are shown in .

2.3.2 Coping Capacity Influencing Factors With coping capacity scores as the dependent variable, regression analysis identified self-monitoring, self-awareness, self-discipline, emotional support, medical insurance, and pension insurance as significant influencing factors (P<0.05). Details are shown in .

Discussion

3.1 Significant Score Variations in Sensitivity Dimension Across Personal, Behavioral, and Health Characteristics Both univariate and multivariate analyses revealed significant differences in sensitivity dimension scores across various personal characteristics. Higher education levels correlate with improved access to self-management knowledge and healthier behavioral choices. Improved economic status enhances sensitivity scores, likely by enabling better utilization of health resources and services. Agricultural workers showed lower sensitivity scores, possibly due to limited access to self-management information and services influenced by occupational and living environments. Living environment satisfaction also significantly affected sensitivity scores.

Behavioral factors—including nutrition/diet, health behaviors, and health literacy—significantly influenced sensitivity scores. Poor dietary patterns constitute major risk factors for hypertension and diabetes. Unhealthy behaviors like smoking and alcohol consumption lower scores and increase system vulnerability. Health literacy, as the capacity to obtain, understand, and use health information, substantially impacts self-management outcomes.

Health status indicators—ADL, mental health, and disease count—also showed significant effects. Poorer ADL correlated with lower sensitivity scores, as activity limitations constrain exercise capacity crucial for disease management. Better mental health associated with higher scores, as positive psychological states enhance management confidence and physical outcomes. Those with single or no chronic conditions scored higher than those with multiple comorbidities; for example, managing both cardiovascular disease and diabetes simultaneously increases management burden and vulnerability.

3.2 Coping Capacity Scores Significantly Influenced by Internal and External Support Internal support: Self-monitoring, self-awareness, and self-discipline significantly affected coping capacity scores. Effective self-monitoring enhances understanding of health status and enables timely responses to adverse changes. Strong self-awareness helps older adults recognize health risks and avoid harmful factors while reducing negative emotions and fostering proactive coping. Self-discipline, particularly medication adherence, is fundamental to improving health outcomes and represents a core component of successful self-management.

External support: Emotional support, medical insurance, and pension insurance significantly influenced coping capacity scores. Strong emotional support from family or healthcare providers enhances motivation and confidence for disease management. Medical and pension insurance provide economic security for long-term disease management, influencing healthcare utilization patterns and promoting greater health consciousness.

Limitations

This study has limitations. Factor selection was constrained by project screening and expert consensus scope, potentially affecting model accuracy. Future research should employ data mining techniques like factor analysis to refine variable definitions.

Author Contributions

CHEN Tong: conceptualization, data collection, initial draft. BI Yuqing: conceptualization and design. KOU Ruxin, XING Jiarun: data collection and processing. CHEN Qian, WANG Mengxue: manuscript revision. LUO Sheng: topic selection, design, and feasibility analysis. LI Wei: quality control, review, and overall responsibility. All authors approved the final manuscript.

Conflict of Interest

The authors declare no conflict of interest.

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