Medication Adherence and Its Influencing Factors in Elderly Patients with Comorbidities: Postprint

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Abstract

Background With the intensification of population aging, the proportion of elderly patients with chronic comorbidities is increasing. Whether these patients strictly adhere to medication prescriptions significantly impacts the effectiveness of comorbidity management. Objective To investigate medication adherence among elderly patients with chronic comorbidities in Guangdong Province and analyze its influencing factors, providing evidence for comorbidity management in this population. Methods From October 2022 to March 2023, a multistage stratified cluster random sampling method was used to select 998 patients aged 60 years and above with chronic comorbidities from 27 communities in Guangdong Province for investigation. Anonymous questionnaires were administered through face-to-face interviews conducted at community general practice clinics and resident group discussion sessions. With medication adherence as the dependent variable and patient gender, age, marital status, living situation, education level, annual personal income, family medication supervision, family doctor assistance, number of diseases, disease understanding, medication attention, BMI, smoking, and alcohol consumption as independent variables, a multivariate Logistic regression model was employed to analyze the influencing factors of medication adherence among elderly patients with chronic comorbidities in Guangdong Province. Results A total of 1,000 questionnaires were distributed, with 998 valid questionnaires recovered, yielding an effective response rate of 99.8%. Among the 998 elderly patients with chronic comorbidities in Guangdong Province, 719 (72.0%) exhibited good medication adherence, while 279 (28.0%) showed poor adherence; 512 (51.3%) were male and 486 (48.7%) were female. Multivariate Logistic regression analysis revealed that education level (high school/technical secondary school: OR=0.298, 95%CI=0.117–0.762; college and above: OR=0.325, 95%CI=0.127–0.831), annual personal income (>30,000–50,000 RMB: OR=7.694, 95%CI=2.071–28.582; >50,000–100,000 RMB: OR=12.408,

95%CI=3.229–47.686; >100,000–200,000 RMB: OR=4.893, 95%CI=1.174–20.397), family medication supervision frequency (occasionally: OR=1.842, 95%CI=1.222–2.779), family doctor assistance (somewhat helpful: OR=2.537, 95%CI=1.531–4.205), disease understanding (mostly understand: OR=3.015, 95%CI=1.948–4.667; relatively understand: OR=3.510, 95%CI=1.955–6.300; understand somewhat/not understand: OR=3.469, 95%CI=1.338–8.994), medication attention (mostly attentive: OR=4.928, 95%CI=3.336–7.278; relatively attentive: OR=3.670, 95%CI=1.915–7.033; attentive somewhat/not attentive: OR=8.560, 95%CI=2.497–29.33), BMI (underweight: OR=2.303, 95%CI=1.154–4.598; overweight/obese: OR=0.598, 95%CI=0.390–0.915), and alcohol consumption (OR=1.959, 95%CI=1.270–3.022) were influencing factors of medication adherence among elderly patients with chronic comorbidities in Guangdong Province (P<0.05). Conclusion The medication adherence among elderly patients with chronic comorbidities in Guangdong Province was relatively good at 72.0%. Patients with high school education or above, low-income populations, frequent family medication supervision, substantial family doctor assistance, thorough disease understanding, high medication attention, overweight/obese status, and non-drinkers demonstrated better medication adherence. Conversely, high-income populations, those with occasional family supervision, limited family doctor assistance, poor disease understanding, low medication attention, underweight BMI, and alcohol consumers showed poorer medication adherence. All stakeholders in society should unite to implement comprehensive measures to improve medication adherence among elderly patients with chronic comorbidities, strengthen integrated comorbidity management, and promote the health status of elderly patients.

Full Text

Preamble

Study of Medication Adherence and Its Influencing Factors among Elderly Patients with Multimorbidity

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Abstract

Background

As the aging population continues to increase, there has been a rise in the prevalence of multimorbidity in the elderly. The adherence to medication regimens

by elderly patients with multimorbidity significantly impacts the effectiveness of chronic disease management.

Objective
This study analyzes the factors that impact medication adherence among the elderly with multimorbidity in Guangdong province, aiming to provide a foundation for the management of multimorbidity in this population.

Methods
A multi-stage stratified cluster random sampling method was used to survey 998 multimorbid patients aged 60 years and above in Guangdong province between October 2022 and March 2023. Using community general practice clinics and resident group discussions, face-to-face anonymous questionnaires were administered to patients with multimorbidity. Medication adherence served as the dependent variable, while patient sex, age, marital status, living conditions, education level, personal annual income, family supervision of medication taking, family doctor support, number of diseases, disease awareness, medication awareness, BMI, smoking, and alcohol consumption were independent variables. Multivariate Logistic regression analysis was used to identify factors influencing medication adherence among elderly patients with multimorbidity in Guangdong Province.

Results
A total of 1,000 questionnaires were distributed, and 998 valid questionnaires were collected (valid recovery rate: 99.8%). Among the 998 elderly patients with multimorbidity in Guangdong Province, 719 cases (72.0%) showed good medication adherence and 279 cases (28.0%) showed poor adherence; 512 cases (51.3%) were male and 486 cases (48.7%) were female. Multivariate Logistic regression analysis revealed that education level (high school/secondary school: OR=0.298, 95%CI=0.117~0.762; college and above: OR=0.325, 95%CI=0.127~0.831), personal annual income (>30,000~50,000 RMB: OR=7.694, 95%CI=2.071~28.582; >50,000~100,000 RMB: OR=12.408, 95%CI=3.229~47.686; >100,000~200,000 RMB: OR=4.893, 95%CI=1.174~20.397), frequency of family members' supervision of medication taking (occasionally: OR=1.842, 95%CI=1.222~2.779), family doctor's help (slightly helpful: OR=2.537, 95%CI=1.531~4.205), understanding of the condition (mostly understood: OR=3.015, 95%CI=1.948~4.667; better understood: OR=3.510, 95%CI=1.955~6.300; some/no understanding: OR=3.469, 95%CI=1.338~8.994), medication concern (mostly concerned: OR=4.928, 95%CI=3.336~7.278; more concerned: OR=3.670, 95%CI=1.915~7.033; somewhat concerned/unconcerned: OR=8.560, 95%CI=2.497~29.33), BMI (too low: OR=2.303, 95%CI=1.154~4.598; overweight/obese: OR=0.598, 95%CI=0.390~0.915), and alcohol consumption (OR=1.959, 95%CI=1.270~3.022) were significant influencing factors (P<0.05).

Conclusion
Elderly patients with multimorbidity in Guangdong province demonstrated relatively good medication adherence at 72.0%. Better adherence was observed among those with high school education or above, lower income, frequent fam-

ily supervision, substantial family doctor support, good understanding of their condition, high medication concern, overweight/obese status, and non-drinkers. Conversely, poorer adherence was found among high-income earners, those with occasional family supervision, minimal family doctor assistance, low disease understanding, low medication concern, low BMI, and alcohol drinkers. All stakeholders in society should collaborate to implement comprehensive measures that improve medication adherence among elderly patients with multimorbidity, strengthen integrated disease management, and promote health in this population.

Keywords
Multimorbidity; Elderly patients; Medication adherence; Root cause analysis; Logistic regression analysis; Guangdong

Introduction

As global aging intensifies, the prevalence of chronic diseases continues to rise, with an increasing proportion of elderly individuals experiencing multiple chronic conditions simultaneously [1-3]. In 2008, the WHO formally introduced the term "multimorbidity" to define the coexistence of two or more chronic diseases in the same patient [4]. In 2016, WHO expanded this definition to include two or more chronic diseases, long-term mental disorders, or long-term infectious diseases in the same patient [5]. Recent research has demonstrated that multimorbidity poses a major threat to global health [6-8]. Due to its large population base and rapid aging process, China faces particularly prominent multimorbidity challenges, with a prevalence of 41% among middle-aged and elderly individuals [9]. Pharmacotherapy represents one of the most important approaches for controlling diseases in patients with multimorbidity. Whether these patients strictly follow medical advice regarding medication significantly impacts multimorbidity management outcomes, as poor medication adherence can hinder treatment and recovery, increase readmission rates and medical costs, and even lead to disease deterioration and death [10-12]. This study focuses on medication adherence among elderly patients with multimorbidity in Guangdong province, analyzing related influencing factors to provide theoretical evidence and reference for developing effective chronic disease management strategies for this population.

Methods

Study Design and Sampling

Between October 2022 and March 2023, we conducted a questionnaire survey of elderly patients with multimorbidity using a multi-stage stratified cluster random sampling method. In the first stage, three cities in Guangdong province

were randomly selected based on economic level and geographic location. In the second stage, three districts/counties were randomly selected from each city. In the third stage, three communities were randomly selected from each district/county.

Inclusion criteria: (1) Age $\geq$ 60 years; (2) Diagnosed by secondary-level or higher hospitals with two or more of the following chronic conditions: hypertension, diabetes, dyslipidemia, malignant tumors, chronic lung disease, liver disease, heart disease, stroke, kidney disease, stomach or digestive system diseases, mental and emotional disorders, memory-related diseases, arthritis or rheumatism, or asthma; (3) Residing in the community for more than one year; (4) Receiving pharmacotherapy for more than one year.

Exclusion criteria: (1) Unconscious or with obvious cognitive impairment, unable to cooperate with the investigation; (2) Hearing or speech impairment, unable to communicate normally; (3) Unwilling to participate in the survey or sign the informed consent form.

Data Collection

Based on the Chinese version of the 36-Item Short Form Health Survey (SF-36), the Health-Promoting Lifestyle Profile (HPLP-C), and the 4-item Morisky Medication Adherence Scale (MMAS-4), we designed the "Influencing Factors of Medication Adherence in Elderly Patients with Multimorbidity Questionnaire." The questionnaire collected information on patient sex, age, marital status, living conditions, education level, personal annual income, BMI, number of diseases, family supervision of medication taking, family doctor support, disease awareness, medication awareness, smoking status, alcohol consumption, and medication adherence.

Variable Selection and Definition

According to the WHO framework for factors influencing medication adherence [13], independent variables were categorized as: (1) Socioeconomic factors: sex, age, marital status, living conditions, education level, personal annual income, and family supervision of medication taking; (2) Healthcare system factors: family doctor support; (3) Disease treatment factors: number of diseases; (4) Patient-related factors: disease awareness, medication awareness, BMI, smoking, and alcohol consumption.

BMI classification: $<$18.5 kg/m^2 as underweight, 18.5-23.9 kg/m^2 as normal weight, 24.0-27.9 kg/m^2 as overweight, and $>$27.9 kg/m^2 as obese. Smoking was defined as $ $1 cigarette per day for $ $6 months. Alcohol consumption was defined as $ $1 drinking occasion per week for $ $6 months. The dependent variable, medication adherence, was measured using the 4-item Morisky Medication Adherence Scale [14], comprising four questions: "Have you ever forgotten to take your medication?", "Are you sometimes careless about taking your medication?", "When you feel better, do you sometimes stop taking

your medication?", and "When you feel worse, do you sometimes stop taking your medication?" Adherence was classified as good if all four questions were answered "no," and poor otherwise. Variable assignments are shown in .

Quality Control

Although the survey questionnaire could not be directly analyzed for reliability and validity, all scales used had previously undergone reliability and validity testing to ensure feasibility. Additionally, Delphi expert consultation and pilot surveys were conducted during the questionnaire design phase to verify content validity. After questionnaire development, uniformly trained community medical staff served as investigators, conducting face-to-face anonymous surveys through community general practice clinics and resident group discussions. Valid questionnaires were defined as those with complete data and no missing values, and duplicate responses were excluded to ensure data quality.

Statistical Analysis

SPSS 26.0 statistical software was used for all data processing and analysis. Measurement data were expressed as ($\bar{x}\pm s$), and count data were expressed as relative frequencies. Inter-group comparisons were performed using ^{2} tests. Multivariate Logistic regression analysis was used to explore influencing factors of medication adherence among elderly patients with multimorbidity in Guangdong province, with $P<0.05$ considered statistically significant.

Results

Basic Characteristics

A total of 1,000 questionnaires were distributed, and 998 valid questionnaires were collected (valid recovery rate: 99.8%). Among the 998 elderly patients with multimorbidity in Guangdong Province, 719 cases (72.0%) showed good medication adherence and 279 cases (28.0%) showed poor adherence. The sample included 512 males (51.3%) and 486 females (48.7%); 623 cases (62.4%) were aged 60-65 years, 304 cases (30.5%) were 66-70 years, and 71 cases (7.1%) were over 70 years; 934 cases (93.6%) were married; 53 cases (5.3%) lived alone; and 37 cases (3.7%) had primary school education or below.

Univariate Analysis of Influencing Factors

Univariate analysis showed no statistically significant differences in medication adherence by sex, marital status, living situation, or number of diseases ($P>0.05$). However, significant differences were observed by age, education level, personal annual income, frequency of family supervision of medication taking, level of family doctor support, disease awareness, medication awareness,

BMI, smoking status, and alcohol consumption status (P<0.05). These results are presented in .

Multivariate Logistic Regression Analysis

Using medication adherence (good=0, poor=1) as the dependent variable, factors with statistical significance in univariate analysis were included as independent variables in multivariate Logistic regression analysis. The significance level was set at α=0.05, with results shown in . Likelihood ratio testing yielded ^{2}=356.711, P<0.001, indicating overall model significance. Goodness-of-fit testing showed ^{2}=7.767, P=0.457 (P>0.05), suggesting adequate model fit. The model's predictive accuracy was 81.1%.

Results indicated that education level, personal annual income, frequency of family supervision of medication taking, family doctor support, disease awareness, medication awareness, BMI, and alcohol consumption status were significant influencing factors (P<0.05). Specifically, the risk of poor medication adherence was lower among those with higher education levels (high school/secondary school: OR=0.298, 95%CI=0.117~0.762; college and above: OR=0.325, 95%CI=0.127~0.831), higher among those with higher income levels (>30,000-50,000 RMB: OR=7.694, 95%CI=2.071~28.582; >50,000-100,000 RMB: OR=12.408, 95%CI=3.229~47.686; >100,000-200,000 RMB: OR=4.893, 95%CI=1.174~20.397), higher among those with occasional family supervision compared to frequent supervision (OR=1.842, 95%CI=1.222~2.779), higher among those receiving less family doctor support (OR=2.537, 95%CI=1.531~4.205), higher among those with lower disease awareness (mostly understood: OR=3.015, 95%CI=1.948~4.667; better understood: OR=3.510, 95%CI=1.955~6.300; some/no understanding: OR=3.469, 95%CI=1.338~8.994), higher among those with lower medication awareness (mostly concerned: OR=4.928, 95%CI=3.336~7.278; more concerned: OR=3.670, 95%CI=1.915~7.033; somewhat concerned/unconcerned: OR=8.560, 95%CI=2.497~29.33), higher among underweight individuals (OR=2.303, 95%CI=1.154~4.598) and lower among overweight/obese individuals (OR=0.598, 95%CI=0.390~0.915) compared to those with normal BMI, and higher among alcohol drinkers (OR=1.959, 95%CI=1.270~3.022).

Discussion

Basic Situation of Medication Adherence in Elderly Patients with Multimorbidity

This study found that 72.0% (719/998) of elderly patients with multimorbidity in Guangdong Province had good medication adherence, which is higher than reported in other domestic studies. For example, the rate of good adherence was 54.6% among multimorbid patients in Foshan in 2016 [15], 56.20% among

elderly multimorbid patients in Changsha in 2017 [16], and 37.6% among elderly chronic disease patients in rural Shandong in 2017 [17]. These findings suggest that overall medication adherence among elderly multimorbid patients in Guangdong Province is relatively good. Since 2017, Guangdong has comprehensively implemented the "Strengthening Primary Care" initiative, actively promoting the integration and sharing of medical resources. Primary healthcare institutions have received substantial support and development, with significantly improved service capacity. Chronic disease management has gradually shifted to community settings, with regular physical examinations, free clinics, and health consultations provided for elderly patients, strengthening disease management for elderly multimorbid patients. These efforts enable elderly patients to access professional medical care and health services more conveniently, contributing to improved overall medication adherence.

Analysis of Influencing Factors

Socioeconomic Factors Our results demonstrate that education level is an important factor affecting medication adherence, with higher education associated with lower risk of poor adherence—a finding consistent with some domestic research [18-19]. Patients with lower education levels may have insufficient cognitive and learning abilities and be less willing to accept scientific guidance, leading to poorer adherence. In contrast, those with higher education more easily understand disease and medication knowledge, demonstrating better adherence in daily life.

Interestingly, we found that higher personal annual income was associated with higher risk of poor medication adherence, contrary to some studies [20-21]. This may be because lower-income patients, motivated by cost considerations, pay more attention to following medical advice to reduce treatment expenses [22-23]. Family supervision also emerged as a crucial factor. With advancing age, elderly patients may experience memory decline, leading to missed or incorrect doses. Timely reminders and supervision from family members can effectively improve medication-taking behavior [24], enhancing adherence. For elderly multimorbid patients, family support and involvement play a vital role in improving medication adherence.

Healthcare System Factors This study found that family doctor support was closely related to medication adherence. Through daily contact and communication, family doctors provide health consultations, education, and assessment services, impart disease-related knowledge and medication precautions, and remind patients to take medications on time. Additionally, good doctor-patient relationships have been shown to improve medication adherence [25]. Therefore, actively obtaining family doctor support is important for achieving better medication adherence.

Patient-Related Factors We found that better disease understanding and higher medication awareness were associated with better adherence, consistent with other research findings [26-27]. PENDER et al. [28] demonstrated that patients' knowledge about disease prevention and treatment influences their health behaviors. When patients have in-depth understanding of their disease and are willing to learn about medication therapy, they can better comprehend medical advice and more actively follow treatment plans in daily life, thereby improving adherence. Conversely, poor disease understanding and low medication awareness often lead to problematic medication behaviors such as unauthorized discontinuation, incorrect dosing, or irregular timing, which clearly reduce adherence [29-30].

Furthermore, we found that overweight and obese elderly multimorbid patients showed better medication adherence, consistent with LIU et al. [31]. Overweight and obesity are risk factors for many chronic diseases such as hypertension and diabetes [32-33]. Because these patients have higher body weight, healthcare providers tend to monitor them more closely, resulting in better adherence.

Regarding health behaviors, we found that alcohol drinkers had poorer medication adherence than non-drinkers, similar to findings from domestic studies [34]. Alcohol consumption may negatively affect patients' cognition and judgment, leading to neglect and omissions in medication taking. Additionally, drinking behavior may reflect a less rigorous attitude toward treatment execution, reducing adherence levels. Lack of healthy behaviors may indicate insufficient attention to personal health, lack of self-discipline, and a passive lifestyle, which can lead to inadequate recognition of the importance of pharmacotherapy and consequently poorer adherence [26,35-36].

In summary, this study demonstrates that medication adherence among elderly multimorbid patients in Guangdong Province is influenced by multiple factors including socioeconomic conditions, healthcare system support, and patient characteristics. As aging intensifies and the number of elderly multimorbid patients continues to grow, chronic disease management faces increasing challenges. Patients, family members, communities, and healthcare teams should collaborate to strengthen multimorbidity management. First, health education should be enhanced, particularly providing easily understandable health knowledge and treatment information tailored to different education levels through promotional materials and health lectures to improve health literacy and disease understanding, which in turn enhances adherence. Second, family members play an important role in health management for elderly multimorbid patients and should be encouraged to provide more care and support, collaborating with community service teams and family doctors to supervise and manage medication use from multiple dimensions. Additionally, primary healthcare institutions can implement more targeted health management programs for elderly patients, regularly monitoring physical indicators, guiding patients to develop healthy lifestyle habits such as exercise, and improving unhealthy behaviors like smoking and drinking to enhance overall health status. Through these compre-

hensive measures, we can provide more holistic chronic disease management for elderly multimorbid patients and safeguard their health.

Author Contributions: GUAN Xinyue, WANG Xiaoran, and ZHANG Dan conceived and designed the study and implemented the research process. GUAN Xinyue and WANG Xiaoran collected and organized data, performed statistical analysis, created tables and figures, and drafted the manuscript. ZHANG Dan revised the manuscript, was responsible for quality control and review, and provided overall supervision.

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.