Postprint: Multimorbidity Patterns, Hospitalization Service Utilization, and Related Influencing Factors among Inpatients in Guangxi Township Health Centers

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Abstract

Background: Currently, the epidemiological status of multimorbidity, hospitalization service utilization, and related influencing factors among inpatients in rural primary healthcare institutions in China remain unclear, which is detrimental to the effective prevention and treatment of multimorbidity among rural residents.

Objective: This study aims to investigate the comorbidity patterns, hospitalization service utilization, and related influencing factors of multimorbidity among inpatients in township health centers in Guangxi, so as to provide epidemiological evidence for comprehensively understanding the current situation of multimorbidity faced by inpatient care in rural primary healthcare institutions and for improving the quality of corresponding medical and health services.

Methods: Using multistage stratified sampling and cluster sampling methods, 10 township health centers were randomly selected from 5 cities in Guangxi (Nanning, Wuzhou, Liuzhou, Yulin, and Guigang). De-identified medical record data of all multimorbidity inpatients from these 10 township health centers during the period from January 2021 to June 2023 were collected through the hospitalization system and chronic disease management system. Statistical methods including Kruskal-Wallis H test, Mann-Whitney U test, and multinomial Logistic regression analysis were employed to explore the demographic characteristics, prevalence rate of multimorbidity, number of chronic comorbidities, comorbidity patterns, number of hospitalizations, and factors influencing the number of chronic comorbidities and hospitalizations among multimorbidity inpatients in Guangxi township health centers.

Results: A total of 9,330 multimorbidity inpatients were finally included, with a mean age of (68.1$±$11.8) years, and the prevalence rate of multimorbidity was 31.24% (9,330/29,865). The number of chronic comorbidities was predominantly 2 (53.22%), followed by 3 (28.76%), 4 (12.92%), and $ $5 (5.10%). Hypertension was the most common chronic comorbidity, and the combination of hypertension, chronic cervical and lumbar spine disease, chronic gastrointestinal disease, stroke, diabetes mellitus, hyperlipidemia, and chronic pulmonary disease constituted the most prevalent comorbidity patterns among patients with 2, 3, 4, and $ $5 chronic conditions. The median number of hospitalizations among patients with 2, 3, 4, and $ $5 chronic conditions ranged from 1 to 3 times, and there were significant differences in the number of hospitalizations among the top 10 most prevalent comorbidity patterns in patients with 2, 3, and 4 chronic conditions. Advanced age, high BMI, female sex, current or former smoking, alcohol consumption, type of medical insurance, ethnic minority, and marital status were associated with an increased number of chronic comorbidities ($P<0.05$). Advanced age, female sex, ethnic minority, marital status, low education level, current or former smoking, alcohol consumption, number of chronic comorbidities, and type of medical insurance were associated with increased hospitalizations ($P<0.05$).

Conclusion: The prevalence rate of multimorbidity among inpatients in Guangxi township health centers is relatively high. Hypertension is the most common chronic comorbidity, and its multidimensional combination with chronic cervical and lumbar spine disease, chronic gastrointestinal disease, stroke, diabetes mellitus, hyperlipidemia, and chronic pulmonary disease constitutes the most prevalent comorbidity patterns. The influencing factors for the number of chronic comorbidities and hospitalization service utilization are complex and diverse, and multi-level prevention and treatment strategies and measures should be adopted to address the challenges of multimorbidity faced by rural primary healthcare institutions.

Full Text

Multimorbidity Patterns, Inpatient Care Utilization, and Associated Factors Among Inpatients with Multimorbidity in Township Health Centers of Guangxi

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Abstract

Background: The epidemiology of multimorbidity, inpatient care utilization, and associated factors among inpatients in rural primary health care facilities in China remain unclear, hindering effective prevention and management of multimorbidity in rural populations.

Objective: This study aims to investigate multimorbidity patterns, inpatient care utilization, and associated factors among hospitalized patients in township health centers in Guangxi, offering epidemiological evidence to understand the multimorbidity burden facing rural primary care institutions and improve healthcare quality.

Methods: A combination of multistage stratified sampling and cluster sampling was employed to randomly select 10 township health centers from five cities in Guangxi (Nanning, Wuzhou, Liuzhou, Yulin, and Guigang). De-identified medical records of all inpatients with multimorbidity from January 1, 2021, to June 30, 2023, were retrieved from inpatient and chronic disease management systems. Statistical analyses including Kruskal-Wallis H test, Mann-Whitney U test, and multinomial logistic regression were used to examine demographic characteristics, multimorbidity prevalence, number of co-existing chronic diseases, multimorbidity patterns, hospitalization frequency, and associated factors.

Results: A total of 9,330 inpatients with multimorbidity were included, with a mean age of (68.1$±$11.8) years. The overall prevalence of multimorbidity was 31.24% (9,330/29,865). Two co-existing chronic diseases was most common (53.22%), followed by three (28.76%), four (12.92%), and $ $5 (5.10%). Hypertension was the most prevalent co-existing chronic disease. The most frequent multimorbidity patterns involved combinations of hypertension, chronic cervical and lumbar spondylosis, chronic gastrointestinal diseases, stroke, diabetes mellitus, hyperlipidemia, and chronic pulmonary diseases. The median hospitalization frequency ranged from 1 to 3 times across groups with 2, 3, 4, and $ $5

chronic diseases, with significant differences observed among the top 10 prevalent patterns within the 2-, 3-, and 4-disease groups. Age, high BMI, female sex, current or former smoking, alcohol consumption, medical insurance type, ethnic minority status, and marital status were associated with increased number of co-existing chronic diseases ($P<0.05$). Age, female sex, ethnic minority status, marital status, low education level, current or former smoking, alcohol consumption, number of co-existing chronic diseases, and medical insurance type were associated with increased hospitalization frequency ($P<0.05$).

Conclusion: The prevalence of multimorbidity among inpatients in Guangxi township health centers is high. Hypertension is the most common co-existing chronic disease, forming the most prevalent multimorbidity patterns in combination with chronic cervical and lumbar spondylosis, chronic gastrointestinal diseases, stroke, diabetes mellitus, hyperlipidemia, and chronic pulmonary diseases. The influencing factors for both the number of co-existing chronic diseases and hospital service utilization are complex and diverse, necessitating comprehensive, multi-faceted strategies to address the challenges of multimorbidity in rural primary health care facilities.

Keywords: Multiple chronic conditions; Township health centers; Comorbidity number; Multimorbidity pattern; Inpatient care utility; Root cause analysis

Introduction

Multimorbidity refers to the coexistence of two or more chronic health conditions in the same individual. These conditions include both diagnosed chronic diseases such as hypertension and diabetes, as well as geriatric syndromes like frailty, depression, and dementia. Multimorbidity is associated with premature mortality, lower health-related quality of life and functional status, depression, polypharmacy, and frequent healthcare utilization, posing a major global health challenge. China exhibits a high prevalence of multimorbidity that increases with age. According to the 2018 China Health and Retirement Longitudinal Study (CHARLS), the prevalence of multimorbidity was 43.48% among adults aged 45-59, rising to 62.86% among those aged 60-69, and reaching 69.42% among individuals aged 70 and older. The pathogenesis of multimorbidity is complex, involving multiple health-related factors including aging, genetics, inflammation, psychological factors, behaviors, and socioeconomic conditions. Compared with single chronic diseases, multimorbidity further increases hospitalizations, emergency department visits, and other healthcare service utilization, complicating medical care.

In recent years, Chinese researchers have conducted studies on multimorbidity from various perspectives, including comorbidity patterns, disease burden, risk factors, and health hazards. However, the literature remains limited, with most studies focusing on community populations, urban hospital patients, or community health center outpatients. There is a lack of investigation into the status

of multimorbidity among inpatients in rural primary healthcare facilities, and many studies rely on self-reported data at the population level, compromising accuracy. Examining multimorbidity among inpatients in rural primary healthcare institutions will help clearly characterize the epidemiological features of multimorbidity in rural primary care services and provide epidemiological evidence for improving chronic disease prevention and treatment outcomes. This study utilizes electronic inpatient medical records from township health centers in Guangxi to investigate the prevalence, comorbidity patterns, hospitalization frequency, and associated factors of multimorbidity, offering valuable insights into the multimorbidity epidemic trends facing rural primary care practitioners and informing improvements in healthcare service quality.

Methods

Study Data

This study collected de-identified medical records of inpatients with multimorbidity from January 2021 to June 2023 through Guangxi's township health center inpatient and chronic disease management systems. Indicators including sex, age, ethnicity, marital status, education level, medical insurance type, poverty status, occupation, BMI, smoking and alcohol consumption, number of co-existing chronic diseases, multimorbidity patterns, and hospitalization frequency over the 2.5-year period were compiled into survey forms and distributed to each township health center for completion by their medical affairs department heads.

Inclusion and Exclusion Criteria

Inclusion criteria: De-identified medical records of all discharged patients diagnosed with two or more chronic diseases between January 2021 and June 2023 at the sampled township health centers.

Exclusion criteria: (1) Incomplete records (cases with missing data after querying the inpatient and chronic disease management systems); (2) Records with hospitalization duration less than 24 hours (patients hospitalized for less than 24 hours often lack accurate discharge diagnoses).

Included Chronic Disease Types

Based on the "Guangxi Basic Medical Insurance Outpatient Special Chronic Disease Management Measures" (Gui Medical Insurance Regulation [2022] No. 2) and common chronic diseases in rural Guangxi, this study included 22 chronic diseases: hypertension; diabetes mellitus (type 1 and type 2); hyperlipidemia; stroke (including cerebral infarction, cerebral hemorrhage, and sequelae); chronic pulmonary disease (including chronic bronchitis, COPD, emphysema, pulmonary hypertension, cor pulmonale, bronchiectasis, pulmonary

tuberculosis, and bronchial asthma); chronic cervical and lumbar spondylosis (including cervical and lumbar spine diseases); coronary heart disease; chronic heart failure (including rheumatic heart disease); atrial fibrillation; liver disease (including cirrhosis and chronic hepatitis); malignant tumors; emotional and mental disorders (including sleep disorders, insomnia, anxiety, depression, and schizophrenia); dementia (including Alzheimer's disease, vascular dementia, and other dementias); chronic gastrointestinal diseases (including chronic gastritis and chronic enteritis); chronic kidney disease (including chronic renal insufficiency, renal failure, uremia, and nephrotic syndrome); thyroid disease (including hyperthyroidism and hypothyroidism); prostate disease (including prostatic hyperplasia and chronic prostatitis); arthropathy (including rheumatoid arthritis and osteoarthritis); hematologic diseases (including aplastic anemia, thalassemia, and primary immune thrombocytopenia); immune system diseases (including systemic lupus erythematosus, psoriasis, AIDS, and ankylosing spondylitis); nervous system diseases (including Parkinson's syndrome, epilepsy, cerebral palsy, and myasthenia gravis); and metabolic diseases (including hyperuricemia, gout, and osteoporosis). Patients discharged with any two or more of these chronic diseases were included.

Sampling Methods and Minimum Sample Size Calculation

A multistage stratified sampling method combined with cluster sampling was employed. Five sample cities (Wuzhou, Nanning, Yulin, Liuzhou, and Guigang) were randomly selected from eastern, southern, western, northern, and central regions of Guangxi. Using the 2022 median annual income of Guangxi township health centers as a reference, one central township health center with income above the median and one non-central center with income below the median were randomly selected from each city, yielding 10 sample institutions.

The minimum sample size was estimated using the formula: $n = (z^2 \times p \times q) / d^2$, where p represents the overall prevalence rate of multimorbidity among inpatients (set at 0.5), q = 1-p, z is the standard normal distribution value (1.96 when α=0.05), and d = 0.05. The calculation indicated that at least 384 multimorbidity inpatients were needed per institution, totaling 3,840 patients across all centers.

Statistical Methods

Data were entered using Excel 2010 and analyzed with SPSS 27.0. Categorical data were expressed as relative frequencies, with inter-group comparisons using ^{2} test or Fisher's exact test. Non-normally distributed continuous data were expressed as M(QR), with multi-group comparisons using Kruskal-Wallis H test and pairwise comparisons using Mann-Whitney U test. Pearson correlation, Spearman rank correlation, and logistic regression analyses were used to explore factors influencing the number of co-existing chronic diseases and hospitalization frequency. $P<0.05$ was considered statistically significant.

Results

Basic Characteristics of Inpatients with Multimorbidity

Among 29,865 inpatients from the 10 sample township health centers, 9,365 had multimorbidity. After excluding 35 cases with incomplete data or hospitalization <24 hours, 9,330 patients were included, exceeding the minimum sample size estimate. Multimorbidity patients accounted for 31.24% of all inpatients. The sample included 2,198 cases from Wuzhou, 1,969 from Nanning, 1,702 from Yulin, 1,154 from Liuzhou, and 2,307 from Guigang.

Patients had 2-9 co-existing chronic diseases, with an average of (2.7$±$0.9) conditions. The distribution was: 4,966 patients (53.22%) with 2 diseases, 2,683 (28.76%) with 3 diseases, 1,205 (12.92%) with 4 diseases, and 476 (5.10%) with $ $5 diseases. The cohort included 4,906 females (52.6±$11.8) years, with 7,024 patients (75.3%) aged $ $60 years. Ethnic distribution was predominantly Han and Zhuang (9,007 cases, 96.6%). Education levels were mainly primary school or illiterate (7,707 cases, 82.6%). Most patients were farmers (8,873 cases, 95.1%), married (7,653 cases, 81.7%), covered by urban-rural resident medical insurance (7,691 cases, 82.4%), and non-smokers (6,322 cases, 67.8%). Alcohol abstainers or former drinkers comprised 7,363 cases (78.9%), and 3,368 patients (36.1%) had BMI $ $24. Most patients (5,127 cases, 55.0%) were hospitalized once. Significant differences in the number of co-existing chronic diseases were observed across sex, age, ethnicity, education, occupation, marital status, insurance type, poverty status, smoking, alcohol consumption, BMI, and hospitalization frequency (P<0.05). Details are shown in Table 1 .

Multimorbidity Patterns

A total of 993 multimorbidity patterns were identified: 133 patterns with 2 diseases, 266 with 3 diseases, 309 with 4 diseases, and 285 with $ $5 diseases. Hypertension was the most common co-existing chronic disease. Combinations of hypertension, chronic cervical and lumbar spondylosis, chronic gastrointestinal diseases, stroke, diabetes mellitus, hyperlipidemia, and chronic pulmonary diseases constituted the top 10 most prevalent patterns across all disease count categories. The top 10 patterns, case numbers, and proportions for patients with 2, 3, 4, and $ $5 chronic diseases are shown in Table 2 .

Hospitalization Frequency by Multimorbidity Pattern

Over the 2.5-year period, total hospitalizations ranged from 1-10 times for patients with 2 diseases, 1-16 times for 3 diseases, 1-15 times for 4 diseases, and 1-18 times for $ $5 diseases. Patients with $ $5 chronic diseases had significantly higher hospitalization frequency than other groups, and those with 3 diseases had more hospitalizations than those with 2 diseases (P<0.05). Among the

top 10 patterns in each category, median hospitalization frequency ranged from 1 to 4.5 times. Significant differences were found among the top 10 patterns within the 2-, 3-, and 4-disease groups (P<0.05). Specifically, among patients with 2 diseases, the hypertension + chronic cervical/lumbar spondylosis pattern had more hospitalizations than hypertension + stroke or hypertension + diabetes (P<0.05). Among those with $ $5 diseases, no significant differences were observed between patterns (P>0.05). Details are shown in Table 3 .

Patterns with Highest Median Hospitalization Frequency

Among the top 10 patterns in each disease count category, those with the highest median hospitalization frequency were: for 2 diseases—chronic cervical/lumbar spondylosis + atrial fibrillation, chronic cervical/lumbar spondylosis + immune system disease, and liver disease + metabolic disease; for 3 diseases—chronic pulmonary disease + chronic cervical/lumbar spondylosis + liver disease, hypertension + chronic pulmonary disease + emotional/mental disorders, and diabetes + chronic heart failure + chronic gastrointestinal disease; for 4 diseases—hypertension + diabetes + hyperlipidemia + nervous system disease, diabetes + chronic pulmonary disease + coronary heart disease + atrial fibrillation, diabetes + chronic pulmonary disease + atrial fibrillation + chronic gastrointestinal disease, and chronic pulmonary disease + chronic cervical/lumbar spondylosis + chronic heart failure + arthropathy; for $ $5 diseases—hypertension + diabetes + chronic pulmonary disease + chronic cervical/lumbar spondylosis + chronic gastrointestinal disease + arthropathy, hypertension + diabetes + stroke + chronic cervical/lumbar spondylosis + prostate disease, and hypertension + diabetes + hyperlipidemia + stroke + chronic kidney disease + chronic cervical/lumbar spondylosis + coronary heart disease + chronic gastrointestinal disease + metabolic disease. No significant differences in hospitalization frequency were observed among these high-frequency patterns (P>0.05). Details are shown in Table 4 .

Factors Influencing Number of Chronic Diseases

The number of co-existing chronic diseases was set as the dependent variable (y), with demographic indicators as independent variables (x). Variable assignments are detailed in Table 5 . Pearson or Spearman analysis screened variables for multinomial logistic regression, revealing that age, BMI, sex, ethnicity, occupation, marital status, insurance type, poverty status, education level, smoking history, and alcohol consumption were associated with multimorbidity count (see Appendix 1).

Multinomial logistic regression results showed that age, BMI, sex, smoking, alcohol consumption, ethnicity, marital status, and insurance type significantly influenced the number of co-existing chronic diseases (P<0.05). Specifically, age and smoking history affected comparisons between 2 vs. 3, 2 vs. $ $5, 3 vs. $ $5, and 4 vs. $ $5 diseases (P<0.05). BMI influenced all comparisons except 3 vs. 4 diseases (P<0.05). Sex and alcohol consumption affected all comparisons except

2 vs. 3 diseases (P<0.05). Ethnicity influenced comparisons between 2 vs. 4, 2 vs. $ $5, 3 vs. 4, and 3 vs. $ $5 diseases (P<0.05). Marital status affected comparisons between 2 vs. 3, 2 vs. 4, 2 vs. $ $5, 3 vs. 4, and 3 vs. $ $5 diseases (P<0.05). Insurance type influenced comparisons between 2 vs. 3 and 2 vs. 4 diseases (P<0.05). Occupation, education level, and poverty status showed no significant effects in multiple comparisons. Details are shown in Table 6 .

Factors Influencing Hospitalization Frequency

Total hospitalization frequency over 2.5 years was set as the dependent variable (y), with demographic indicators as independent variables (x). Variable assignments are shown in Table 5. Pearson or Spearman analysis identified age, BMI, sex, ethnicity, occupation, marital status, insurance type, poverty status, education level, smoking history, alcohol consumption, and number of co-existing chronic diseases as factors associated with hospitalization frequency (see Appendix 2).

Ordinal logistic regression revealed that age, sex, ethnicity, marital status, insurance type, education level, smoking history, alcohol consumption, and number of co-existing chronic diseases were significantly associated with hospitalization frequency (P<0.05). Details are shown in Table 7 .

Discussion

This is the first domestic study to examine the epidemiological characteristics and trends of multimorbidity among inpatients in rural primary healthcare institutions, revealing high multimorbidity prevalence, predominant two-disease patterns, and distinct comorbidity profiles compared to urban facilities. The study identified complex, diverse factors influencing both disease count and hospitalization frequency, providing crucial reference points for understanding the multimorbidity burden in rural primary care and improving service quality.

Epidemiological Characteristics of Multimorbidity in Guangxi Township Health Centers

The multimorbidity prevalence of 31.24% among inpatients in Guangxi township health centers was notable, predominantly affecting individuals aged $ $60 years, with higher proportions among those $ $70 years compared to those aged 60-70. International studies report multimorbidity prevalence of 3%-68% among adults $ $18 years in China, Brazil, South Africa, India, Mexico, and Iran, while the US shows 58.4% among adults $ $20 years, and Finland, Poland, Russia, and Spain report 57.92%-71.93% among adults $ $50 years. Substantial variation exists across countries and regions. Within China, prevalence differs significantly: 24.7% among adults aged 18-79 in Jilin Province and 47.5% among rural adults $ $65 in Anhui Province. These discrepancies likely stem from differences in

diagnostic criteria, age distributions, disease types, case detection capabilities, and data sources. However, the trends of higher multimorbidity prevalence with advancing age and greater female predominance are consistent across most studies and align with our findings.

In Guangxi township health centers, two-disease multimorbidity was most common, followed by three, four, and $ $5 diseases. Hypertension was the most prevalent co-existing condition, with combinations of hypertension, chronic cervical/lumbar spondylosis, chronic gastrointestinal diseases, stroke, diabetes, hyperlipidemia, and chronic pulmonary disease forming the most frequent patterns. These patterns differ from those observed in urban tertiary hospitals and community health centers. For instance, studies of elderly inpatients in several Chinese tertiary hospitals found two-disease patterns most common, followed by five, six, four, seven, eight, and three diseases, with hypertension + ischemic heart disease, hypertension + diabetes, hypertension + malignant tumors, ischemic heart disease + diabetes, and hypertension + cerebrovascular disease being the most prevalent patterns. In the geriatrics department of a Tianjin tertiary hospital, three-disease patterns were most common (33.1%), followed by two-disease (26.8%) and $ $4-disease (21.9%) patterns, with malignant tumors, diabetes, hyperlipidemia, stroke, hypertension, coronary heart disease, COPD, and depression forming the most frequent combinations. In a Shanghai community health center, $ $4-disease patterns were most prevalent, with hypertension, cerebral infarction, coronary heart disease, osteoporosis, diabetes, and COPD being the main components. In Shanghai's Jing'an District community health centers, the distribution was 24.46% with 2 diseases, 17.55% with 3 diseases, 13.57% with 4 diseases, and 8.92% with $ $5 diseases, with hypertension, ischemic heart disease, diabetes, hyperlipidemia, cerebrovascular disease, and gastroduodenitis forming the most common patterns. Our study found lower rates of coronary heart disease, malignant tumors, and emotional/mental disorders—common in urban facilities—but higher rates of chronic cervical/lumbar spondylosis. The proportion of patients with $ $3 diseases was also lower than in tertiary and community hospitals, suggesting less complex multimorbidity in rural settings. These differences likely reflect variations in chronic disease management capacity, referral patterns, and patient age distributions between urban and rural institutions.

Hospital Service Utilization Among Multimorbidity Patients in Guangxi Township Health Centers

Over the 2.5-year study period, hospitalization frequency increased with the number of co-existing chronic diseases, indicating a positive correlation between disease count and hospitalizations—consistent with multiple domestic and international studies. Iranian researchers confirmed in a large cohort of 50,045 individuals aged 40-75 that in low-to-middle socioeconomic settings, higher disease counts increase hospitalization risk and frequency. Similar positive associations between multimorbidity and hospital admissions have been observed

in high-income countries. Domestic studies have primarily used hospitalization days as the main utilization metric. One study in a Guangxi tertiary hospital found that hospitalization days increased with disease count among multimorbidity patients. Another study using household survey data from 4,598 chronic disease patients in Jiangsu found that each additional chronic disease increased hospital bed-days by 1.73 times and outpatient visits by 1.44 times. Our study further identified specific high-hospitalization patterns within each disease count category: among 2-disease patterns, hypertension + chronic cervical/lumbar spondylosis had higher hospitalization frequency than hypertension + stroke or hypertension + diabetes; among 3-disease patterns, hypertension + diabetes + chronic cervical/lumbar spondylosis generated more hospitalizations than hypertension + hyperlipidemia + chronic cervical/lumbar spondylosis, hypertension + diabetes + stroke, or hypertension + diabetes + hyperlipidemia; among 4-disease patterns, hypertension + diabetes + hyperlipidemia + chronic cervical/lumbar spondylosis had significantly higher hospitalization frequency than hypertension + diabetes + hyperlipidemia + stroke or hypertension + hyperlipidemia + chronic cervical/lumbar spondylosis + chronic gastrointestinal disease. Notably, the most prevalent patterns were not necessarily those with the highest hospitalization frequency. For example, among 2-disease patterns, the three most prevalent were hypertension + stroke, hypertension + diabetes, and hypertension + chronic cervical/lumbar spondylosis, whereas the top three for hospitalization frequency were chronic cervical/lumbar spondylosis + atrial fibrillation, chronic cervical/lumbar spondylosis + immune system disease, and liver disease + metabolic disease. These identified common and high-frequency patterns can inform epidemiological approaches to multimorbidity prevention and management in rural primary care settings.

Factors Influencing Disease Count and Hospitalization Frequency in Guangxi Township Health Center Inpatients

Our study identified age, BMI, sex, smoking, alcohol consumption, ethnicity, marital status, and insurance type as factors influencing the number of coexisting chronic diseases, while age, sex, disease count, ethnicity, marital status, insurance type, education level, smoking, and alcohol consumption affected hospitalization frequency. Previous studies have reported similar findings: sex, chronic disease duration, physical activity, sleep, self-rated health, medication use, education, and insurance type influenced disease count among elderly multimorbidity patients in Guangdong; age, widowhood, overweight/obesity, and former smoking were associated with disease count among Shanghai community-dwelling elderly; and disease count affected hospitalization treatment and frequency in international studies. Our findings align with these results. Additionally, factors identified in domestic and international studies as influencing multimorbidity risk—including aging, smoking, alcohol consumption, physical activity, BMI, sleep duration, and social activity—overlap with our identified factors affecting disease count and hospitalization frequency. This demonstrates the complexity of multimorbidity influences, encompassing socioeconomic, be-

havioral, and aging-related factors, and underscores the need for rural primary care institutions to implement multi-level prevention and treatment strategies targeting these factors to improve multimorbidity outcomes and reduce hospital service utilization.

Study Limitations: This study used medical record data from multimorbidity inpatients in Guangxi rural township health centers, limiting generalizability to rural community populations. Additionally, the limited capacity of township health centers to diagnose and treat multimorbidity, coupled with high referral rates, may have affected data accuracy to some extent.

Author Contributions: Shen Ying conceived and designed the study. Xi Qian, Ji Shuyu, Peng Houxuan, Qin Jinqiong, Wang Xuan, and Zheng Yanping collected and organized data. Xi Qian drafted the manuscript. Shen Ying, Xi Qian, Zhao Can, and Zuo Yanli performed statistical analysis, created figures and tables. Shen Ying revised the manuscript and provided quality control, taking overall responsibility for the article.

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.