Objective. Nasopharyngeal carcinoma is particularly prevalent in Guangdong and Guangxi (southern China); the economic burden of nasopharyngeal cancer patients is heavy in China. This study is aimed at retrospectively analyzing the basic features and economic burden of newly diagnosed nasopharyngeal carcinoma patients admitted to the First Affiliated Hospital of Guangxi Medical University and at providing a scientific basis for nasopharyngeal carcinoma prevention and control strategies.

Methods. The data of 3,727 nasopharyngeal carcinoma inpatients diagnosed from January 2012 to December 2020 were extracted from the Guangxi Nasopharyngeal Carcinoma Healthcare Big Data Management Information Platform. Basic demographic characteristics, duration of hospital stay, and hospitalization cost of nasopharyngeal carcinoma patients were collected and analyzed statistically. Results. The incidence period of nasopharyngeal carcinoma was primarily from 30 to 69 years of age, with the 40–49-year age group comprising the largest proportion of nasopharyngeal carcinoma patients, accounting for 34.18% of the patients with newly diagnosed nasopharyngeal carcinoma in the hospital. The male-to-female ratio was 2.87:1. There were 2,223 cases from rural areas, 2,153 from the Han ethnic group, and 1,460 from the Zhuang ethnic group, accounting for 59.65%, 55.77%, and 39.17% of the total number of cases, respectively. The average duration of hospitalization decreased whereas the average hospitalization cost increased annually. Multivariate analysis of hospitalization cost showed that the duration of hospital stay, rural/urban, and ethnicity was the main influencing factors: the longer the duration of hospital stay, the higher the hospitalization cost; patients from rural incurred lower costs than from urban; ethnic Zhuang patients incurred significantly lower costs than patients from other ethnicities. Conclusion. Early diagnosis and treatment should be actively carried out to reduce the incidence of nasopharyngeal carcinoma, especially for rural, ethnic Zhuang, and males in the 40–49-year age group patients. The future research on nasopharyngeal carcinoma will focus on exploring the pathogenesis of nasopharyngeal carcinoma, improving the screening system, and reducing the burden on patients, in order to further improve the survival rate and quality of life of patients with nasopharyngeal carcinoma.
1. Introduction

Nasopharyngeal carcinoma is a malignant tumor originating from the mucosal epithelium of the nasopharynx, which primarily occurs in Southeast Asian countries and southern China. According to the World Health Organization (WHO) International Agency for Research on Cancer, there were 133,000 new nasopharyngeal carcinoma cases and 80,000 deaths worldwide in 2020, including 62,000 new cases and 34,000 deaths in China, accounting for more than 43% of the global disease burden [1]. Nasopharyngeal carcinoma is particularly prevalent in Guangdong and Guangxi (southern China), and the incidence decreases from south to north [2]. The incidence is higher in males than in females, with a ratio of about 2.5:1 in China [3, 4]. Moreover, it increases with age in people over 20 years old and reaches its peak at approximately 45 to 60 years old [5]. The etiology of nasopharyngeal carcinoma may be hereditary, environmental, and/or linked to Epstein-Barr virus infection [5]. With the development of medical technology, the incidence and mortality of nasopharyngeal cancer in China have decreased significantly compared with the past. However, with the aging of China’s population, nasopharyngeal carcinoma incidence and mortality may continue to rise. The incidence of nasopharyngeal cancer in rural residents was significantly higher than that in urban residents (1.5:1), especially in males [6]. The economic burden of nasopharyngeal cancer patients presented disparity in different rural and urban areas and showed temporal change; the cancer burden in China remains at a high level despite improvements in health care and increasing funding on cancer control [7].

Data released in 2020 showed that the incidence of nasopharyngeal cancer in Guangxi was 10.71/100,000, and the mortality was 5.15/100,000, significantly higher than the national level (2.67/100,000 and 1.31/100,000); this shows that the incidence and mortality of nasopharyngeal cancer in Guangxi are still higher than the national level [8]. Increasing disease burden on patients and their families will worsen prevention and control.

This study aimed at retrospectively analyzing the demographics and economic burden of newly diagnosed nasopharyngeal carcinoma patients admitted to the First Affiliated Hospital of Guangxi Medical University in Nanning city from 2012 to 2020 to provide a scientific basis for the formulation of prevention and control strategies.

2. Material and Methods

2.1. Data Source. We extracted 3,830 cases of nasopharyngeal cancer patients hospitalized and diagnosed in the First Affiliated Hospital of Guangxi Medical University in Nanning city from January 2012 to December 2020 from the Guangxi Nasopharyngeal Carcinoma Healthcare Big Data Management Information Platform. Sample inclusion criteria included (1) medical records with primary diagnosis of nasopharyngeal malignant tumor (ICD-10 disease code C11) after discharge and (2) period of admission from 1 January 2012 to 31 December 2020. The general information of the patients (gender, age, address, ethnic origin, regional origin, and medical insurance payment category), their duration of hospitalization, total hospitalization cost, and other information were extracted. Sample exclusion criteria included (1) cases with hospitalization of <1 day, (2) incomplete patient information, and (3) cases with other complications. The resulting cohort included 3727 participants for the final analysis (Figure 1). The study was approved by the ethics review board of the First Affiliated Hospital of Guangxi Medical University (2021-102).

2.2. Statistical Analysis. The data collected were entered into a Microsoft Excel spreadsheet and statistically analyzed (IBM SPSS Version 26; International Business Machine, Armonk, NY, United States of America). Qualitative data were statistically described by frequency and composition ratio; the χ² test was used for comparison between groups, and the rank-sum test was used for statistical analysis of different types of data. The Mann–Whitney U test was used for the influence of gender and rural/urban on total hospitalization cost. The Kruskal-Wallis H test was used for the influence of ethnicity on total hospitalization costs. Spearman rank correlation analysis was used to assess the influence of age and duration of stay on total hospitalization cost. A multiple linear regression model was used to analyze the factors influencing hospitalization expenses. P values < 0.05 were considered statistically significant. P values ≤ 0.001 were considered statistically significant highly.

3. Results

3.1. Demographic Characteristics. From 2012 to 2020, a total of 3,727 nasopharyngeal cancer patients were diagnosed, including 2,765 males and 962 females, with a male-to-female ratio of 2.87:1. The number of cases was highest in 2017 (504 cases), and the male-to-female ratio was highest in 2015 (3.41:1), as shown in Table 1. There was no significant difference in gender in different years (χ² = 5.655, P = 0.686).

Among the 3,727 patients included, the mean age of onset was 46.54 ± 11.26 years, with the youngest being 11 years old and the oldest being 81 years old. The incidence of the disease was primarily concentrated in 30-69-year-old patients, and 40-49-year-old patients accounted for the largest proportion (34.18%). There was no significant difference in gender in the different age groups (χ² = 10.795, P = 0.148), as shown in Table 2.

Among the 3,727 patients, 938 were from Nanning city, accounting for 25.17% of the total, and 2,789 were from outside Nanning city, accounting for 74.83% of the total. There were 2,223 cases from rural areas, accounting for 59.65% of the total, and 1,504 cases from urban areas, accounting for 40.35% of the total. These data indicate that the incidence of nasopharyngeal carcinoma outside of Nanning is higher than that within Nanning, with rural areas experiencing higher rates than urban areas.

In this study, there were 2,153 (55.77%) patients of Han ethnicity, 1,460 (39.17%) of Zhuang ethnicity, and 114 (3.06%) from other ethnic groups, as shown in Figure 2.
3.2. Economic Burden. The average duration of stay of nasopharyngeal cancer patients showed a decreasing trend, with an average annual decrease rate of 3.3% and a month-on-month decrease of 2.5% (Table 3). The average hospitalization cost showed an increasing trend, with an annual average growth rate of 5.9% and a month-on-month increase of 7.5% (Table 4).

3.3. Factors Influencing Total Hospitalization Cost. Data from our study show a skewed distribution of the total hospitalization cost; therefore, a nonparametric test (the rank-sum test) was used for statistical analysis.

3.3.1. Relationship between Gender and Total Hospitalization Cost. The median total hospitalization cost for male patients was 77,305.90 yuan, and that for female patients was 76,470.07 yuan, which was not statistically significant (Mann–Whitney U test, \( Z = -0.244, P = 0.807 \)). Thus, gender was not associated with total hospitalization costs (Table 5).

3.3.2. Relationship between Age and Total Hospitalization Cost. According to the Spearman rank correlation calculation (\( R = -0.003, P = 0.8600 \)), there was no correlation between age and total hospitalization cost (Figure 3(a)).

3.3.3. Relationship between Ethnicity and Total Hospitalization Cost. The average hospitalization cost for ethnic Han patients was 68,800.63 yuan, that for ethnic Zhuang patients was 60,624.60 yuan, and that for other patients was 68,787.48 yuan. The nonparametric rank-sum test (Kruskal–Wallis H test, \( H = 27.42, P \leq 0.001 \)) suggested...
that the total hospitalization costs of different ethnic groups were significantly different. After pair-wise comparison, the total hospitalization cost was found to be different between ethnic Han and ethnic Zhuang patients (adjusted $P \leq 0.001$). There was no difference in total hospitalization cost between Han and other ethnic groups and between Zhuang and other ethnic groups (adjusted $P = 0.823$, respectively; Table 5).

### 3.3.4. Relationship between Rural/Urban and Total Hospitalization Cost

The median total hospitalization cost of rural patients was 61,454.37 yuan, and that of urban patients was 71,720.99 yuan. According to the Mann–Whitney U test ($Z = -6.211, P \leq 0.001$), the difference was statistically significant. Therefore, it can be assumed that the total cost of hospitalization differs between rural and urban patients (Table 5).

### 3.3.5. Relationship between Duration of Stay and Total Hospitalization Cost

Spearman rank correlation analysis of the duration of stay and total hospitalization cost ($R = 0.694, P \leq 0.001$) suggested a positive linear correlation; the longer the stay, the higher the cost of hospitalization (Figure 3(b)).

### 3.3.6. Multivariate Regression Analysis of Total Hospitalization Cost

Since the distribution of hospitalization cost was positively skewed, it presented an approximately normal distribution after logarithmic transformation. Multiple linear regression was performed using hospitalization cost as the dependent variable and ethnicity, rural/urban, and duration of hospitalization as the independent variables. The results showed that the main factors influencing patient hospitalization costs were duration of stay, ethnicity, and rural/urban, as shown in Table 6.

Further analysis of ethnic subgroups using multivariate linear regression analysis showed that the total hospitalization costs of rural patients were significantly lower than those of urban patients ($P \leq 0.001$), as shown in Table 7.

### 4. Discussion

At present, the cause of nasopharyngeal cancer is not clear, which increases the difficulty of primary prevention.
Moreover, the onset of nasopharyngeal cancer is insidious, and there are no distinct symptoms and signs at the early stage, which complicates secondary prevention. When a patient is diagnosed, they have usually reached the middle and late stages of cancer and face treatment complications, such as a long treatment cycle, poor prognosis, high recurrence rate, and probability of distant metastasis [9, 10]. Hence, improved early diagnosis and treatment and reduced disease burden of nasopharyngeal cancer have become an urgent and critical necessity. The incidence of nasopharyngeal cancer has always been high in southern China [2]. As the largest grade A tertiary hospital in Guangxi Province, the nasopharyngeal cancer cases provided in this study have certain research and reference significance.

A total of 3,727 patients were included in this study. The results show that the onset of nasopharyngeal carcinoma is primarily between 30 and 69 years of age, and that the 40–49-year-old age group represents the largest proportion (34.18% of new cases of nasopharyngeal carcinoma in the hospital). Li et al. [11] analyzed nasopharyngeal carcinoma cases in the Guangxi Tumor Hospital from 2002 to 2011 and showed that the peak age of incidence was in the 41–60-year-old group, accounting for 61.59%. The present study suggests that the age of nasopharyngeal carcinoma has decreased. In all age groups, male patients outnumbered female patients; the male-to-female ratio was 2.87:1, which is similar to data in the relevant literature [11]. This suggests that male patients have a heavier disease burden. The male-female ratio also widens with age, primarily owing to differences in social functions between men and women, with men exposed to higher stress environments and other risk factors (such as smoking and work stress) [12]. As such, governments should take gender into account when planning and allocating health resources. The data showed that males aged 30 to 69 are at the highest risk of nasopharyngeal cancer, and screening and protection of this group should be strengthened for the prevention and treatment of nasopharyngeal cancer.

We identified 2,223 cases from rural areas, accounting for 59.65% of the total. Some urban areas of Guangxi Zhuang Autonomous Region are highly industrialized, and some industries have moved to the suburbs and closer to the countryside, resulting in the deterioration of air quality in residential areas. Local residents are easily exposed to harmful substances, increasing disease incidence. In terms of ethnic groups, there were 2,153 ethnic Han patients (55.77%) and 1,460 ethnic Zhuang patients (39.17%), according to the 2017 Guangxi Statistical Yearbook [13]. By the end of 2016, the Han population of Guangxi Zhuang Autonomous Region accounted for 62.8% of the population of Guangxi, whereas the Zhuang population accounted for 31.39%. Zhuang is the most populous ethnic minority in China, most of which live in Guangxi. The distribution of Zhuang population is an important factor affecting the proportion of ethnic population and cancer incidence in Guangxi [14]. The proportion of Zhuang patients in this study was slightly higher, which may be related to the fact that Nanning and its surrounding cities and counties, including Liuzhou, Baise, Laibin, Hechi, and Chongzuo, are inhabited by ethnic Zhuang residents.

High medical expenses are the key factor leading to “high and difficult medical treatment” for ordinary people [15]. Therefore, the key to solving the problem of excessive rise in medical expenses is to control the unreasonable growth of hospitalization expenses. It is particularly important to study and analyze hospitalization expenses and influencing factors. In this study, the average duration of hospitalization of newly diagnosed nasopharyngeal carcinoma patients decreased every year, and this decrease was related to adjusted medical insurance policies [16]. However, the average hospitalization cost increased. In recent years, owing to factors such as the increase in population, price inflation, and medical advancements, medical expenses have also increased year-on-year [17]. Thus, the economic burden of nasopharyngeal cancer is increasing.

Multivariate analysis of hospitalization cost showed that the duration of stay, rural/urban, and ethnicity were the main influencing factors. The duration of stay greatly influenced hospitalization cost: the longer the duration, the higher the cost. To ensure the quality of medical services, the average duration of hospital stay must be shortened [18]; this would allow hospitals to minimize resource costs and maximize benefits. At the same time, patient hospitalization costs and the accompanying time burden for family members would be reduced, effectively reducing patient disease burden. The hospitalization cost for rural patients was lower than that for other patients, which may be related to the higher overall economic level of urban patients; rural patients tend to save more in the treatment process than urban patients. Moreover, the reimbursement rate for urban patients is mostly higher than that for rural patients. Additionally, unnecessary examinations or expensive drugs used in the treatment process could also result in higher hospitalization costs. However, owing to different medical insurance policies, the reimbursement rate of rural patients is low. In general, rural patients have a heavier economic burden. The total hospitalization cost for ethnic Zhuang patients was significantly lower than that for patients of other ethnicities. The reason for this trend is not completely understood but may be similar to that associated with the trend observed.

Table 5: Analysis of partial factors influencing total hospitalization costs.

| Factors   | N   | Hospitalization cost (yuan) | P value |
|-----------|-----|----------------------------|---------|
| Gender    |     |                            |         |
| Female    | 962 | 76470.07 ± 42281.67        | 0.807   |
| Male      | 2765| 77305.90 ± 42954.43        |         |
| Ethnicity |     |                            |         |
| Han       | 2153| 68800.63 ± 43354.23        | ≤0.001  |
| Zhuang    | 1460| 60624.60 ± 41663.67        |         |
| Others    | 114 | 68787.48 ± 40027.48        |         |
| Rural     | 2223| 61454.37 ± 41559.61        | ≤0.001  |
| Urban     | 1504| 71720.99 ± 43815.87        |         |
in rural patients; further study is needed in this area. Among China’s ethnic minorities, the largest number is the Zhuang, with 65.63 percent of the rural population and 34.37 percent of the urban population [19]. But the per capita disposable income of urban residents is higher than that of rural residents (2.56 : 1) [20]. In addition, differences in economic development level and medical treatment level between urban and rural areas, as well as differences in living habits, eating habits, and disease spectrum [8], jointly lead to higher incidence and disease burden of nasopharyngeal cancer in rural patients than urban. So hospital management should be strengthened to ensure both treatment effect and the shortening of the average length of hospital stay. The economic burden of patients with nasopharyngeal carcinoma is particularly high for rural and ethnic Zhuang patients. It is recommended that the hospital management should adjust the hospitalization cost structure, control drug use proportions, reduce average hospitalization duration, and avoid excessive medical treatment to reduce the burden on patients [21].

In conclusion, early diagnosis and treatment should be actively carried out to reduce the incidence of nasopharyngeal carcinoma, such as strengthening the science popularization education of nasopharyngeal carcinoma, popularizing EB virus antibody test [22, 23], conducting clinical trials of nasopharyngeal carcinoma vaccine, and improving the living habits and the quality of the ecological environment [3, 24], especially for rural, ethnic Zhuang, and males in the 40–49-year age group patients. The future research on nasopharyngeal carcinoma will focus on exploring the pathogenesis of nasopharyngeal carcinoma, improving the screening system [25], reducing the burden on patients, and formulating individualized treatment strategies, in order to further improve the survival rate and quality of life of patients with nasopharyngeal carcinoma.

Data Availability

These data used to support the findings of this study are available from the corresponding author upon request.

Ethical Approval

The study was approved by the ethics review board of the First Affiliated Hospital of Guangxi Medical University (2021-102).

Conflicts of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Authors’ Contributions

Min Kang conceived the original idea and wrote the proposal. Min Kang, Rensheng Wang, Lifang Zhou, Wei Lv, and Bo Wei designed the study, organized the data collection, and analyzed the data. Min Kang, Dong Yang, Nengfu Bin, Ziyan Zhou, Mingjun Shen, Chaolin Yang, and Yating Qin organized the data collection and analyzed the data. Min Kang, Dong Yang, Nengfu Bin, and Zhiru Li wrote the manuscript for publication. All authors contributed to
editing the manuscript and provided critical feedback and approved the final manuscript. Dong Yang and Nengfu Bin contributed equally to this work.

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References

[1] H. Sung, J. Ferlay, R. L. Siegel et al., “Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries,” *CA: a Cancer Journal for Clinicians*, vol. 71, no. 3, pp. 209–249, 2021.

[2] E. T. Chang and H. O. Adami, “The enigmatic epidemiology of nasopharyngeal carcinoma,” *Cancer Epidemiology, Biomarkers & Prevention*, vol. 15, no. 10, pp. 1765–1777, 2006.

[3] Y. P. Chen, A. T. C. Chan, Q. T. Le, P. Blanchard, Y. Sun, and J. Ma, “Nasopharyngeal carcinoma,” *The Lancet*, vol. 394, no. 10192, pp. 64–80, 2019.

[4] W. Chen, R. Zheng, P. D. Baade et al., “Cancer statistics in China, 2015,” *CA: a Cancer Journal for Clinicians*, vol. 66, no. 2, pp. 115–132, 2016.

[5] K. R. Wei, R. S. Zheng, S. W. Zhang, Z. H. Liang, Z. M. Li, and W. Q. Chen, “Nasopharyngeal carcinoma incidence and mortality in China, 2013,” *Chinese Journal of Cancer*, vol. 36, no. 1, p. 90, 2017.

[6] Y. H. Zou, X. Z. Liao, K. Q. Xu, and S. L. Zhu, “Morbidity and mortality of nasopharyngeal carcinoma in tumor registration areas of Huan Province from 2009 to 2012,” *Practical Preventive Medicine*, vol. 12, pp. 1415–1418, 2016.

[7] M. Cao, H. Li, D. Sun, and W. Chen, “Cancer burden of major cancers in China: a need for sustainable actions,” *Communications*, vol. 40, pp. 205–210, 2020.

[8] Q. L. Li, J. Cao, M. H. Rong, L. Y. Ge, H. P. Yu, and J. H. Yu, “Morbidity and mortality of malignant tumor in Guangxi tumor registry region in 2016,” *Chinese Journal of Cancer Prevention and Treatment*, vol. 12, no. 1, pp. 44–51, 2020.

[9] M. Y. Chen, K. Kuang, B. G. Shi, X. Z. Liao, and S. Y. Xiao, “Survival analysis of inpatients with nasopharyngeal carcinoma,” *Practical Preventive Medicine*, vol. 10, pp. 1465–1469, 2012.

[10] S. Li, S. X. Liang, and H. P. He, “Analysis of nasopharyngeal carcinoma cases in Guangxi Cancer Hospital from 2002 to 2011,” *Modern Oncology*, vol. 21, no. 8, pp. 1735–1737, 2013.

[11] K. Li, G. Z. Lin, Y. Li, H. Dong, and S. F. Song, “Survival rate and influencing factors of nasopharyngeal carcinoma patients reported in Guangzhou in 2009[)],” *Practical Preventive Medicine*, vol. 23, no. 12, pp. 1412–1414, 2016.

[12] B. Widet, “Nasopharyngeal carcinoma incidence in North Tunisia: negative trends in adults but not adolescents, 1994-2006,” *Asian Pacific Journal of Cancer Prevention*, vol. 16, no. 7, pp. 2653–2657, 2015.

[13] J. Liu and M. Xu, “Clinical analysis of 306 hospitalized patients with nasopharyngeal carcinoma in Baise,” *China Journal of Modern Medicine*, vol. 13, pp. 57–60, 2015.

[14] Y. T. Dong, “Discussion on the population of Zhuang nationality in Guangxi,” *Population and Economy*, vol. 6, pp. 40–43, 1983.

[15] U. Restelli, G. L. Ceresoli, D. Croce et al., “Economic burden of the management of metastatic castrate-resistant prostate cancer in Italy: a cost of illness study,” *Cancer Management and Research*, vol. 9, pp. 789–800, 2017.

[16] B. H. Wei, G. P. Lao, L. Su, H. F. Li, and Z. H. Mo, “Trend of age of onset in patients with nasopharyngeal carcinoma[)],” *China Journal of Modern Medicine*, vol. 22, no. 29, pp. 83–86, 2012.

[17] M. Kimman, R. Norman, S. Jan, D. Kingston, and M. Woodward, “The burden of cancer in member countries of the Association of Southeast Asian Nations (ASEAN),” *Asian Pacific Journal of Cancer Prevention*, vol. 13, no. 2, pp. 411–420, 2012.

[18] J. J. Liu, L. Ma, J. Li, W. L. Li, and T. Zhang, “An analysis to hospitalization expense for the malignant tumor inpatients of medical insurance[)],” *Medicine & Philosophy*, vol. 38, no. 8, pp. 90–93, 2017.

[19] J. X. Li and M. Liu, “Current situation and changing characteristics of China’s minority population,” *Northwest Nationalities Research*, vol. 4, pp. 120–137, 2019.

[20] National Bureau of Statistics, *Statistical Bulletin of the People’s Republic of China on National Economic and Social Development 2021[N], People’s Daily*, 2022.

[21] Q. Ye, “Analysis of the basic characteristics and hospitalization expenses of the first hospitalized nasopharyngeal carcinoma in a hospital,” *Chinese Journal of Hospital Statistics*, vol. 27, no. 2, pp. 139–141, 2020.

[22] Y. F. Si, Z. X. Deng, J. J. Weng et al., “A study on the value of narrow-band imaging (NBI) for the general investigation of narrow-band imaging (NBI),” *Chinese Journal of Modern Medicine*, vol. 13, pp. 234–237, 2006.

[23] W. Li, D. G. Huang, S. H. Qu et al., *Diagnostic value of Epstein-Barr virus antibody screening for early nasopharyngeal carcinoma in physical examination population[)],* vol. 42, no. 18, 2020*Guangxi Medical University, 2020.

[24] Y. M. Zheng, P. Tuppin, A. Hubert et al., “Environmental and dietary risk factors for nasopharyngeal carcinoma: a case-control study in Zangwu County, Guangxi, China,” *British Journal of Cancer*, vol. 69, no. 3, pp. 508–514, 1994.

[25] S. H. Qu, J. J. Weng, and J. Z. Wei, “Prevention and treatment of nasopharyngeal carcinoma in Guangxi[)],” *Chinese Journal of New Clinical Medicine*, vol. 14, no. 7, pp. 633–641, 2021.