

Study on hospitalization cost of elderly patients with lung cancer in the Western region of China

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ABSTRACT

Background: By collecting the medical record information of hospitalization cost (HC) of the elderly over 60 years, to comprehensively analyze the influencing factors of the rise of HC from the internal and external dimensions, so as to put forward targeted measures and suggestions to control the excessive growth of HC.

Objectives: to assess the hospitalization cost of elderly patients with lung cancer in the Western region of China

Methods: Taking a tertiary hospital in Guangxi Zhuang Autonomous Region of China, herein after referred to as Guangxi Xi as a sample, the medical record home page data of lung cancer patients over 60 years old from 2012 to 2016 were collected, and the influencing factors of HC were analyzed. Grey Relation Analysis and Structural Variation Degree were used in the analysis of internal influencing factors. Structural Equation Model was used in the analysis of external influencing factors.

Results: The HC of elderly patients with lung cancer was found to be increased year by year from 2012 to 2016. The structural variation degree of HC from 2015 to 2016 was the largest, which was 12.81%. The Grey Relation analysis results showed that the correlation degrees of medicine cost, examination cost and consumables cost were 1.000, 0.8606 and 0.7559 respectively, which were the main internal factors affecting HC. The structural equation model showed that the length of stay, whether to operate, re-hospitalization plan, the number of complications, occupation and hospitalization frequency had an impact on the HC and their total impact effects were 0.688, 0.428, 0.221, 0.184, 0.054 and 0.044 respectively.

Conclusion: The HC of elderly patients with lung cancer are increasing year by year, but the increase rate is reasonable. The cost of medicine and consumable have been solved to a certain extent, while the examination cost still needs to be further controlled. The length of stay is still the main influencing factor, and other factors will indirectly affect the hospitalization cost through this factor.

Keywords: Elderly patients, Lung cancer, Hospitalization cost, Grey Relation Analysis, Structural Variation Degree

1. Introduction

Lung cancer is the most common malignant tumor in the world, ranking the first among all the high-incidence cancers in China [1]. On average, seven people per minute are diagnosed with malignant tumors, and the first tumor is lung cancer. The rapid growth of lung cancer incidence and the direct medical costs and indirect social and economic burden caused by poor prognosis are high in countries around the world [2]. Studies on the global economic burden of disease show that the disease burden of COPD, lung cancer and lower respiratory tract infection in China are ranked fourth, fifth and ninth, respectively [3]. A study from Shandong University shows that the number between 2015 and 2016 [4] up to 52% of cancer patients experienced financial difficulties, and 18% of patients borrowed more than 50,000 yuan for cancer treatment. As most of the elderly groups without stable income, the families of elderly lung cancer patients bear a greater economic burden. With the increasing number of aging in China, the proportion of the elderly population is getting higher and higher, and the number of elderly patients also increases.

At present, the rapid development of medical and health undertakings in China, the patient burden of rising, medical cost structure and growth of the unreasonable factors, medical

services, especially hospitalization service growing rapidly, drugs, large medical equipment inspection treatment and medical consumables income accounted for higher, etc., lead to hospitalization costs rise too fast has become a hot issue of social concern. In order to explore the influencing factors of hospitalization costs and reduce the cost burden of patients, especially elderly patients, this study comprehensively analyzed the information of the influencing factors of hospitalization costs from both internal and external dimensions, so as to put forward targeted measures to control hospitalization costs.

2. Methods

2.1 Study subjects

The data came from the home page of a large third-class A general hospital in Guangxi from 2012 to 2016 (Medical record home page). According to the International Classification of Diseases (ICD-10), patients discharged mainly diagnosed with lung malignancy were selected, ICD-10 was classified as C34.900, and they were 60 years old and above. During the selection of cases, we followed the following principles. Patients whose criteria were less than 500 yuan, less than 1 day, more than 90 days, and cases with wrong or irregular costs, a total of 1548 patients were included.

2.2 Research Content

The research is mainly divided into internal influence factor analysis and external influence factor analysis. Internal influence factors analysis is mainly to explore the internal cost of hospitalization costs, the influence of the total hospital costs, so the analysis index is mainly for Chinese hospital unified home page hospitalization costs classification, divided into comprehensive medical service cost, diagnosis, treatment, rehabilitation, traditional Chinese medicine, western medicine, medicine, blood and blood products, consumables, etc. External influence factors mainly explore the difference of hospitalization costs and its impact on the hospitalization costs due to size, external influence factors choose years, medical payment, hospitalization, gender, age, nationality, occupation, marriage, weather, local, relationship, actual hospital days, admission, number of complications, blood type, hand, hospital way, whether there was a Re-hospitalization plan within 31 days after discharge (re-admission hospitalization plan).

2.3 Research Methods

The main purpose of this study was to understand the internal influencing factors and external influencing factors, first, to eliminate the impact of price increases on costs, transformation of various cost input; Internal impact factor analysis section, Using the Grey

Relation analysis and the Structural Variation method, analyze the impact of the internal structural costs on the change of hospitalization costs; analysis section of external impact factors; first, the differentiation analysis of the hospitalization costs of patients under different indicators, then, with the indicators of differences as the independent variables. The hospitalization cost was the dependent variable, structural equation model was analyzed, explored the external influencing factors of hospitalization costs.

2.3.1 Grey Relation analysis method

Grey Relation analysis method is to compare the similarities and differences between the development trend among various factors within the system, and evaluate the proximity of each factor to a specific object. The closer the two are, the greater the correlation, and the smaller the contrary, which has the advantages of unlimited sample size, simple principle, wide range of application and intuitive results [5], now, it is widely used in the medical and health care field. The Grey Relation analysis adopted in this paper is a new Grey Relation analysis proposed by Takakawa and others, as follows [6-7];

(1) Determine the reference columns and the comparison columns

In this paper, the total hospitalization cost of lung cancer patients is selected $\{x_0(k)\}$ as the

reference sequence, the structural costs it contains as comparative numbers $\{x_i(k)\}$, that is the comprehensive medical service cost, diagnosis cost, treatment cost, rehabilitation cost, TCM treatment cost, western medicine cost, Chinese medicine cost, blood and blood products cost, consumables cost for the comparative sequence, total m item ($m=9$); then compare the difference between the sequence and the reference series approach $\Delta_i(k)$, this is $\Delta_i(k) = |x_0(k) - x_i(k)|$, and find out the annual maximum and minimum interpolation $\Delta_{max}(k)$, $\Delta_{min}(k)$, where k takes 1-5 represents each year 2012-2016, total of n years ($n=5$), for $x_i(k)$ the structural costs of item i of year k , the total hospitalization cost in year k is $x_0(k)$.

(2) Calculate the correlation coefficient of various structural costs in each year $\xi_i(k)$

$$\xi_i(k) = \frac{\rho \Delta_{max}(k) + \Delta_{min}(k)}{\rho \Delta_{max}(k) + \Delta_i(k)}$$

ρ here is the resolution coefficient, with $0 < \rho < 1$. If the ρ smaller, the greater the difference between the correlation coefficient, the stronger the differentiation ability. Usually ρ take 0.5, $\rho = 0.5$ in this study.

(3) Calculate the correlation degree β_i and ranking of various structural cost

β_i . The correlation degree can directly reflect the influence of the comparison series on the reference series. The β_i larger, greater the

impact of an index in the reference series on the total hospitalization cost of the comparison series.

The β_i calculation formula is: $\beta_i = \frac{1}{n} \sum_{k=1}^n \xi_i(k)$

2.3.2 Structural Variation method

This study used the structural variation method to analyze the structural variation of hospitalization cost of elderly lung cancer patients in Guangxi from 2012 to 2016. Three calculation indexes were mainly involved: structural variation degree, structural variation value and structural contribution rate [8-9].

(1) Value of Structure Variation (VSV) refers to the difference between the composition ratio of each component of the thing and the beginning value of a certain period of time. The VSV is calculated by the following formula, where it represents the cost item within the total hospitalization cost, X_i , it means the proportion of the expense item to the total hospitalization cost, 1 means the end and 0 indicates the beginning; if $VSV > 0$, it indicates the positive change of the total hospitalization cost at the end of the period, otherwise the negative change and the final level is lower than the initial level.

$$VSV = X_{i1} - X_{i0}, \quad i = 1, 2, 3, \dots, n$$

(2) Degree of Structure Variation (DSV) refers to the comprehensive degree of variation of each component of something in a certain period,

and the average annual structural variation is DSV / m (m is the number of comparative periods). The DSV calculation formula is:

$$DSV = \sum_{i=1}^n |VSV|, \quad i=1,2,3,\dots,n$$

(3) The Structural Variation Contribution rate, refers to a period of each component structure change value of the absolute value ($|VSV|$) in the structure variation, namely $|VSV| / DSV$, in this study as an example, the impact of the total hospitalization cost structure changes.

2.3.3 Structural Equation Model

Structural Equation Model, referred to as SEM, first by the early 1970s Joreskog and Wiley scholars will factor analysis, path analysis and other statistical methods integrated the preliminary concept, after other researchers, by Ullman SEM is defined as a validation of one or more independent variables and a set of multivariate analysis equation [10]. SEM has become the important statistical method of quantitative research in contemporary behavior and social field, it combines the traditional multivariate statistical analysis of "factor analysis" and "linear model of regression analysis" statistical technology, for various causal models can be model identification, estimation and verification, widely used in the field of health, statistical analysis process in Amos26.0 software, mathematical formula can refer to relevant scholars, not here [11].

2.4 Statistical Methods

Software selection: Microsoft Visual Fox Pro 9.0 software was used for data storage, data screening and cost price index transformation were performed by Microsoft Excel 2007, structural variation method and generalized linear model analysis were conducted by SPSS 19.0 software; structural equation model was analyzed by Amos 26 software, and the significance level was taken as 0.05.

2.5 Ethical Approval:

Because this study used anonymous electronic data made public by hospitals, it was obtained off-site. This manuscript does not report on or involve the use of any animal or human data or tissue, there is no ethical element, for the record.

3. Results

3.1 CPI conversion of hospitalization costs

In order to eliminate the impact of rising prices on the hospitalization cost of elderly lung cancer patients, this paper took the hospitalization cost in 2012, and adjusted the hospitalization cost from 2013 to 2016, according to the website of Guangxi Zhuang Autonomous Region, the consumer price index (CPI) in 2013-2016 was 102.2%, 102.1%, 101.5% and 101.6%. The calculation formula is as follows;

$$Y_i = Y_{i0} / \prod_{2013}^i p_i, \quad i=2013, 2014, 2015, 2016.$$

where i is the year, and p_i for the i -year consumer price index, Y_0 for the total cost of baseline hospitalization, Y_i total adjusted hospitalization costs in year i . According to the

calculation, the total hospitalization cost of elderly lung cancer patients increased annually from 2012 to 2016, as shown in Table 1.

Table 1: Changes in total hospitalization costs for elderly lung cancer patients from 2012 to 2016

Year	Cost (CNY)	CPI (%)	AC (CNY)	AI(CNY)	LRR (%)
2012	15537.6	—	15537.6	—	—
2013	18042.5	102.20	17654.2	2116.6	13.62
2014	20269.6	102.10	19425.3	1771.2	10.03
2015	21084.1	101.50	19907.3	482.0	2.48
2016	22255.3	101.60	20682.2	774.9	3.89

Note. CPI = consumer price index; CNY = China Yuan; LRR=link relative ratio; AI=Amount of increase; AC=Adjusted-cost.

3.2 Analysis results of internal influencing factors

3.2.1 Structural Variation analysis method

(1) Basic information of hospitalization cost for elderly lung cancer patients. The total hospitalization cost of elderly lung cancer patients was divided according to the comprehensive medical service cost, diagnosis cost, treatment cost, rehabilitation cost, traditional Chinese medicine treatment cost, western medicine cost, Chinese medicine cost,

blood and blood products cost and consumables cost. The proportion of various cost is shown in Table 2. Overall, the highest proportion, accounting for more than 40% every year, followed by diagnostic costs including pathological diagnosis, laboratory diagnosis, impact diagnosis and clinical diagnosis, consumables or treatment, which was in third place from 2012 to 2015, and comprehensive medical service in 2016.

Table 2: Hospital costs and composition of lung cancer among the elderly over 60 years from 2012 to 2016

Year	All-in cost (CNY)	CMS cost: (%)	Diagnostic cost (%)	Medical cost(%)	Rehabilitation cost (%)	The TCM cost (%)	WM cost (%)	TCM drug cost (%)	BBP cost(%)	Consumable cost (%)
2012	15537.6	7.82	27.17	8.30	0.17	0.12	41.87	0.48	3.44	10.64
2013	17654.2	6.87	25.30	7.46	0.13	0.24	46.49	0.60	2.66	10.24
2014	19425.3	6.63	24.96	8.48	0.01	0.45	44.56	0.67	2.07	12.16
2015	19907.3	6.08	27.57	8.73	0.03	0.22	42.73	0.86	2.57	11.21
2016	20682.2	6.04	30.47	8.01	0.01	0.09	45.47	1.62	2.34	5.95

NOTE.CMS=Comprehensive medical service; TCM=Traditional Chinese Medicine; WM=Western medicine; BBP=Blood and blood products

(2) Change value and change degree of hospitalization cost structure. The changes of the structure and structure of the cost from

2012 to 2016 were calculated according to the formula in the search method, and the results are shown in Table 3. It can be seen that the

structural change was highest in 2015-2016, and the structural change value was the largest, followed by diagnostic cost and western drug cost above 2%; the second period was 2012-

2013, followed by the diagnostic cost, the biggest structural changes between 2012-2016, and they were above 1%.

Table 3: (%) and structural variation of cost from 2012-2016

Metric	2012-2013	2013-2014	2014-2015	2015-2016	2012-2016
CMS cost	-0.95	-0.24	-0.56	-0.04	-0.83
Diagnostic cost	-1.86	-0.34	2.60	2.90	5.17
medical cost	-0.84	1.02	0.25	-0.72	0.55
Rehabilitation cost	-0.04	-0.12	0.02	-0.03	-0.13
TCM cost	0.11	0.21	-0.23	-0.12	-0.14
WM cost	4.63	-1.93	-1.83	2.74	-1.02
Drug costs	0.12	0.06	0.19	0.76	1.02
BBP cost	-0.78	-0.59	0.50	-0.23	-0.32
Consumable cost	-0.40	1.92	-0.95	-5.27	-4.29
DSV	9.722	6.434	7.145	12.812	13.467

NOTE.CMS=Comprehensive medical service; TCM=traditional Chinese medicine; WM=Western medicine; BBP=Blood and blood products; DSV=Degree of Structure Variation.

(3) Contribution rate of hospitalization cost was higher, specific, 2012-2013, the first three structure change. In 2012-2016 cost structure contribution from large to small, diagnosis, change contribution rate is shown in table 4, 2013-2014, contribution from large to small through the structure variation of more than 10% west medicine, consumables, treatment, 2014-2015, the first three contribution rates were of the project screening, diagnosis, medicine, diagnosis, consumables, and 2016. consumables structure change contribution rate

Table 4: (%) for the contribution rate of various cost structure changes from 2012 to 2016

Metric	2012-2013	2013-2014	2014-2015	2015-2016	2012-2016
CMS cost	9.740	3.721	7.773	0.287	6.175
Diagnostic cost	19.182	5.245	36.425	22.658	38.377
medical cost	8.615	15.815	3.563	5.655	4.066
Rehabilitation cost	0.390	1.863	0.292	0.221	0.945
TCM cost	1.180	3.283	3.251	0.946	1.056
WM	47.590	29.985	25.648	21.385	7.589
Drug costs	1.224	0.992	2.676	5.957	7.561
BBP cost	8.009	9.178	7.044	1.786	2.347
Consumable cost	4.069	29.918	13.328	41.104	31.883

NOTE.CMS=Comprehensive medical service; TCM=traditional Chinese medicine; WM=Western medicine; BBP=Blood and blood products.

3.2.2 Gray Relation analysis method

The correlation coefficient of each cost index in the total hospitalization costs was calculated according to the formula of the grey relation analysis method (see Table 5), It can be seen

that the correlation coefficient of western drug costs maintained the highest level of 1 in each year, while other different cost types are available in different years, the relation coefficient with the total hospitalization costs

fluctuates greatly, unable to intuitively see the degree of relation between various costs and total hospitalization costs, furthermore, the overall relation between various costs and total hospitalization costs is calculated (see Table 6),

By the correlation values from large to small, the top three relations of the cost and the total hospitalization cost of elderly lung cancer patients were: western medicine, diagnosis, and consumables.

Table 5: relation coefficients of various cost indicators in the total hospitalization costs

Year	CMS cost	Diagnostic cost	medical cost	Rehabilitation cost	TCM cost	WM	Drug costs	BBP costs	consumable cost
2012	0.7604	0.8803	0.7630	0.7216	0.7214	1.0000	0.7231	0.7377	0.7758
2013	0.7231	0.8300	0.7260	0.6905	0.6910	1.0000	0.6927	0.7024	0.7405
2014	0.7354	0.8432	0.7450	0.7030	0.7050	1.0000	0.7060	0.7127	0.7649
2015	0.7453	0.8761	0.7593	0.7153	0.7161	1.0000	0.7192	0.7276	0.7729
2016	0.7261	0.8745	0.7361	0.6969	0.6973	1.0000	0.7045	0.7079	0.7256

Table 6: Correlation degree and ranking of various cost indicators in hospitalization cost

Category	Correlation degree	Sort
WM	1.0000	1
Diagnostic cost	0.8608	2
consumable cost	0.7559	3
medical cost	0.7459	4
CMS cost	0.7381	5
BBP cost	0.7177	6
Drug costs	0.7091	7
TCM cost	0.7062	8
Rehabilitation cost	0.7054	9

NOTE.CMS=Comprehensive medical service; TCM=traditional Chinese medicine; WM=Western medicine; BBP=Blood and blood products.

3.3 Analysis results of external influencing factors

3.3.1 Univariate analysis of hospitalization costs

Normal test for hospitalization costs and Hospitalization days, using Shapiro-Wilk, the statistical analysis of hospitalization costs was 0.744 ($P < 0.0001$), 0.649 ($P < 0.0001$), which did not meet the normal distribution, using nonparametric test. For numerical variables, such as age, number of hospitalization, and number of complications, Spearman rank correlation showed that hospitalization costs were 0.786 ($P < 0.0001$), 0.109, ($P = 0.0005$) ($P = 0.010$, $0 < 0.05$) and -0.008 ($P = 0.748 > 0.05$).

For the categorical variables, the Kruskal Wallis was used to examine the differences in hospitalization costs under different indicators of external factors, 1.475 for sex, marriage, relationship, admission, 1.475 ($P = 0.225$), 1.957 ($P = 0.581$), 1.223 ($P = 0.269$), 12.949 ($P = 0.073$), 7.391 ($P = 0.060$), 9.339 ($P = 0.096$), respectively, both were greater than the significance level of 0.05. There was no statistically significant difference; the test statistics of index medical payment, nationality, occupation, surgery, departure, and re-hospitalization plan were 46.871 ($P < 0.001$),

10.025 ($P=0.007$), 60.701 ($P=0.000$), 141.194 ($P<0.001$), 95.769 ($P<0.001$), 76.283 ($P<0.001$), respectively. All were less than the significance level of 0.05, the difference was statistically significant.

3.3.2 Analysis of the structural equation model

According to the results of univariate analysis, the number of complications, number of hospitalizations, age, medical payment method, ethnicity, occupation, surgery, departure mode, and re-hospitalization plan were taken as

independent variables, hospitalization days as the intermediate variable, and total hospitalization cost as the dependent variable, using Amos26.0 software to fit the structural equation model, and according to the correlation, finally concluded that the medical payment, occupation, surgery, rehospitalization plan, the number of complications directly affect the total hospitalization costs, or through the hospitalization days, path and path coefficient is shown in Figure 1.

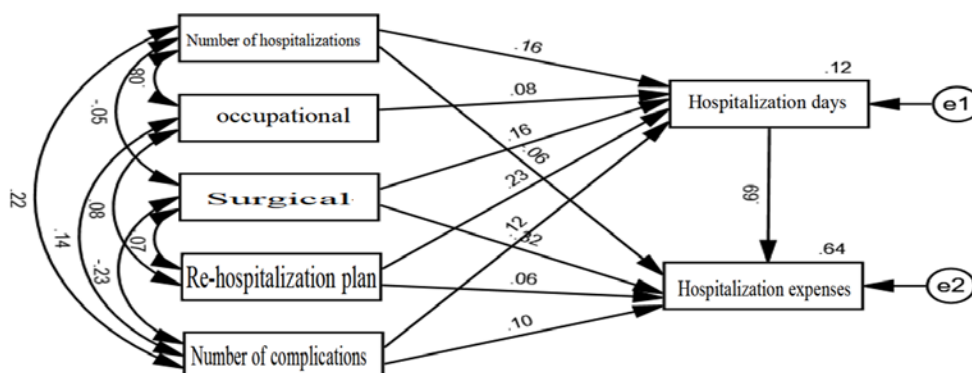


Figure 1: Theoretical model of structural equation for hospitalization cost influencing factors in elderly lung cancer patients in Guangxi

It can be seen that the influencing factors in the model mainly affect the total hospitalization cost of elderly lung cancer patients through two ways: number of hospitalizations, occupation, surgery, re-hospitalization plan, complications, number of hospitalization days directly affect the total hospitalization cost, or medical payment, occupation, surgery, hospitalization plan, complications indirectly affect the total

hospitalization cost. See Table 7, where the total effect is only statistically significant paths. According to the total effect size, it can be concluded that the influence of each factor on the hospitalization cost of elderly patients is from large to small order: number of hospitalizations, surgery, re-hospitalization plan, number of complications, occupation and number of hospitalizations.

Table 7: Path and effect of influencing factors on hospitalization cost in elderly patients with lung cancer

Factors	DAP	PC	IAP	PC	GE
Occupation	—	—	occupational → hospitalization days hospitalization costs	0.054	0.054
NOH	NOH → hospitalization costs	- 0.064	NOH → hospitalization days → hospitalization cost	0.108	0.044
NOC	NOC → hospitalization costs	0.103	NOC → hospitalization days hospitalization cost	0.081	0.184
Re-hospitalization plan	Re-hospitalization plan → hospitalization cost	0.063	Re-hospitalization plan s → hospitalization days → hospitalization cost	0.158	0.221
Surgical	Surgical → hospitalization costs	0.316	Surgical → hospitalization days → hospitalization cost	0.111	0.428
Hospitalization days	Hospitalization days → Hospitalization cost	0.688			

NOTE.DAP=Direct action path ; PC=Path coefficient ; IAP=Indirect action path ; GE=gross effect ; NOH=Number of hospitalizations; NOC=Number of complications;

From the fit test of the structural equation model, $\chi^2=1.378$, $df=4$, and $P=0.848>0.05$ ^{2}df [12], accept H_0 suppose that the model is adapted to the sample data; after the selection of other structural equations and calculation, the fit degree of the model also reaches a high level. See Table 8, all indicators are directly output by Amos26 software.

Table 8: To investigate the fitting degree of structural equation of hospitalization expenses in elderly patients with lung cancer

The main fit index	Desired value	Standard
GFI	0.999	>0.90
AGFI	0.998	>0.90
RMSEA	0.000	<0.08
CFI	1.000	>0.90
NFI	0.999	>0.90

NOTE.GIF=goodness-of-fit index; AGFI=Adjusted goodness-of-fit index; RMSEA=Root mean square of error; CFI= Compare the Fit Index; NFI=Specification Fitting Index.

4. Discussion

4.1 The hospitalization cost of elderly lung cancer patients is increased year by year, but the increase is basically reasonable

From 2012 to 2016, the cost gradually increased. Taking 2016 as an example, the per capita disposable income of urban residents in Guangxi was 28,324 yuan, while in 2016, the average hospitalization cost of elderly lung cancer patients reached 22,255.3 yuan [13]. Accounting for 78.6% of income, WHO calls health expenditure for more than 50% of

household disposable income catastrophic expenditure, which undoubtedly brings a great economic burden to the elderly [14]. As can be seen from the proportion, the highest proportion is the western medicine cost, followed by the diagnosis cost, which is often known as the examination and examination cost, which specifically includes the pathological diagnosis cost, laboratory diagnosis cost, influence diagnosis cost, clinical diagnosis project cost, which is

compared with other studies [15][16]. The conclusion is similar, the reason may be related to the treatment of lung cancer disease, chemotherapy is the main treatment of lung cancer, more than 90% of lung cancer need to receive chemotherapy treatment, chemotherapy effect of small cell lung cancer both early or late, even about 1% of early small cell lung cancer cured by chemotherapy, so the higher proportion of drug costs is understandable [17][18]. Although the overall hospitalization cost has increased year by year, the increase is reduced, and it is in line with the requirement of the 13th Five-Year Plan for Deepening the Reform of medical and Health System in Guangxi issued by 2017 in 2017 that the growth rate of medical cost in public hospitals in the region aimed to fall below 10% in 2017.

4.2 The cost of medicine and consumables has been solved to a certain extent, while the inspection cost still needs to be further controlled

From the point of view of the internal influencing factors, based on the results of the structural variability analysis, from 2015 to 2016, the most variable, among them, the structural change contribution rate of consumables cost, diagnosis cost and western medicine cost is the largest. This means that the increase in costs from 2015 to 2016 was accompanied by the adjustment of multiple

expense ratio structure. The main changes are consumables, diagnosis and western medicine. The reason may be in that, in February 2015, the General Office of the State Council issued the Guiding Opinions on Improving the Centralized Drug Procurement in Public Hospitals, to propose classified drug procurement, in October of the same year. Health and family planning and other 16 ministries and commissions (bureau) to establish departmental coordination mechanism, organized and carried out the first batch of national drug price negotiation pilot work, in 2016, the National Health and Family Planning Commission announced the first results of the negotiations, involving 3 drugs, mainly for drugs for hepatitis B and lung cancer, in the same year, Guangxi also included these drugs in the reimbursement scope of the new rural cooperative medical care system. Participating patients will pay 50% of the pooling fund for using the two drugs, so probably due to the increased hospital use of reimbursable lung cancer treatments, indirectly led to a higher proportion of drug costs. In August 2016, the hospital launched the reform of urban public hospitals. In accordance with the requirements of the opinions on the Implementation of the Pilot Comprehensive Reform of Urban Public Hospitals issued by Guangxi, the price of examination and

treatment of large medical equipment was reduced while reducing the cost of drugs and medical consumables and canceling drug markups. We see, consumables greatly reduced, medicine through centralized procurement and health care, also get certain solution, and check the whole is in the growing trend, the reason may be that elderly lung cancer patients due to older, more complications, need more examination to understand the specific condition, naturally produced more examination cost.

Further combined with the grey correlation analysis results, with elderly lung cancer patients hospitalization internal influence the biggest cost structure for western medicine, diagnosis, consumables, in turn, we often say medicine, examination and consumables, for this conclusion suggests the local departments, can design from treatment, treatment path, reimbursement mode for elderly lung cancer patients, further promote drugs, consumables, and reimbursement, gradually form regional medical inspection institutions, image center, to reduce the burden of such groups without labor ability. It is worth noting that on October 10, 2018, the National Healthcare Security Administration issued the Notice on including 17 kinds of drugs in the Category B List of National Basic Medical Insurance, Work-related Injury Insurance and maternity

Insurance. The 17 kinds of anti-cancer drugs were successfully included in the medical insurance list, including five kinds of lung cancer drugs [19], After 2018, the drug cost of lung cancer patients decreased significantly, and the overall cost was also reduced

4.3 Days of hospitalization remains the main influencing factor, while other factors will indirectly affect hospitalization costs through this factor

From the perspective of external influencing factors, the factors affecting hospitalization costs from large to small are the number of hospitalizations, surgery, rehospitalization plan, number of complications, occupation, number of hospitalizations, and other studies [19-21]. The conclusion is similar. The effect of hospitalization days on hospitalization costs has become a common rule in the study of various diseases, and for whether surgery index, in general, for elderly patients, postoperative wound healing time is slow, need more hospital stay to recover, hospital days increase natural costs will rise, and surgery as one of the treatment of lung cancer patients, need technical difficulty is higher, whether from human cost or health resources (surgical drugs, consumables, etc.) consumption is more, relatively higher costs [22]. Similarly, the greater the number of complications, the more complex the disease, the more difficult the treatment, and the higher the cost. For

rehospitalization plan index, that is, whether there are discharge 31 days hospitalization planning operation, less other studies into the index, the index is mainly indirectly affecting the hospitalization costs, it may be related to the severity of the disease, have hospitalization plan patients ill, need to come back to continue hospitalization or surgery, so the hospitalization cost will be higher.

For the number of hospitalization index, we can see more through the cost of hospitalization, hospitalization means already through hospitalization, hospitalization means need for treatment, disease recurrence or deterioration, for cancer, each treatment will cause some damage to the body, and treatment requires longer rehabilitation, longer hospitalization time, treatment will be more difficult; another possibility is that the patient more serious condition, longer hospital time, but due to the influence of hospital policy, the number of hospitalization [23]. For career indicators, the elderly group over 60 years old has reached the retirement age, so most of the patients are farmers and retired workers, and retired workers have stable and higher pension, on the choice of treatment received less economic factors, greater choice, and for farmers, income is unstable and low, may be more likely to choose cheap treatment, also led to the difference of different professions. However,

the effect of occupation and the number of hospital admissions on hospitalization costs was relatively small compared to the other four measures.

4.4 It is suggested to continue to deepen the reform of DRG payment and smooth reimbursement channels, and promote the construction of a hierarchical diagnosis and treatment system

In view of the impact of these factors on the internal use of hospitalization cost, the practical reform of DRGs payment method can be solved to a large extent. DRGs payment reform basic principle is based on inpatient discharge cases, according to the main diagnosis, surgical treatment, age, gender, complications, discharge outcome and hospital time, clustering cases with similar clinical characteristics, hospital time and medical resources are divided into several groups, according to different regulations, medical insurance institutions to determine the corresponding reimbursement criteria and quota compensation to medical institutions^[23], Standardized diagnosis and treatment process, less waste, and included in the medical insurance. In November 2020, Guangxi Medical Insurance Bureau and other departments issued the Interim Measures on DRG Payment for Residential Medical cost of Guangxi Basic Medical Insurance, requiring tertiary hospitals in the region to formally

implement DRG payment from December 1, 2020. At present, Guangxi Medical Insurance Bureau has issued the Guangxi Basic Medical Insurance DRG Group Weight Plan (version 1.0), and has also announced the implementation rules of DRG payment for basic medical insurance. DRGs payment in Guangxi is progressing in an orderly manner. Liuzhou, Guangxi, is one of the first cities in China to carry out the pilot project of medical insurance DRGs payment. It has been confirmed that through the reform, the unreasonable growth of medical cost has been controlled and the medical burden of the insured has been significantly reduced [24]. To solve the influence of occupation on hospitalization costs is more likely solving the problem of low-income groups. In addition to the centralized procurement mentioned above, continue to promote the construction of hierarchical diagnosis and treatment system, relying on medical relation, open the two-way referral channel, realize the disease insurance, medical assistance and remote medical insurance settlement channels, and facilitate low-income groups or the elderly. Moreover, some studies have shown that appropriate intervention for some high-risk re-inpatients can also reduce their medical burden to some

extent [25].

Overall, this study has some limitations. The included indicators can be included within the capacity, and cannot cover all the influencing factors. The cost growth may also be affected by technological progress, new drug research and development, and program improvement. Although, it is a retrospective analysis and study, but according to the impact of the factors found in the model analysis on the cost, we can still reflect some problems, for other scholars.

Conclusion: The HC of elderly patients with lung cancer are increasing year by year, but the increase rate is reasonable. The cost of medicine and consumable have been solved to a certain extent, while the examination cost still needs to be further controlled. The length of stay is still the main influencing factor, and other factors will indirectly affect the hospitalization cost through this factor.

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References:

- [1] Chen Jindong. Current status and development trend of morbidity and mortality of various types of cancer in China [J].Journal of Zunyi Medical College, 2018,41 (06): 653-662.
- [2] Molinier L, Combescure C, Chouaid C, et al. Cost of lung cancer: a methodological review.[J].Pharmacoeconomics, 2006,24(7):651-659.
- [3] GBD 2013 Mortality and Causes of Death Collaborators. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013.[J].Lancet(London, England), 2015,385(9963):117-71.
- [4] Mingzhu Su BSN, Jiahui Lao MS, Nan Zhang MS, et al. Financial hardship in Chinese cancer survivors[J].Cancer, 2020,126(14):3312-3321.
- [5] Guo Weiwen, Mei Wenhua, Guo Wenyan. Analysis of the change trend of patients in a tertiary public hospital in a city [J].China Ill., 2018,19 (08): 66-70.
- [6] Kosakawa, Yu Huiqiang, Zhou Tong, et al. A new grey relation analysis method [J].China Health Statistics, 1999 (01): 51-52.
- [7] Guo Min, Jin Jibin, Guo Changman, et al. Analysis of the inflow population of Binhai New Area of Tianjin [J].China Health Statistics, 2018,35 (2): 242-245.
- [8] Ou Jiaxin, Zhu Hong, Zhang Yuanni, et al. Study on the structural change of inpatient cost in General Public Hospitals of Guangdong Province from 2017 to 2019 [J].Health Economy in China, 2021,40 (06): 71-74.
- [9] Luo Guosheng, Feng Qiming, Gao Hongda, et al. Analysis on the hospitalization cost and composition change of grade 3 hypertension patients in a large third-class A hospital in Guangxi from 2012 to 2016 based on structural variability [J].Guangxi Medicine, 2019,41 (19): 2465-2469.
- [10] Cheng enlightened. Characteristics and Application of the Structural Equation Model [J].Statistics and Decision-making, 2006, (10): 22-25.
- [11] Wan Chonghua, Luo Jiahong. Advanced Medical Statistics [M]. Beijing: Science Press, 2014:218.
- [12] Mary, Da Zhenqiang, best wishes, etc. Analysis of influencing factors and verification of structural equation model for large hospitalization costs in a hospital [J].Health Statistics of China, 2020,37 (1): 59-60,65.
- [13] The Guangxi Zhuang Autonomous Region Bureau of Statistics. In 2016, the income of urban residents in Guangxi increased steadily [EB / OL].<http://www.gxzf.gov.cn/gxsj/sjyw/20170310-584564.shtml>, 2017-03-10 / 2021-11-01.
- [14] Du Liang, Zhu Xue, Zhang Yu, et al. Prediction analysis of hospitalization costs and their change trends in lung cancer patients [J].Modern preventive Medicine, 2019,46 (18): 3377-3380,3389.
- [15] Hu Anxia, Pei Zhongyang, Yan Juanjuan, et al. Hospitalization costs and influencing factors in elderly lung cancer patients [J].Chinese Journal of Gerontology, 2019,39 (20): 5111-5113.
- [16] Zhang Limin, Wu Jingtao, Yu Chuanhua, et al. Analysis of the cost changes and causes of lung cancer inpatients in a third A hospital from 2004 to 2017 [J].Chinese Hospital Statistics, 2019,26 (6): 429-431,434.
- [17] Li Jingjing. The Effect of Psychological Nursing and Health Education on the Quality of Life in Elderly Lung Cancer Patients [J].Medical Equipment in China, 2017,32 (S2): 93-94.

- [18] Chen Hongshui, Leng Jiahua, Gao Guangying, etc. Analysis of hospitalization costs and their influencing factors [J]. Health Economy in China, 2014, 33 (7): 57-60.
- [19] Xu Juanjuan, Li Runhua, Cheng Bin, et al. Study on hospitalization costs and influencing factors of 7387 lung cancer surgery patients in Zhejiang Cancer Hospital [J]. China, 2020, 29 (12): 957-961.
- [20] Xiao Haifan, Liao Xianzhen, License Kui, et al. Analysis of hospitalization costs of 1542 lung cancer patients from 2002 to 2014 [J]. China, 2016, 25 (5): 338-344.
- [21] Wang Tingting, Yu Lihua, Lang Jingjing, et al. Analysis of hospitalization cost of lung cancer surgery patients based on structural equation model [J]. Health Economy in China, 2019, 38 (6): 61-63.
- [22] Sang Weidong. Analysis of hospitalization costs and influencing factors in patients with middle and advanced non-small cell lung cancer [J]. Journal of Jiujiang College (Natural Science edition), 2012, 27 (4): 92-94.
- [23] Feng Ying. Effect of disease diagnosis-related grouping on the increase of medical costs in control medical institutions [J]. Pharmaceutical economics of China, 2021, 16 (5): 22-26, 32.
- [24] Liao Zangyi, blue Zhicheng. Effect and core Experience of Liuzhou DRG-point Method [J]. Medical Insurance of China, 2020 (09): 18-22.
- [25] Wang WT, He B, Wang YH, et al. The relationships among Muslim Uyghur and Kazakh disabled elders' Life satisfaction, activity of daily living, and informal family care giver's burden, depression, and Life satisfaction in far western China: A structural equation model [J]. International Journal of Nursing Practice, 2017, 23(2): e12521.