Analysis of Characteristics of Inpatient Death Records in a Tertiary Hospital in Hubei Province

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Abstract: *Objective*: To study the distribution characteristics of in-hospital death cases, explore the composition characteristics of death disease spectrum, and provide reference for hospital management. *Methods:* The first page information of inpatient death medical records from 2018 to 2022 in a tertiary hospital in Hubei Province was collected, and the main diagnoses were classified according to the International Classification of Diseases, Tenth Revision (ICD-10) standard for the cause of death. The t test and x^2 test were used to statistically analyze the distribution characteristics of the death cases in terms of gender, age group, season, cause of death, and other factors. *Results*: From 2018 to 2022, the total mortality rate in our hospital was 0.38%, the overall male-to-female death ratio was 2.04:1, and the overall average age at death was 65.89 years old; 65.87 years old for males and 65.91 years old for females. Most of the dead patients were over 60 years old, with the mortality rate in is the highest during the winters being the highest. The disease with the highest mortality rate of was circulatory system diseases. *Conclusion*: The professional, technical, and nursing skills of medical institutions, should be improved to reduce the in-hospital mortality rate.

Keywords: Hospitalized patients; In-hospital mortality; Sex distribution; Age distribution; ICD-10

1. Introduction

In-hospital mortality is an important indicator of a hospital's quality, especially tertiary hospitals, and an important content of the 18 core qualities for the safety systems of hospitals [1-3]. In this study, we analyzed the characteristics of inpatient death cases in a tertiary hospital in Hubei Province from 2018 to 2022 by exploring the development of causes of death among inpatients, the distribution characteristics of several factors, the trend of disease spectrum and in-hospital mortality. We discovered the main factors that threaten the lives of patients, discovered the weak points in the management of dead patients, formulated disease prevention and control strategies hospitals, optimized the allocation of medical resources, and provided a scientific basis for

determining the focus of medical work, so as to further improve the hospital's medical service quality and social service capabilities [4].

2. Materials and methods

2.1. Sources of information

The basic data of this study come from the homepage of the medical records of discharged patients in the HIS system of our hospital from 2018 to 2022. All medical records have been cataloged before data extraction, and the International Classification of Diseases ICD-10 is used as the disease classification standard. Cases suffering from multiple diseases at the same time are analyzed based on their main diagnosis. The date of discharge and reason of death of the patients were obtained from the front page of the medical record. Besides, relevant information such as the patient's ID number, gender, age, and diagnosis on discharge were extracted.

2.2. Research methods

The annual in-hospital mortality rate was calculated based on the number of discharged patients [in-hospital fatality rate = (number of deaths in a certain period/number of discharges in the same period) × 100%]; According to *the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume II (Guidebook)*, the patients were divided into 10 groups based on their age with a class size of 10 years [5]; According to the "Climate Seasonal Division and Characteristic Analysis in Southwest China," spring is from March to May every year, and summer is from June to August, autumn is from September to November, and winter is from December to February of the next year [6].

2.3. Statistical methods

Excel and SPSS 29.0 we used to organize and analyze the data. Quantitative data were described by mean ± standard deviation, and t-test was used for data comparison among groups; qualitative data were described by number of cases (n) and constituent ratio (%), and x^2 test was used for data comparison among groups. The test level α = 0.05, and the α value of multiple comparisons was corrected by Bonferroni method.

3. Results

3.1. Mortality and gender distribution of hospitalized patients

From 2018 to 2022, a total of 190102 patients were discharged from our hospital (96,231 males, 93,871 females), and 724 died in hospital (486 males, 238 females), with a total case fatality rate of 0.38%. The case fatality rate of females (0.25%) was lower than males (0.51%). It was found that the rate of hospitalizations in 2020 was the lowest. However, the number of deaths did not change significantly, which makes the mortality rate the highest, with the mortality rate of males being 0.70% and females being 0.35%. The year 2021 had the lowest mortality rate, with 0.41% for males and 0.16% for females. In 2022, the male death rate was 0.52% and the female death rate was 0.28% (**Table 1**).

3.2. Statistics on age difference of dead patients

From 2018 to 2022, the average age of death in our hospital is 65.89 years old, with males being 65.87 years old, and females being 65.91 years old; the overall median age of death is 69 years old, with males being 67 years old, and females being 71 years old. The details of each year are shown in **Table 2**.

Table 1. Mortality and gender distribution of hospitalized patients from 2018 to 2022

Classification	Total number of people			Male			Female			Ratio of male to female deaths
Year	Number of inpatients	Number of death	Death rate%	Number of inpatients	Number of death	Death rate%	Number of inpatients	Number of death	Death rate%	
2018	42971	165	0.38	21542	109	0.51	21429	56	0.26	1.95
2019	47659	166	0.35	24028	109	0.45	23631	57	0.24	1.91
2020	27875	147	0.53	14161	99	0.70	13714	48	0.35	2.06
2021	35439	101	0.28	17924	73	0.41	17515	28	0.16	2.61
2022	36158	145	0.40	18576	96	0.52	17582	49	0.28	1.96
Total	190102	724	0.38	96231	486	0.51	93871	238	0.25	2.04

Table 2. Statistics on age differences of dead patients from 2018 to 2022

Classification	Overall			Male				Female			
Year	Median age of death (years)	Mean age of death (years)	Standard deviation	Constituent ratio of death	Median age of death (years)	Mean age of death (years)	Standard deviation	Constituent ratio of death	Median age of death (years)	Mean age of death (years)	Standard deviation
2018	68	65.65	18.29	66.06	66	64.24	18.40	33.94	74	68.41	17.90
2019	69	63.80	20.55	65.66	66	64.83	17.43	34.34	72	61.84	25.54
2020	67	64.67	17.35	67.35	66	64.57	17.54	32.65	69	64.90	17.14
2021	69	65.88	18.64	72.28	69	67.40	17.96	27.72	71	61.93	20.09
2022	70	69.74	14.29	66.21	69	69.07	13.43	33.79	73	71.06	15.91
Total	69	65.89	18.06	67.13	67	65.87	17.09	32.87	71	65.91	19.26

3.3. Distribution of deaths by age and gender of dead patients

From 2018 to 2022, the inpatients who died in our hospital were mainly elderly patients over 60 years old, with a total of 498 patients, accounting for 68.78% of the total number of deaths. Among them, the age group with the most deaths was 61–70 years old for men, with 120 persons, accounting for 24.69%; and 71–80 years old for women, with 172 persons, accounting for 23.76%. The number of deaths among patients 0–40 years old was the least, with both genders accounting less than 2.1%, respectively; among these patients, the proportion of deaths between 31–40 years old was the highest, reaching 2.80%, and the difference in death among patients of different ages was statistically significant ($t = 2.983$, $P < 0.001$), as shown in **Table 3**.

Table 3. Distribution of the number of deaths by gender in different age groups

Age group/ year	Male		Female		Overall	
	Number of deaths	Constituent ratio%	Number of deaths	Constituent ratio%	Number of deaths	Constituent ratio%
0–10	5	1.03%	7	2.94%	12	1.66%
11–20	8	1.65%	4	1.68%	12	1.66%
21–30	8	1.65%	7	2.94%	15	2.07%
31–40	10	2.06%	5	2.10%	15	2.07%
41–50	42	8.64%	15	6.30%	57	7.87%
51–60	84	17.28%	31	13.03%	115	15.88%

Table 3. (Continued)

Age group/ year	Male		Female		Overall	
	Number of deaths	Constituent ratio%	Number of deaths	Constituent ratio%	Number of deaths	Constituent ratio%
61–70	120	24.69%	45	18.91%	165	22.79%
71–80	105	21.60%	67	28.15%	172	23.76%
81–90	94	19.34%	53	22.27%	147	20.30%
91–100	10	2.06%	4	1.68%	14	1.93%
Total	486	100.00%	238	100.00%	724	100.00%

3.4. Distribution of patients' death composition in different seasons

From 2018 to 2022, the overall number and composition of deaths in our hospital in winter is the highest, among which male deaths accounted for 28.60%, female deaths accounted for 28.45%; followed by spring, in which male deaths accounted for 25.51%, female deaths accounted for 25.97%; the proportion of deaths in summer was the smallest, with male deaths accounting for 21.40% and female deaths accounting for 22.65% (**Table 4**).

Table 4. Distribution of number of patient deaths in different seasons

Season	Month	Male		Female		Overall	
		Number of cases	Constituent ratio%	Number of cases	Constituent ratio%	Number of cases	Constituent ratio%
Spring	March to May	124	25.51	64	26.89	188	25.97
Summer	June to August	104	21.40	60	25.21	164	22.65
Autumn	September to November	119	24.49	47	19.75	166	22.93
Winter	December to February	139	28.60	67	28.15	206	28.45
	Total	486	100.00	238	100.00	724	100.00

3.5. Annual distribution of different causes of death according to ICD-10 statistics

According to the data, circulatory system diseases rank first in the cause of death, injuries, poisoning and external causes rank second, respiratory diseases rank third, tumors rank fourth, and digestive system diseases rank fifth. The proportion of injury, poisoning and external causes is increasing year by year; circulatory system diseases rank first every year (**Table 5**).

Table 5. Annual distribution of different causes of death

Serial number	Coding	International Classification of Diseases Code	2018 (%)	2019 (%)	2020 (%)	2022 (%)	Total (%)
1	A	Infectious and parasitic diseases	2.42	2.41	2.72	0.69	2.07
2	B	Viral infections of skin or mucous membrane lesions	0.61	0.00	2.04	0.00	0.55
3	C	Tumors	13.94	12.05	17.69	11.03	12.98
4	D	Blood or hematopoietic organ diseases or diseases involving the immune mechanism	3.03	0.00	0.00	0.00	0.83

Table 5. (Continued)

Serial number	Coding	International Classification of Diseases Code	2018 (%)	2019 (%)	2020 (%)	2022 (%)	Total (%)
5	E.	Endocrine, nutritional, or metabolic diseases	0.00	1.81	0.00	0.69	0.55
6	G	Nervous system diseases	1.82	2.41	0.00	3.45	1.93
7	I	Circulatory system diseases	32.73	33.73	32.65	25.52	30.11
8	J	Respiratory diseases	14.55	15.66	12.93	27.59	17.68
9	K	Gastrointestinal diseases	7.27	3.01	8.84	7.59	7.04
10	L	Skin or subcutaneous tissue diseases	0.61	0.00	0.00	0.00	0.14
11	m	Musculoskeletal system and connective tissue disorders	1.21	1.81	0.00	0.00	0.69
12	N	Genitourinary system diseases	1.21	2.41	1.36	2.07	2.21
13	o	Pregnancy, childbirth, or puerperium	0.61	0.00	0.00	0.00	0.14
14	Q	Congenital malformations, deformations, or chromosomal abnormalities	0.00	0.60	0.68	0.00	0.28
15	R	Symptoms, signs, or abnormal clinical and laboratory findings that cannot be classified elsewhere	3.03	4.22	0.68	0.00	1.93
16	ST	Injury, poisoning, and extrinsic causes	16.97	18.67	20.41	21.38	20.58
17	Z	Factors affecting health status and exposure to healthcare facilities	0.00	1.20	0.00	0.00	0.28
Total			1	1	1	1	1

3.6. Distribution of cause of death in different age groups in relation to gender

From 2018 to 2022, the causes of death under the age of 18 were mainly injury, poisoning, and circulatory system diseases, and the male to female ratio was 1.18:1. The main causes of death for patients between 36 and 59 years old are injury, poisoning, and external causes, followed by circulatory system diseases and tumors; the ratio male to female ratio was 2.8:1. For patients over 60 years old, the main cause of death was circulatory system diseases, followed by injury, poisoning, and external causes, and respiratory diseases; the male to female ratio was 1.94:1.

4. Discussion

This study showed that the total number of inpatients in our hospital was the least in 2020 from 2018 to 2022, and the mortality rate in 2021 was the lowest. The difference between the number of deaths among male and female patients was significant, and the overall ratio is 2.04:1. The reason for the decrease has something to do with the adjustment of the scope of hospital admissions.

From the perspective of gender distribution, there is little difference in the total number of hospitalizations, but the mortality rate of men was significantly higher than that of women. There might be several reasons for that: (1) Men are more prone to certain risk factors like smoking, drinking, obesity, lack of exercise, and refusing to seek medical treatment; (2) middle-aged men in this county and city are more engaged in field jobs, so there are more injuries and deaths from external causes.

In terms of the average age of death and the median, there was little difference between the average age

and the median age of death of males, and it had an upward trend. The downward fluctuation of the average age of female death curve is caused by the death of newborn girls in the early years, which lowers the mean and median values; the average age of death of both males and females were both lower than what is recorded in the seventh national census data [7]. The reasons include the following: (1) The hospital is located in the Wuling minority area, where the living conditions are harsh and the weather conditions are severe, and the people are poor; therefore, the facilities and benefits need to be improved. (2) The healthcare services are limited with poor hygiene, and the patient's condition are usually already serious when admitted to the hospital, with many underlying diseases. Therefore, the medical services of hospitals should be improved.

In terms of age of death, most deaths occurred at 60 years old and above for both men and women, which is basically consistent with the results of other studies [4]. This is because they are more prone to functional decline and diseases. Therefore, hospitals also need to develop geriatric disease medical treatment and nursing services, increase comprehensive treatment capabilities, promote multidisciplinary cooperative diagnosis and treatment, and utilize medical resources to ensure better treatment for the elderly.

In terms of the proportion of deaths in each season, the proportion is slightly higher in winter, followed by spring. The leading cause of death in winters is systemic diseases, because winter is the season with high incidence of cardiovascular and cerebrovascular diseases among the elderly. Besides, and it is also related lifestyle (smoking) and diet (eating pickles, high-salt, and high fat diet) of the population in this area. In addition to active treatment, it is also necessary to vigorously promote healthy habits such as limiting salt intake, reducing weight, exercising more, stop smoking, and limiting alcohol consumption [8].

The top three causes of death in this study are circulatory system disease, injury, poisoning, external cause disease and respiratory system disease. Society, economy, ecological environment, population structure, lifestyle, behavior habits, biological factors, are all factors that influence mortality rate [9,10].

5. Conclusion

In short, the mortality rate of inpatients is an important indicator of the quality of medical services of a hospital. The results of the statistical analysis of our hospital's data show that the overall trend is basically consistent with those reported in other regions in Southwest China. It also shows that the overall quality and technical capabilities of our hospital makes our data slightly different from other regions. Through this study, it is proposed that multi-faceted publicity and improvement should be carried out on the dietary structure, daily habits, and medical awareness of residents in the region. Besides, and the business capabilities, technical levels, and nursing capabilities of medical institutions should be improved and developed in multiple aspects, so as to reduce hospital mortality.

Disclosure statement

The authors declare no conflict of interest.

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