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Current curative expenditure of non-communicable diseases changed in Dalian, China from 2017 to 2019: a study based on 'System of Health Accounts 2011'

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ABSTRACT

Objectives To analyse the current curative expenditure (CCE) of NCDs in China from 2017 to 2019.

Design A cross-sectional study. Medical institutions were collected by multistage stratified random sampling from 2017 to 2019.

Setting Dalian, China

Participants 408 institutions and 8 104 233 valid items were included in the study. NCDs patients were selected according to International Classification of Diseases-10.

Primary and secondary outcome measures CCE for NCDs was measured based on the System of Health Accounts 2011. Influenced factors were analysed by linear regression. All analyses and calculations were performed by STATA V.15.0.

Results The CCE of NCDs was ¥14.929 billion in 2017, ¥16.377 billion in 2018 and ¥18.055 billion in 2019, which accounted for more than 65% of total expenditure spent each year. More than 60% came from public financing. The proportion of family health financing continued to decline, reaching 31.16% in 2019. The expenditures were mainly in general hospitals, above 70%. Elderly patients account for the majority. Diseases of the circulatory system, diseases of the digestive system and neoplasms were the main NCDs. Year, age, gender, length of stay, surgery, insurance and institution level affected hospitalisation expenses.

Conclusions NCDs are the main CCE of diseases in China, and their resources are not allocated reasonably. To reduce the CCE of NCDs, the government needs to optimise resource allocation and rationalise institutional flows and functions.

Strengths and limitations of this study

► This is the latest study on the changing trend of chronic health costs in China.
► 'System of Health Accounts 2011' can calculate the actual medical expenses of patients, as well as the distribution among different funding sources, medical institutions and ages.
► A total of 408 medical institutions and 8 104 233 cost records for non-communicable diseases (NCDs) were selected.
► In this paper, only the patients with the first diagnosis of NCDs were selected without considering other complications, which may underestimate the cost of NCDs.

INTRODUCTION

Due to the gradual transition of the spectrum of the disease, non-communicable diseases (NCDs) are now the leading causes of morbidity and mortality worldwide.[1][2] According to the WHO, NCDs currently cause more deaths than all other causes combined. In 2012, 56 million people died worldwide, 38 million (68%) were caused by NCDs, and NCD deaths are projected to reach 52 million by 2030.[3] The situation is worse in low-income and middle-income countries (LMICs). Nearly three-quarters of these NCDs deaths occurred in LMICs, and the death rate is about 1.6 times higher than in high-income countries.[3][4] It is also a considerable challenge even among the wealthiest countries, which are members of the Organisation for Economic Co-operation and Development.[5] NCDs are among the most prevalent and costly health conditions in the USA. Besides, NCDs also have a massive impact on families and poverty.[6][7] Especially for the uninsured and the elderly.[8]

NCDs have a long incubation period and cannot heal after the onset or are challenging to heal,[9–11] which raised the demand for long-term care expenditures. During 2001–2025, cumulative economic losses due to NCDs under a 'business as usual' scenario in LMICs have been estimated at US$7 trillion, which is sum far outweighs the annual US$11.2 billion cost of implementing a set of high-impact interventions to reduce the NCDs economic

burden.[3] A recent study estimates that over the next 20 years, at the global level, NCDs will cost more than US$47 trillion and will push millions of people below the poverty line.[12] As a result, many countries worldwide have made NCDs a priority for Universal Health Coverage, which is considered an essential element of sustainable human development goals.[13–16]

China is the largest low/middle-income country in the world. It had 6.6 million deaths from chronic diseases in 2015, the highest of any country in the world.[17] In addition to the excessive death toll related to the population base, China's ageing population, especially the elderly over the age of 60, is related to the increase. A study showed that 92% of the elderly had at least one NCD, and 77% had two NCDs.[18] China has more than 230 million people over 60, accounting for 16.7% of the total population in 2016.[19] Since 2010, the elderly population has increased by 29.5%.[20] Older adults with good household assets and access to medical services were less likely to experience multimorbidity.[21]

Previous work was focused on specific types of NCDs or particular regions of the world.[22–25] Although this can provide a more accurate intervention scheme for specific NCDs, it is easy to waste resources if it is not grasped at a higher level because more people have more than one NCD.[18] In this study, we collected expenditure information of NCDs patients in Dalian and used 'System of Health Account 2011' (SHA 2011) to count each part of curative expenditure.[25 26] Curative expenditure refers to patients receiving medical services in medical institutions, excluding the preventive expenses. It has both outpatient and inpatient components. As a result, China began to adopt the new accounting system 'SHA 2011' in 2014. SHA 2011 further developed additional analytical possibilities. It provides a breakdown of input factors and associated costs for healthcare products and services. For example, based on the characteristics of patients, we can calculate the medical costs under different ages, gender and disease categories.

Current research on SHA 2011 is not much. China National Health Development Research Centre analysed the health costs and financing of chronic NCDs in 2010, which shows that the expenditure of NCDs accounts for nearly 70% of the total health expenditure.[27] After that, only relevant studies on current curative expenditure (CCE) of NCDs in China's Anhui Province and Beijing city.[28 29] With the changes in the disease spectrum and social development, we need new evidence about the economic burden of NCDs, especially the trend. Dalian is located in southern northeast China. It has a higher proportion of people over 60 than the whole country, making it difficult to prevent and control NCDs.[30 31] Therefore, this paper chooses Dalian's health data, analyses the status of the NCDs spending by SHA 2011, provides health policy advice, gives guidance to other parts of China, and offers a reference basis in China's medical insurance.

MATERIAL AND METHODS
The framework of SHA 2011
SHA 2011 removes capital formation costs (investments in infrastructure and equipment) from health costs, allowing for more accurate monitoring of residents' healthcare burden. It can analyse multiple subgroups such as gender and disease type and compare prevention and treatment costs separately.[32]

Data sources
The data consists of two parts: panel statistical data, including Dalian Health Financial Annual Report, Dalian Statistical Yearbook, China National Health Accounts Report, and Dalian Health Accounts Report from 2017 to 2019, mainly from official sources. Another is patients' medical expenses, collected from medical institutions in Dalian by sampling survey.

Sampling survey
Multistage stratified cluster random sampling was used in this study. Lottery-style drawings (prefecture-level cities) and computer programing (selecting streets, communities, and towns) are used to select samples for each stage. This sampling survey was a top-down sample survey conducted in China. The aim was to ensure that the selected medical institutions were represented in a specific region without bias due to individual regions' geographical location and economic level. To make sure the sample is representative. The sampling proportion was one-third for each stratum.[33] The first stratum was to choose sample areas from Dalian city based on considering the perfection of health information management system and the level of economic development. In the second stratum, one general hospital, maternal and child healthcare hospital, Center for Disease Control and Prevention and traditional Chinese medicine hospital were selected from each region. Five community health service centres, 20 township health centres,17 clinics or outpatient departments and 3 villages were selected from each district. A total of 408 institutions with valid data were collected, including 35 community service centres, 40 township health centres, 119 community health service centres, 166 village clinics or community health service stations, 5 traditional Chinese medicine hospitals, eight specialised hospitals, 22 general hospitals and 13 public health institutions (online supplemental figure S1).

The collected data comes from the medical record system of these institutions and belongs to panel data, which included age, gender, disease, type of medical institution, type of insured, season, expenditure and region for all outpatients and inpatients. A total of 12 899 830 valid samples were collected, including 4 215 603 in 2017, 4 304 902 in 2018 and 4 379 325 in 2019.

The collected sample data were cleaned and screened according to the International Classification of Diseases-10 (ICD-10) code of classification of diseases (online supplemental table S1). There are multiple diagnoses of the same patient in the survey data. In this study, only

the patients with the first diagnosis of NCDs were selected without considering other complications. A total of 8 104 233 valid items for NCDs were selected, 2 637 681 in 2017, 2 678 359 in 2018 and 2 788 194 in 2019.

Calculation of CCE

The accounting method of SHA 2011 was to use samples to estimate the whole. The basic database of sample institutions was established by collecting the patient cost data of sample medical institutions. Then, we collected health statistics and health financial almanack, collated the annual medical cost data of all medical institutions in Dalian. We first calculated the proportion of the medical costs of patients with NCDs in the sample to the total cost of all diseases. Then, the ratio is multiplied by the total medical expenses to obtain the total medical expenses of patients with NCDs in Dalian. The specific accounting methods and steps can refer to the previous articles published by our team, and NCDs replaced only the corresponding ICD-10 code.[34] All expenditures were converted from reported currencies to 2019 China Yuan.

Quality control and data management

Data gathering was classified and coded according to ICD-10. Data extract, audits, cleaning and calculation were maintained by implementing the basic accounting guidelines of SHA 2011.[32] The participants were professional coders who had received training from the National Health Commission of China. All data were entered electronically into a data terminal connected with STATA V.15.1 (StataCorp).

Patient and public involvement

Patients or the public were not involved in the design, conduct or dissemination plans of this research.

Analyses of influencing factors of hospitalisation curative care expenditure for NCDs

A total of 827 513 items of inpatient data was extracted from the whole valid items of NCDs. Expenditures do not conform to a Gaussian distribution but were log-normally distributed. The independent variables were the year, age, gender, length of stay, medical insurance or not, surgery or not, and institution level. Descriptive statistics were performed for these variables in the form of mean±SD, median (IQR) or rate (percentage). The multivariate stepwise forward regression model was used to include more significant variables, with $p>0.1$ as the exit criterion and $p<0.05$ as the entry criterion. All statistical analyses were performed using STATA C.15.1 (StataCorp).

RESULTS
The basic situation for NCDs

In 2017–2019, the CCE for NCDs continued to rise. From ¥14.929 billion in 2017 to ¥18.056 billion in 2019, it rose 20.95%. Over the same period, the cost of medical care for all diseases increased by 12.13%, from ¥22.625 to ¥25.370 billion (table 1).

Allocation of CCE in different medical institutions

In terms of expenditure allocation of medical institutions, NCDs expenditures were mainly concentrated in hospitals. In 2019, it was 90.34%. The CCE for NCDs in general hospitals exceeded 70% over the 3 years. Primary hospitals and health institutions continued to decline, and public health institutions accounted for less than 3%. The inpatient expenditures of NCDs were ¥11.990 billion in 2019, accounting for 69.16%, higher than the outpatient, ¥5.050 billion (30.84%). Compared with the whole disease, the CCE for NCDs in primary hospitals and public health institutions accounts for a relatively low proportion. The total inpatient expenditures ratio was significantly higher (table 1).

Allocation of CCE in the different financing scheme

From 2017 to 2019, out-of-pocket (OOP) expenses for NCDs increased by ¥0.722 billion, from ¥4.934 to ¥5.656 billion, while the proportion decreased by 1.86%, from 33.05% to 31.16%. The public financing scheme was the most important source of funds for NCDs and whole diseases, and the proportion of NCDs was higher (63.23% vs 58.71% in 2017, 61.78% vs 59.18% in 2018, 65.55% vs 60.14% in 2019) (table 2).

Allocation of CCE in different ages

With the increase of age, the CCE keep increasing before 65, reaching the highest level in the 60–64 groups. From 2017 to 2019, it was ¥1952, ¥2368, ¥2532 billion, respectively. After that, the expenditure of CCE keep decreasing. The 45–84 age group was the leading group of CCE, and increased more significantly in this group than in other age groups as the years went on. (figure 1)

Allocation of CCE in different ICD-10

Among the 22 categories classified by ICD-10, 15 categories include NCDs. Diseases of the circulatory system were the highest CCE, ¥3764 billion in 2017, ¥4555 billionY in 2018 and ¥4913 billion in 2019. Followed by the diseases of the digestive system and Neoplasms (table 3).

Influencing factors to inpatient expenditure

Multiple linear regression was used to analyse the influencing factors of inpatient expenditures with NCDs. The included independent variables were the year, gender, age, length of stay, surgery, insurance and level of the medical institution. Online supplemental table S2 for their basic characteristics. There was no collinearity between independent variables and dependent variables. Finally, all independent variables can be included in the regression equation ($p<0.001$). The linear model can explain the 33.0% change in total hospitalisation expenses. Hospitalisation costs increased significantly with increasing years, age, length of stay and were higher in men, surgery patients, insured patients and high-level hospitals ($p<0.001$). The first three factors affecting hospitalisation expenses were the length of stay, insurance and gender (table 4).

Table 1 Distribution of NCDS expenses in different types of medical institutions from 2017 to 2019 (¥100 million (%))

Institutions		CCE for NCDs			CCE for all diseases		
		Total	Outpatient*	Inpatient*	Total	Outpatient*	Inpatient*
2017	Hosptial	128.39 (86.00)	29.41 (22.90)	98.99 (77.10)	190.72 (84.30)	55.66 (29.18)	135.06 (70.82)
	General hospital	105.27 (70.51)	17.89 (16.99)	87.38 (83.01)	161.41 (71.34)	42.53 (26.35)	118.88 (73.65)
	Traditional Chinese medicine hospital	6.46 (4.33)	1.47 (22.76)	4.99 (77.24)	9.11 (4.03)	2.67 (29.30)	6.44 (70.70)
	Special hospital	16.66 (11.16)	10.05 (60.32)	6.62 (39.75)	20.20 (8.93)	10.46 (51.77)	9.74 (48.23)
	Primary medical and health institutions	11.93 (7.99)	9.06 (75.95)	2.87 (24.05)	20.93 (9.25)	12.56 (60.02)	8.37 (39.98)
	Outpatient service agencies	6.58 (4.41)	6.58 (100.00)	0.00 (0.00)	9.78 (4.32)	9.78 (100.00)	0.00 (0.00)
	Public health agency	2.40 (1.61)	1.33 (55.70)	1.15 (47.81)	4.81 (2.13)	3.79 (78.82)	1.02 (21.18)
	Total	149.29 (100.00)	46.38 (31.07)	103.01 (69.00)	226.25 (100.00)	81.80 (36.15)	144.45 (63.85)
2018	Hosptial	147.22 (89.90)	37.21 (25.27)	110.01 (74.73)	217.42 (87.44)	64.31 (29.58)	153.1 (70.42)
	General hospital	122.75 (74.95)	26.41 (21.52)	96.33 (78.48)	177.26 (71.29)	47.1 (26.57)	130.15 (73.42)
	Traditional Chinese medicine hospital	6.30 (3.85)	1.66 (26.31)	4.64 (73.69)	10.20 (4.10)	3.30 (32.39)	6.89 (67.61)
	Special hospital	18.17 (11.10)	9.15 (50.34)	9.02 (49.66)	29.97 (12.06)	13.91 (46.41)	16.06 (53.59)
	Primary medical and health institutions	9.03 (5.52)	6.84 (75.74)	2.19 (24.26)	14.56 (5.86)	12.14 (83.39)	2.42 (16.61)
	Outpatient service agencies	6.00 (3.66)	6.00 (100.00)	0.00 (0.00)	9.21 (3.70)	9.21 (100.00)	0.00 (0.00)
	Public health agency	1.51 (0.92)	0.45 (29.93)	1.06 (70.07)	7.44 (2.99)	3.87 (52.01)	3.57 (47.99)
	Total	163.77 (100.00)	50.50 (30.84)	113.26 (69.16)	248.64 (100.00)	89.54 (100.00)	159.09 (100.00)
2019	Hosptial	163.11 (90.34)	43.20 (26.49)	119.9 (73.51)	224.48 (88.48)	67.69 (30.15)	156.8 (69.85)
	General hospital	134.16 (74.30)	30.99 (23.10)	103.16 (76.89)	180.81 (71.27)	48.12 (26.61)	132.69 (73.39)
	Traditional Chinese medicine hospital	9.20 (5.10)	2.41 (26.20)	6.79 (73.80)	13.69 (5.40)	4.41 (32.21)	9.28 (67.79)
	Special hospital	19.75 (10.94)	9.80 (49.62)	9.95 (50.38)	29.99 (11.82)	15.16 (50.55)	14.82 (49.42)
	Primary medical and health institutions	9.88 (5.47)	8.60 (87.04)	1.28 (12.96)	14.19 (5.59)	12.73 (89.71)	1.46 (10.29)
	Outpatient service agencies	5.45 (3.02)	5.45 (100.00)	0.00 (0.00)	6.45 (2.54)	6.45 (100.00)	0.00 (0.00)
	Public health agency	2.12 (1.17)	0.66 (31.13)	1.46 (68.87)	8.57 (3.38)	3.91 (45.62)	4.66 (54.38)
	Total	180.56 (100.00)	57.91 (32.07)	122.64 (67.92)	253.70 (100.00)	90.78 (35.78)	162.91 (64.21)

*The per cent in outpatient or inpatient represents the percentage of total.
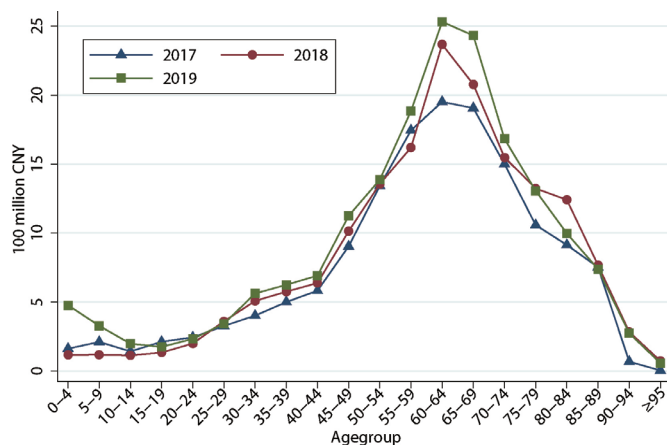CCE, current curative expenditure; NCDs, non-communicable diseases.

Table 2 Distribution of NCDs expenses in different service function from 2017 to 2019 (¥100 million (%))

Service function	CCE for NCDs			CCE for all diseases		
	2017	2018	2019	2017	2018	2019
Public financing	94.40 (63.23)	101.16 (61.78)	118.35 (65.55)	132.84 (58.71)	147.15 (59.18)	152.58 (60.14)
Social medical insurance*	9.90 (6.63)	11.06 (6.76)	13.15 (7.28)	7.53 (3.33)	16.48 (6.63)	19.75 (7.78)
Government financing*	84.50 (56.60)	90.11 (55.03)	105.20 (58.27)	120.78 (53.38)	128.60 (52.55)	132.83 (52.36)
Voluntary financing	5.55 (3.72)	9.27 (5.66)	5.94 (3.29)	13.31 (5.24)	13.33 (5.36)	15.25 (6.01)
Family health expenditure	49.34 (33.05)	53.32 (32.56)	56.26 (31.16)	91.55 (36.05)	88.16 (35.46)	85.86 (33.84)
Total	149.29 (100.00)	163.76 (100.00)	180.55 (100.00)	226.25 (100.00)	248.64 (100.00)	253.70 (100.00)

*The per cent represents the percentage of public financing.
CCE, current curative expenditure; NCDS, non-communicable diseases.

DISCUSSION

The impact of NCDs on the health burden is global, and its economic burden is the heaviest of all types of disease. In LMICs, it is simultaneously a rapid growth in NCDs' health and economic burden.[3] In middle-income countries, such as Russia and India, the OOP burden of NCD payments is significant. Even in the USA, NCDs are among the most prevalent and costly health conditions.[22] NCDs receive comparatively little attention compared with infectious disease treatment.[35] So far, only four Asian countries have published information on NCDs financing,[36] and those were years ago, which presents us with a challenge in formulating health policy. This study aims to describe the expenditure of NCDs in China and analyse the similarities and differences between different medical institutions, service functions, ICD-10 categories, and the influencing factors to inpatient expenditure.

Figure 1 Age distribution of CCE in patients with NCDs, 2017–2019. CCE, current curative expenditure; NCDs, non-communicable diseases.

Previous studies show a steady global increase in household expenditure on NCDs from 1999 to 2014.[37] In 2018, The CCE for NCDs accounted for 65% of the total CCE. Considering the number of included samples, the average health cost of NCDs may be higher than other diseases. Therefore, we should take more forceful measures to deal with the possible impact of NCDs, which is also the call of The United Nations and WHO.[38 39]

This study shows that the CCE of NCDs is related to age. Before the age of 65, the CCE increases with the age increase. Like previous studies, people over 60 are at high risk of NCDs.[40 41] Because of the unhealthy lifestyle, 150 million young people smoke, 84% of teenage girls and 78% of boys lack physical exercise, 11.7% of teenagers drink alcohol. At the same time, 41 million children under five are overweight or obese worldwide,[3] NCDs are becoming younger. This paper confirms this, with costs rising more for patients younger than 10 in 2019 compared with 2017. Previous studies have shown that high blood pressure and diabetes rise among young people.[42 43] This study found that CCE of NCDs higher group is 45–84 age group. Although the elderly are still the main focus of NCDs, we should not ignore the young, and we should advocate a healthy lifestyle, such as not smoking, drinking less alcohol and taking more exercise.[44 45]

The CCE financing of NCDs mainly comes from public financing scheme. Although the proportion of family health expenditure is lower than total disease and continued to decline, it is still above 30%. Contrary to other studies,[6 7] this may be due to higher health expectations among residents of economically developed regions.[3] In recent years, China has adopted some active health policies. In 2013, China's basic medical insurance coverage had reached more than 95%.[46] In 2017, began to implement Drug zero markup policy,[47] in 2018, the national basic public health benefits have increased from ¥50 to ¥55 per person.[48] All this has dramatically reduced

Table 3 Distribution of NCDs expenses in different ICD-10 from 2017 to 2019 (¥100 million (%))

ICD-10	2017	2018	2019
Neoplasms	16.81 (11.26)	23.18 (14.16)	20.64 (11.43)
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	1.69 (1.13)	0.85 (0.52)	0.95 (0.53)
Endocrine, nutritional and metabolic diseases	9.80 (6.56)	9.58 (5.85)	13.17 (7.29)
Mental and behavioural disorders	4.70 (3.15)	3.89 (2.38)	4.61 (2.55)
Disease of the nervous system	8.04 (5.39)	7.35 (4.49)	6.72 (3.72)
Disease of the eye and adnexa	1.97 (1.32)	4.91 (3.00)	7.25 (4.02)
Diseases of the ear and mastoid process	1.78 (1.19)	2.98 (1.82)	1.21 (0.67)
Diseases of the circulatory system	37.64 (25.21)	45.55 (27.82)	49.13 (27.21)
Diseases of the respiratory system	11.34 (7.60)	9.50 (5.80)	10.52 (5.83)
Diseases of the digestive system	26.11 (17.49)	25.59 (15.63)	28.38 (15.72)
Diseases of the skin and subcutaneous tissue	1.63 (1.09)	3.32 (2.03)	2.81 (1.56)
Diseases of the musculoskeletal system and connective tissue	11.66 (7.81)	13.05 (7.97)	17.70 (9.80)
Diseases of the genitourinary system	14.97 (10.02)	12.18 (7.44)	15.26 (8.45)
Congenital malformations, deformations and chromosomal abnormalities	0.97 (0.65)	0.54 (0.33)	1.14 (0.63)
Others	0.22 (0.15)	1.28 (0.78)	1.07 (0.59)
Total	149.29 (100.00)	163.76 (100.00)	180.55 (100.00)

ICD-10, nternational Classification of Diseases-10; NCDs, non-communicable diseases.

household health spending. However, NCDs can cause household poverty.[49 50] The proportion of family health expenditure is high. We should continue to increase financial support to reduce household spending, especially for hospitalised patients,

High-quality medical resources are primarily concentrated in the 3A (class 3/grade A) hospitals in China. Although graded treatment has been carried out for some years, the results are insignificant. People tend to go straight to the 3A hospital.[51] The CCE of NCDs in Dalian city accounts for nearly 90% in the hospital, higher than all diseases, which shows that the hierarchical diagnosis and treatment advocated in China's medical reform is not carried out smoothly. Primary healthcare, such as primary healthcare institutions and public health agencies, should

be given more responsibility.[52] NCDs have a long course and require frequent medical treatment.[9 10] While 80.00% of basic medical care can be provided in primary medical and health institutions, more medical resources can be used for NCDs treatment in primary medical and health institutions, which is more cost-effective in resource allocation and use.[27] Besides, primary care programmes such as family doctors should be promoted by regional characteristics.

For ICD-10 categories, the CCE of the circulation system is highest. On the one hand, it is related to unhealthy lifestyles, such as smoking, lack of exercise and an unbalanced diet. On the other hand, we have to attach importance to the influence of the environment. Although we think the environment is often associated with respiratory diseases,

Table 4 Regression analysis of influencing factors of hospitalisation expenditure

	Unstandardisation coefficient		Standardisation coefficient		
	B	SE	Beta	T	Sig
Constant	8.125	0.004		2001.617	<0.001
Year	0.038	0.001	0.040	41.855	<0.001
Age	0.004	<0.001	0.112	112.077	<0.001
Gender	0.015	<0.001	0.182	197.521	<0.001
Length of stay	0.040	<0.001	0.372	410.564	<0.001
surgery	0.678	0.002	0.375	401.485	<0.001
insurance	0.100	0.003	0.035	37.929	<0.001
Institution level	−0.016	0.001	−0.019	−319.666	<0.001

B=unstandardisation regression coefficient. SE=SE error. Beta=standardisation regression coefficient.T=t test value (t-statistic). Sig=significance (p) of coefficients.

studies have shown that the deterioration of the environment can increase the incidence of various diseases such as chronic diseases.[52] Therefore, we must pay attention to environmental protection, strengthen the health behaviours throughout the whole life cycle, and establish health programmes for key disease populations.

The results of multiple regression analysis showed that length of stay, insurance, and gender were the main factors affecting CCE. The length of stay is related to the severity of the disease and the hospital's efficiency.[53] To control health expenses, the hospital should improve diagnosis and treatment levels and establish common NCDs of the basic norms of evidence-based clinical guidelines.[54] The findings are consistent with research suggesting that men may have a more significant financial burden of NCDs due to unhealthy lifestyle habits.[55] In 2018, the social and medical insurance coverage in Liaoning province was 94%. However, the results show that the reimbursement rate of NCDs is not high. Considering NCDs' economic burden and mortality rate in all types of diseases, the proportion of NCDs should be increased. Special compensation schemes should be explored and designed for NCDs with high prevalence rates, high treatment frequency and early control.

This study has some limitations. First, we only included patients with the first NCDs diagnosis, excluding some patients with multiple diseases, which may underestimate the cost of NCDs. Second, our study only addressed the direct initial hospital costs of NCDs, while indirect costs were not considered, minimising the financial burden of NCDs patients. Third, we selected the NCDs patients from the same medical institutions, but because of the patient's choice of treatment and the change of disease cycle, we cannot ensure that all NCDs patients were homogeneous, which may influence the final results. In the following research, we will try our best to obtain more personal information of these patients with authorisation, and at the same time, we will try to select as many sample institutions as possible to more accurately and comprehensively describe the changing trend of the economic burden of NCDs in China.

CONCLUSION

The SHA 2011 accounting system can help explain CCE. NCDs still face medical coverage problems and access to medical services in China, and their costs are closely related to the length of stay and institution level. The government needs to restructure financing, redistribute the costs of NCDs, and rationalise institutional flows and functions.

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Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants but because patient information was anonymous, the Ethics committee of China Medical University exempted its ethical review of the study. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. All the data relevant for the manuscript are reported in tables. The raw data need to be approved by the local government.

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