

# BMJ Open What is the major driver of China's hospital medical expenditure growth? A decomposing analysis

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## ABSTRACT

**Objectives** This study aimed to quantify increases in the medical expenditures of public hospitals associated with changes in service use and prices, which could inform policy efforts to curb the future growth of hospital medical expenditures.

**Design** Nationwide and provincial data regarding service volume, service price and intensity of public hospitals' outpatient and inpatient care from 2008 to 2018 were extracted from the China Health Statistical Yearbooks, and population size data were obtained from the 2019 China Statistical Yearbook.

**Methods** A decomposition analysis was performed to measure the relative effects of changes in service use (volume or its subcomponent factors) and service price and intensity on the increase in the inpatient and outpatient total medical expenditures of public hospitals from 2008 to 2018.

**Results** After adjusting for price inflation, the total medical expenditure of public hospitals increased by approximately threefold from 2008 to 2018. During this period, the increase in service volume was associated with 67.4% of the observed increase in the total medical expenditures in the inpatient sector and 57.2% of the observed increase in the total medical expenditures in the outpatient sector. Most of the service volume effect is due to an increase in the hospital utilisation rate. The growth in the utilisation rate was associated with 73.7% of the observed growth in the total medical expenditures in the inpatient sector and 60.3% of the observed growth in the total medical expenditures in the outpatient sector.

**Conclusion** Service use, rather than price, appears to be the major driver of increases in medical expenditures in Chinese hospitals. An important policy implication for China and other countries with similar drivers is that the effect of controlling price and intensity growth on containing medical costs could be limited and controlling service utilisation growth could be essential.

## INTRODUCTION

Medical cost escalation is a major problem in both developed and low-income and middle-income countries, including China.<sup>1,2</sup> Efforts to contain medical expenditure growth may benefit from a better understanding of the underlying drivers of increasing medical costs.

## Strengths and limitations of this study

- This study extends the existing literature by focusing on the drivers of growth in public hospitals' medical expenditure during the first decade of the new round of health system reform in China.
- This study decomposed growth in medical expenditure into changes in its primary policy-relevant constituent factors, that is, service volume and price, and subcomponent factors of service volume.
- This study provides region-specific decomposition rates of the sources of the growth in public hospitals' medical expenditure in 31 provinces, autonomous regions and municipalities in mainland China.
- Due to the lack of a price index specific to the health sector in China, this study cannot distinguish between the contributions of the service price and service intensity.
- This study did not consider changes in the types of conditions prompting people to visit hospitals and the ageing of the population.

Studies decomposing growth in China's health expenditure into its constituent parts since the 1990s have revealed different results. Zhai *et al*'s study used data from China's National Health Accounts studies and Global Burden of Disease 2013 studies and decomposed the changes in health expenditures by disease into population growth, population ageing, disease prevalence rate, expenditure per case of disease and excess health price inflation. These authors found that 72.6% of the increases in China's health expenditure between 1993 and 2012 was caused by growth in health expenditure per prevalent case.<sup>3</sup> A recent study by Yip *et al* using China National Health Accounts data decomposed the growth in health spending by healthcare type into an increase in visit volume and an increase in charges per visit or admission. The study showed that the increase in visit volume accounted for approximately 70% of the increase in the total health spending in China between 2008 and 2017, while increases in charges per visit or admission accounted for

approximately 30% of the increase.<sup>4</sup> These studies examined the drivers of health expenditure growth in China from different perspectives (cost of disease or healthcare) during different periods since the 1990s.

Some existing studies explored spending drivers in the USA,<sup>5–7</sup> Switzerland<sup>8</sup> and Brazil<sup>9</sup> by decomposing growth in spending into its constituent parts while focusing on two or more factors, including population growth, population ageing, disease prevalence, utilisation/quantity and cost/price. Among all these factors in the decomposing models in the existing literature, the two primary factors are quantity and price, and the other factors can be considered the further decomposition of these two factors.

As the main body of China's health service delivery system, public hospitals accounted for 92.8% of hospital inpatient admissions and 92.6% of hospital ambulatory visits in 2008; the corresponding values decreased to 81.8% and 85.3% in 2018.<sup>10</sup> Public hospital medical expenditures accounted for approximately half of the total health expenditures in 2018.<sup>10 11</sup> Cost containment in public hospitals has been a key focus of China's new round of health system reform since 2009.<sup>4 12</sup> Public hospital reforms were launched in 2012, including altering provider payment, eliminating drug mark-up and adjusting fee schedules.<sup>11</sup> A guidance document to contain excess public hospital medical expenditure growth issued by the central government in 2015 listed 21 monitoring indicators of medical cost control for public hospitals.<sup>13</sup> Of these indicators, seven indicators monitor charges per unit of service (charges per visit, admission or case), three indicators monitor service utilisation and the remaining indicators mainly monitor the share of the cost of drugs, diagnostic examinations or medical consumables in medical expenditures. Based on these monitoring indicators, it seems that the assumption underlying policy decisions was that price and intensity were the primary drivers of medical costs. However, these reforms did not reduce the overall medical expenditures.<sup>14 15</sup>

Our study extends the existing literature by focusing on the drivers of the growth of national and provincial total medical expenditures of public hospitals during the first decade of the new round of health system reform in China. We focused on the growth in medical expenditure of public hospitals because most of the medical spending is by public hospitals and because cost containment in public hospitals is the focus of healthcare delivery reform across China. We decompose growth in medical expenditure into its primary policy-relevant constituent factors to quantify how much of the growth in real total medical expenditure was attributable to changes in service volume versus service price and intensity. We also explored the impact of changes in the subcomponent factors of the service volume, that is, the population size, hospital utilisation rates and the share of service utilisation in public hospitals, on the growth of public hospitals' real total medical expenditures. One of the main contributions of this study is the provision of the region-specific

decomposition rates of 31 provinces, autonomous regions and municipalities in mainland China. The results of this study could inform cost containment policies in China and other countries that experience soaring medical expenditures.

## STUDY DATA AND METHODS

### Data sources

We extracted 11 years of nationwide data and 8 years of provincial data from the China Health Statistical Yearbooks in 2009–2019 published by the National Health Commission (originally called the Ministry of Health).<sup>4 16</sup> We obtained aggregative information of public hospital medical expenditures per visit or per admission discharged and outpatient and inpatient service volumes of public and private hospitals per year.<sup>10</sup> The nationwide and provincial population size data in specific years between 2008 and 2018 were obtained from the 2019 China Statistical Yearbook, which provides nationwide and provincial population size data from 2008 to 2018.<sup>17</sup>

We chose 2008 as the base year for the nationwide analysis and 2011 as the base year for the provincial analysis because the earliest available years of nationwide and provincial public hospitals' service volume and price and intensity data were 2008 and 2011, respectively. Additionally, there were significant policy changes in 2009 and 2012 as mentioned above, rendering 2008 and 2011 appropriate as base years. The year 2018 was selected as the end date for both the nationwide and provincial analyses because the latest data we could obtain during our study period was 2018, which was also the period of the first decade of new round health system reform.

### Patient and public involvement

The data used for this study were directly harvested from China Health Statistical Yearbooks and China Statistical Yearbook. Therefore there was no direct patient and public involvement.

### Variable definition

In this paper, we use public hospital medical revenue variables as expenditure indicators. According to the interpretation of the indicators in the China Health Statistics Yearbook and previous studies, hospital medical expenditures in this study fall into the following three categories: medical services, drugs and diagnostic examinations/medical consumables.<sup>14</sup> All expenditure variables in this study were adjusted for inflation using the economy-wide consumer price index of China from the International Monetary Fund and were reported in Chinese yuan in 2018 prices.<sup>18</sup>

Table 1 provides the definitions of the variables used in this study. For outpatient care, the service volume was defined as the annual volume of visits to public hospitals; the utilisation rate was defined as annual hospital visits per capita, including public and private hospital visits; the share of public hospitals' utilisation was defined as

**Table 1** Definitions of service volume, utilisation rate, share of public hospitals' utilisation, price and intensity, by type of care

Care type	Service volume	Utilisation rate	Share of public hospitals' utilisation	Price and intensity
Outpatient	Annual volume of visits to public hospitals in outpatient and emergency departments	Annual hospital (including public and private hospitals) visits per capita	The share of public hospitals in the number of hospital visits.	Public hospitals' medical expenditure per visit
Inpatient	Annual volume of admissions discharged from public hospitals	Annual hospital (including public and private hospitals) admissions per capita	The share of public hospitals in the number of hospital admissions	Public hospitals' medical expenditure per admission discharged

the fraction of public hospitals in the number of hospital visits; and price and intensity was defined as the mean expenditure per visit for public hospitals. For inpatient care, the service volume was defined as the annual volume of admissions discharged from public hospitals; the utilisation rate was defined as annual hospital admissions per capita, including public and private hospital admissions; the share of public hospitals' utilisation was defined as the fraction of public hospitals in the number of hospital admissions; and price and intensity was defined as the mean expenditure per admission discharged from public hospitals.

### Decomposition methods

The total medical expenditure of public hospitals is the product of two factors: (1) service volume and (2) price and intensity, as shown in the following equation:

$$TME_y = V_y \times P_y,$$

where  $y$  indicates the year;  $TME_y$  is the total medical expenditure;  $V_y$  is the service volume and  $P_y$  is the service price and intensity.

To measure the relative effect of each factor, we used the decomposition method described by Das Gupta.<sup>19 20</sup> This decomposition was based on the equation above to calculate standardised expenditures for each factor and then calculate their additive contributions to the changes in hospital outpatient or inpatient total medical expenditures from 2008 to 2018. (For a more detailed description of the decomposition method, see online supplemental appendix 1 exhibit 1.1.)

Given that the public hospitals' service volume can be expressed as the product of the population size, hospital utilisation rate, and share of service utilisation in public hospitals (the share of public hospitals in the number of admissions or visits), its effect on the growth of real total medical expenditures reflects the subcomponent effects of population growth, changes in the utilisation rate and changes in the share of service utilisation in public hospitals. We further explored the impact of changes in the population size, utilisation rate, and share of service utilisation in public hospitals on the growth of total medical expenditure of public hospitals by developing a four-factor decomposition model as follows:

$$TME_y = Pop_y \times \frac{V_{th,y}}{Pop_y} \times \frac{V_{ph,y}}{V_{th,y}} \times P_y,$$

where  $y$  indicates the year;  $TME_y$  is the total medical expenditure of public hospitals;  $Pop_y$  is the population size;  $V_{th,y}$  is the service volume of all hospitals (including public and private hospitals);  $V_{ph,y}$  is the service volume of public hospitals and  $P_y$  is the service price and intensity of public hospital care.

Then, we calculated their additive contributions to the growth of public hospital outpatient or inpatient total medical expenditures from 2008 to 2018. The sum of the contributions of the changes in the population size, utilisation rate, and share of public hospitals' utilisation was approximately the same as the contribution of the changes in the service volume in the above two-factor decomposition. (For a more detailed description of the four-factor decomposition method, see online supplemental appendix 1 exhibit 1.2.)

### RESULTS

Both the inpatient and outpatient real total medical expenditures of public hospitals increased annually from 2008 to 2018 (table 2). In 2018, the inpatient real total medical expenditure increased by 3.6-fold, and the outpatient real total medical expenditure increased 2.9-fold compared with the costs in 2008. The growth rates of inpatient and outpatient real total medical expenditures showed downward trends. Inpatient and outpatient real total medical expenditures increased at average annual rates of 18.2% and 14.4%, respectively, between 2008 and 2013 and decreased to 9.1% and 8.3% between 2013 and 2018. The average annual growth rates of public hospitals' service volume and service price and intensity also displayed downward trends, while the average annual growth rate of public hospitals' service volume outpaced that of service price and intensity during the same period.

Figure 1 reveals a 1172.3 billion yuan and a 545.5 billion yuan increase in inpatient and outpatient real total medical expenditures, respectively, for public hospitals from 2008 through 2018. (The exchange rate in 2018 was 6.6 Chinese yuan to one US dollar.) From 2008 to 2018, the increase in admission volume was associated with 67.4% (790.3 billion yuan) of the observed increase in

**Table 2** Medical expenditures and service volumes of public hospital inpatient and outpatient care in China (2008–2018)

	Inpatient			Outpatient		
	Real total medical exp. (billion yuan)	Exp. per admission (yuan)	Admissions* (million)	Real total medical exp. (billion yuan)	Exp. per visit (yuan)	Visits (million)
2008	456.8	6678.7	68.4	285.0	172.8	1649.1
2009	571.2	7344.5	77.8	338.3	191.3	1768.9
2010	676.2	7789.8	86.8	380.6	203.1	1873.8
2011	770.4	7960.4	96.8	426.1	207.6	2052.5
2012	930.6	8224.8	113.1	497.0	217.2	2288.7
2013	1054.3	8600.1	122.6	558.6	227.5	2455.1
2014	1190.1	8894.5	133.8	629.4	237.7	2647.4
2015	1278.5	9345.6	136.8	675.0	248.8	2712.4
2016	1406.1	9573.9	146.9	728.1	255.7	2847.7
2017	1517.6	9764.2	155.4	774.9	262.5	2952.0
2018	1629.1	9976.4	163.3	830.5	272.2	3051.2
<b>Annual growth rates (%)</b>						
2008–2013	18.2	5.2	12.4	14.4	5.6	8.3
2013–2018	9.1	3.0	5.9	8.3	3.7	4.4

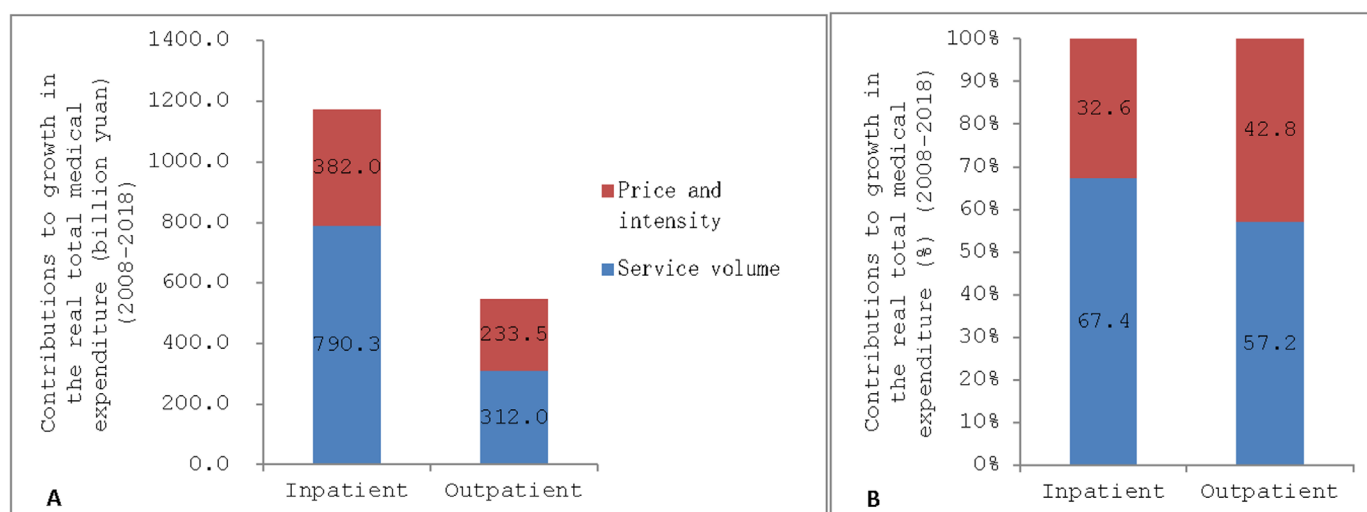
Expenditures per admission discharged or per visit, admission and visit volume data were extracted from the China Health Statistical Yearbooks in 2009–2019. Total medical expenditure represents the authors' analysis of data based on the above equation.

\*Numbers of inpatients who were discharged from public hospitals.

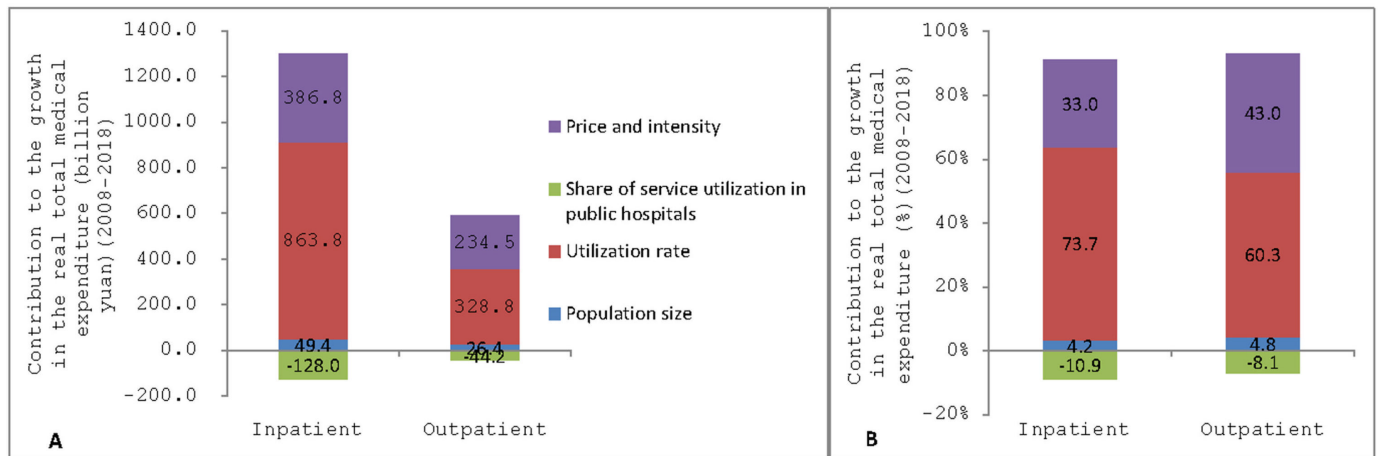
inpatient real total medical expenditure, while the change in price and intensity was associated with the remaining 32.6% (382.0 billion yuan). The increase in visit volume was associated with 57.2% (312.0 billion yuan) of the observed increase in outpatient real total medical expenditure, while the change in the service price and intensity was associated with the remaining 42.8% (233.5 billion yuan).

Figure 2 shows growth in the real total medical expenditure associated with changes in each factor in

the four-factor decomposition from 2008 to 2018. The increase in utilisation rate contributed 73.7% (863.8 billion yuan of the 1172.0 billion yuan increase) of the growth in the real total medical expenditure on inpatient care, and 60.3% (328.8 billion yuan of the 545.5 billion yuan increase) of the growth in the real total medical expenditure on outpatient care. Population growth was associated with a slight increase in inpatient (4.2%) and outpatient (4.8%) total medical expenditures, while a lower share of public hospitals' utilisation was associated



**Figure 1** Contributions of growth in service volume and price and intensity to growth in the real total medical expenditure of public hospitals, 2008–2018. (A) The absolute contribution (billion yuan) of each factor; (B) the relative contribution (%) of each factor. Colours represent the contribution of each factor to the overall growth in real total medical expenditure.



**Figure 2** Growth in the real total medical expenditure of public hospitals associated with changes in each factor in the 4-factor decomposition by type of care, 2008–2018. Growth in the real total medical expenditure of public hospitals from 2008 to 2018 were decomposed into changes in four factors: population size, utilisation rate, share of service utilisation in public hospitals and price and intensity. (A) The absolute contribution (billion yuan) of each factor; (B) the relative contribution (%) of each factor. Colours represent the contribution of each factor to the overall growth in real total medical expenditure. Bars below zero show that the factor contributed to a decrease and bars above zero show an increase.

with a slight reduction in inpatient (10.9%) and outpatient (8.1%) total medical expenditures.

Regarding public hospitals' inpatient and outpatient care in 31 provinces, autonomous regions and municipalities in mainland China, growth in the service volume contributed more than growth in the service price and intensity to the growth in the real total medical expenditures in public hospital inpatient and outpatient care in most provinces from 2011 to 2018 (table 3). Regarding inpatient care, the growth in service volume contributed more than the growth in service price and intensity to the growth in the real total medical expenditures in all provinces except for Tibet. For example, the growth in service volume was associated with 87.3% of the observed growth in the real total medical expenditure in the inpatient sector in Zhejiang Province (38.2 billion yuan of the 43.8 billion yuan increase). Regarding outpatient care, the growth in service volume contributed more to growth in public hospital outpatient real total medical expenditures in most provinces (23 of the 31 provinces).

Increases in hospital utilisation rates accounted for most increases in real total medical expenditures on inpatient and outpatient care in public hospitals in 31 provinces, autonomous regions and municipalities in mainland China from 2011 to 2018 (table 4). Regarding inpatient care, increases in hospital utilisation rates accounted for the largest increases in real total medical expenditures of public hospitals in all 31 provinces, autonomous regions and municipalities. Regarding outpatient care, increases in hospital utilisation rates accounted for the largest increases in real total medical expenditures of public hospitals in 25 provinces, autonomous regions and municipalities, except for six provinces, autonomous regions and municipalities, where increases in price and intensity accounted for the largest increases in the real total medical expenditures of public hospitals. Changes

in the share of public hospital service utilisation were associated with reductions in both inpatient and outpatient real total medical expenditures of public hospitals in 30 provinces, autonomous regions and municipalities, except for Xinjiang. Changes in the population size were associated with increases in both inpatient and outpatient real total medical expenditures of public hospitals in 28 provinces, autonomous regions and municipalities, except for 3 provinces (Liaoning, Jilin and Heilong).

## DISCUSSION

This study measured the increases in inpatient and outpatient real total medical expenditures of public hospitals and how service use and price were collectively associated with these increases from 2008 to 2018. Our results show that the inpatient and outpatient real total medical expenditures of public hospitals increased annually, but the growth rate decreased. The growth in service use explains more of the growth in the real total medical expenditures of public hospitals in China than the growth in service price and intensity, especially for inpatient care.

The annual growth rate of inpatient and outpatient real total medical expenditures of public hospitals decreased by nearly half from 2013 to 2018 compared with that during the period from 2008 to 2013. This finding is consistent with the goal of containing the excess growth of medical expenditures of public hospital reform since 2012.<sup>13</sup> Empirical studies in Beijing<sup>21 22</sup> and Guangdong<sup>23</sup> showed the same trend. Payment method reforms since 2011 have played a role in containing the excess growth of public hospital expenses.<sup>24</sup>

Our findings of the major drivers of public hospitals' medical expenditures differ from those reported by Zhai *et al*, who used data from the 1993–2012 period and reported that the contribution of increasing health



**Table 3** Contributions of growths in the service volume and price and intensity to the growths of public hospital real total medical expenditures on inpatient and outpatient care in 31 provinces, autonomous regions and municipalities in mainland China, 2011–2018

Province	Inpatient		Outpatient	
	Service volume	Price and intensity	Service volume	Price and intensity
Beijing	77.7	22.3	51.5	48.5
Tianjin	70.0	30.0	47.7	52.3*
Hebei	56.7	43.3	67.2	32.8
Shanxi	62.4	37.6	60.8	39.2
IM	78.5	21.5	66.5	33.5
Liaoning	65.9	34.1	48.3	51.7*
Jilin	54.8	45.2	45.2	54.8*
HLJ	72.2	27.8	54.7	45.3
Shanghai	74.5	25.5	58.2	41.8
Jiangsu	77.7	22.3	60.5	39.5
Zhejiang	87.3	12.7	70.6	29.4
Anhui	76.1	23.9	65.3	34.7
Fujian	56.9	43.1	45.0	55.0*
Jiangxi	59.6	40.4	46.1	53.9*
Shandong	62.6	37.4	68.1	31.9
Henan	59.8	40.2	59.0	41.0
Hubei	67.4	32.6	70.4	29.6
Hunan	66.2	33.8	61.5	38.5
Guangdong	65.1	34.9	36.0	64.0*
Guangxi	63.8	36.2	58.1	41.9
Hainan	68.9	31.1	55.7	44.3
Chongqing	76.1	23.9	59.1	40.9
Sichuan	68.9	31.1	59.8	40.2
Guizhou	82.3	17.7	76.0	24.0
Yunnan	79.6	20.4	58.1	41.9
Tibet	49.3	50.7*	34.7	65.3*
Shaanxi	69.5	30.5	63.4	36.6
Gansu	81.2	18.8	65.1	34.9
Qinghai	60.9	39.1	37.5	62.5*
Ningxia	68.8	31.2	58.7	41.3
Xinjiang	63.6	36.4	63.7	36.3

Provincial expenditures per admission discharged or per visit, admission and visit volume data have only been available since 2011 from the China Health Statistical Yearbooks in 2012–2019.

\*The exception of provinces where increases in price and intensity accounted for the largest increases in the real total medical expenditures of public hospitals.

HLJ, Heilongjiang; IM, Inner Mongolia; PHU, public hospitals' utilisation; Pop size, population size.

expenditure per prevalent case to the growth in health expenditures was more than 70%.<sup>3</sup> This study contradicts our finding that approximately 70% of the increase in the inpatient real total medical expenditure of public hospitals was associated with the service volume based on data from the 2008–2018 period. Several differences can

contribute to the varying results across the studies, such as different perspectives (eg, cost of disease vs hospital care) and component factors. A key source of the differences may be the varying time periods. Yip *et al*'s results closely parallel ours. Using data from the 2008–2017 period, Yip *et al* found that the increase in service volume accounted for approximately 70% of the increase in total health spending in China.<sup>4</sup>

Our findings also suggest that most of the service volume effect is due to an increase in the hospital utilisation rate. Our findings closely parallel Moses *et al*'s<sup>25</sup> results. Moses *et al*'s decomposition of change in the volume of outpatient visits and inpatient admissions by countries from 1990 to 2016 showed that in China, more than 80% of the increase in volume of outpatient visits and inpatient admissions was due to an increase in age-sex utilisation rates, and less than 20% could be attributed to changes in the other three factors (population growth, population ageing and sex composition).<sup>25</sup>

Is the increase in service use acceptable? One study indicated that the need factor (ie, whether one had a chronic disease) was a dominant factor determining health service utilisation among rural residents in China.<sup>26</sup> According to the China National Health Services Survey, the prevalence of chronic diseases among respondents aged 65 and above increased from 46.8% in 2008 to 62.3% in 2018.<sup>27 28</sup> The share of population aged 65 and above increased from 8.3% in 2008 to 11.9% in 2018.<sup>17</sup> Coupled with the soaring real gross domestic product and declining share of out-of-pocket spending on health services, the affordability of health services has improved.<sup>4 29</sup> An extensive body of literature highlights the impact of expanding China's basic medical insurance on increasing health service use, especially inpatient services.<sup>30–34</sup> It is plausible that rising hospital service utilisation is related to the increase in the underlying need for and improvements in access to hospital services. However, the increase in health service utilisation may also be supply-induced.<sup>35</sup> However, because under utilisation was a concern before the health system reform initiated in 2009, the increase in hospital service utilisation currently represents as improvements in access.

These findings may inform health policy makers, whose current cost contains policy instruments mainly to control the cost per visit or per admission,<sup>13</sup> that controlling price and intensity growth are crucial, but their effect on containing medical costs could be limited. In the coming years, health service utilisation is likely to increase due to the ageing population and the increased burden of non-communicable diseases. A study of China's health expenditure projections showed that the increase in services per case of disease and unit cost would contribute 4.3 and 2.4 percentage points, respectively, of the 8.4% annual average growth rate in health expenditure during the 2015–2035 period.<sup>36</sup> Controlling service utilisation growth can be essential through a nationwide effort for a healthier population, which could include disease prevention, healthy ageing, ensuring quality care and minimising

**Table 4** Contributions of changes in each factor in the 4-factor decomposition to the growth in real total medical expenditure on public hospital inpatient and outpatient care in 31 provinces, autonomous regions and municipalities in mainland China, 2011–2018

Province	Inpatient				Outpatient			
	Pop. size	Utilisation rate	Share of PHU	Price and intensity	Pop. size	Utilisation rate	Share of PHU	Price and intensity
Beijing	9.5	75.2	-7.0	22.2	11.5	50.8	-10.8	48.6
Tianjin	24.4	44.6	1.2	29.8	35.8	37.2	-25.4	52.4*
Hebei	5.6	65.2	-14.3	43.6	5.9	75.1	-13.9	33.0
Shanxi	4.7	74.3	-17.0	38.0	5.0	65.1	-9.5	39.3
IM	3.0	82.6	-7.2	21.6	3.0	69.5	-6.0	33.5
Liaoning	-1.0	92.3	-25.8	34.6	-1.1	71.0	-22.0	52.1
Jilin	-2.6	79.1	-22.2	45.8	-2.6	58.5	-11.0	55.1
HLJ	-2.9	98.3	-23.6	28.1	-3.9	78.0	-19.7	45.6
Shanghai	4.6	72.0	-2.0	25.5	6.0	55.1	-2.9	41.8
Jiangsu	2.9	85.4	-10.7	22.5	3.1	69.6	-12.3	39.7
Zhejiang	7.6	88.8	-9.1	12.7	9.1	72.1	-10.7	29.4
Anhui	8.5	82.0	-14.5	24.0	7.0	65.6	-7.3	34.7
Fujian	9.4	57.5	-9.9	43.1	8.3	40.1	-3.3	54.9*
Jiangxi	4.0	65.2	-9.8	40.6	4.4	48.8	-7.2	54.0*
Shandong	5.9	70.4	-13.9	37.6	6.2	73.3	-11.5	32.0
Henan	2.6	76.5	-20.0	40.9	3.0	72.2	-16.7	41.5
Hubei	3.3	73.6	-9.7	32.8	4.0	71.7	-8.7	32.9
Hunan	6.0	79.4	-19.5	34.2	6.3	68.1	-13.1	38.7
Guangdong	10.3	60.6	-5.8	34.8	12.5	26.9	-3.3	63.9*
Guangxi	6.9	63.8	-7.0	36.3	7.9	52.8	-2.5	41.8
Hainan	9.8	70.1	-11.0	31.1	8.8	52.9	-5.9	44.3
Chongqing	7.8	92.9	-25.1	24.4	6.9	60.4	-8.3	40.9
Sichuan	4.6	80.4	-16.4	31.4	4.2	63.3	-7.8	40.3
Guizhou	4.0	92.8	-14.8	18.0	3.9	84.7	-12.9	24.3
Yunnan	5.5	83.0	-9.0	20.5	5.0	59.5	-6.5	41.9
Tibet	10.8	55.5	-17.5	51.3	12.1	36.6	-14.3	65.6*
Shaanxi	3.8	80.0	-14.6	30.8	4.2	65.1	-6.0	36.6
Gansu	3.3	86.9	-9.0	18.9	3.3	67.9	-6.2	34.9
Qinghai	7.2	65.4	-11.8	39.3	8.0	42.0	-12.7	62.7*
Ningxia	11.2	77.7	-20.3	31.5	9.2	57.8	-8.3	41.3
Xinjiang	20.9	42.7	0.1	36.2	17.2	43.2	3.6	36.0

Provincial expenditures per admission discharged or per visit, admission and visit volume data have only been available since 2011 from the China Health Statistical Yearbooks in 2012–2019.

\*The exception of provinces where increases in price and intensity accounted for the largest increases in the real total medical expenditures of public hospitals.

HLJ, Heilongjiang; IM, Inner Mongolia; PHU, public hospitals' utilisation; Pop size, population size.

unreasonable healthcare demands.<sup>37 38</sup> Positive incentive mechanisms should be established to enhance an integrated medical and long-term care delivery system, which would be expected to increase outpatient and long-term care in primary facilities and prevent unnecessary hospitalisation.

However, this study has several limitations. First, the analysis relies on government administrative data, which may be subject to reporting errors. Second, due to the lack of a price index specific to the health sector in China, this study cannot distinguish between the contributions of service price and service intensity. Third, due to the



lack of age-specific price and intensity of public hospitals' inpatient and outpatient care for disease conditions in both base year and end year, this study did not consider changes in types of conditions prompting people to visit the hospitals and the ageing of the population. Further research is needed to identify the sources of the increase in public hospital medical expenditures by type of condition and by controlling for ageing, which could provide crucial evidence for decision makers.

## CONCLUSIONS

We conclude that service use, rather than price, appears to be the major driver of the increases in China's hospital medical expenditures. An important policy implication for China and other countries with similar drivers is that the effect of controlling price and intensity growth on containing medical costs could be limited and controlling service utilisation growth could be essential.

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