Unintended Impacts of the Global Budget on the Quality of Healthcare Among Inpatients with Heart Failure in China: An Explanatory Sequential Mixed-Methods Study

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Abstract

Background: To evaluate the impact of global budget payment (GBP) reform on the quality of healthcare among inpatients with heart failure (HF) and analyze the influencing factors of healthcare quality in the context of GBP reform.

Methods: The administrative data on patients with HF from January 1, 2014 to December 31, 2017 were used, and the in-hospital mortality and length of stay (LOS) were compared using logistic regression and zero-truncated negative binomial regression, respectively. The content analysis method was then used to organize and analyze the records of in-depth interviews with key insiders.

Results: A total of 4222 eligible HF patients and 58 interview records were finally analyzed. The in-hospital mortality increased from 1.21% to 3.58% after the GBP reform was implemented (OR, 2.197; 95% CI, 1.153 to 4.229). The average LOS in the pre-budget and post-budget groups was 9.65 days and 9.07 days (IRR, 1.012; 95% CI, 0.997 to 1.027), respectively. Additionally, the top three influencing factors ranked by key frequency analysis are the diagnosis and treatment technology level (50, 86.21%), the supervision of healthcare quality (50, 86.21%) and the implementation of the core system in healthcare quality system (49, 84.48%).

Conclusions: The implementation of the GBP had a detrimental effect on the outcome quality for inpatients with HF. Besides, hospital administration, especially quality control, was the most important factor affecting healthcare quality after the implementation of the GBP reform. GBP policy possibly needs to be further improved by policy-makers.

Background

Increasing household investments in health, decreasing health benefits and surging healthcare costs have brought a huge challenge to healthcare reform in China and most countries in the world[1, 2]. In order to cope with these challenges, the prepayment schemes represented by global budget payment (GBP), diagnosis-related groups (DRG) payment and capitation payment have gradually replaced the payment of fee-for-service as the mainstream payment method for medical insurance[3]. Similarly, China also has carried out a series of payment reforms to control the unreasonable increase in medical expenses[4]. The GBP is the basis of other payment reforms. The total amount of medical insurance payments has been controlled nationwide in China since 2012. As stipulated by Chinese governments, a certain amount of money will be available as reimbursement for hospitals[4]. A lot of regions in China have carried out a series of practices on the reform of the GBP and made great achievements in controlling healthcare costs. However, in a meanwhile, all the measures taken to drive the payment reform have put medical service providers into a moral hazard because these providers may control healthcare costs by lowering its quality, which obviously runs counter to the original intention of GBP reform and is not conducive to its sustainable development[5, 6]. Therefore, as the GBP reform continuously deepens,

all parties start to focus on understanding the impact of GBP reform on healthcare quality and accurately identifying the factors affecting medical service quality.

Some researchers found that GBP has been very effective in controlling healthcare costs in developed countries and Taiwan, China[7], but such effect is achieved possibly by reducing the quality of medical services[8, 9]. Game theory is the theoretical basis of this type of research. Researchers believed that quality improvement was accompanied by cost increases, so the regulation of reimbursement ceiling resulted in quality degradation, especially when it was difficult for customers to identify the quality level of healthcare. There is a clear trade-off effect between cost and quality[10]. However, some studies indicated that healthcare quality exhibited an upward trend instead of decline on the premise that cost was effectively controlled, which has been proved by Massachusetts-based Alternative Quality Contract (AQC) cohort[11]. Analogously, Giorgio et al. Believed that GBP system slightly reduced costs for nursing homes without impacting quality[12]. For these two opposite conclusions, Leatherman et al. Found that there was no so-called trade-off effect between cost and quality by analyzing four cases because there were differences in disease severity, adjusted case mix, and geographic location[13].

However, GBP and healthcare quality are rarely studied in developing countries, especially in mainland China. Most studies focus on the effect of GBP on medical behaviors and cost control[14, 15]. In addition, in terms of research design, most studies on GBP mainly selected a specific medical service or individual diseases to observe and analyze the changes in quality indicators. Each step was based on quantitative data[9, 13, 16, 17]. However, the factors affecting healthcare quality can hardly be generally described because of the complexity of medical market, the differences between countries and regions and the heterogeneity between institutions and patients[18, 19]. Therefore, researchers are advised to give quantitative results in more details about background and personal experience (qualitative information) so as to better understand the internal mechanism and general rule of the impact of GBP on healthcare quality[20].

In summary, a unified conclusion has not yet been reached in the empirical research on the impact of GBP on healthcare quality. There may not be a so-called trade-off effect between cost control and healthcare quality improvement, and most researches focus on the impact of GBP on healthcare quality in developed countries instead of developing countries. China's unique layered medical system and the medical insurance system covering the largest population make China's experience very useful for developing countries and countries with a layered medical system. Additionally, qualitative researches can be conducted to explain quantitative research results to more clearly sort out the impact of GBP on healthcare quality. It is of high practical guidance value for the refined management of hospitals in the context of the GBP reform. To sum up, this study aims to investigate the impact of GBP on healthcare quality in China using mixed-methods sequential explanatory design.

Methods

Research design

An explanatory sequential mixed-methods design is employed in this research. The explanatory sequential design is a two-phase design in which original quantitative results are explained by qualitative data[20]. This design is applicable to the studies where significant, non-significant or surprising quantitative results need to be explained by qualitative results[21]. In the initial quantitative phase of the study, administrative data of HF inpatients for the years of 2014, 2015, 2016, and 2017 were analyzed to study the changes in healthcare quality by fitting the regression model. Specifically, these four years represent the pre-GBP period (2014), post-GBP but prior to region-wise service cap implementation period (2015–2016), and post-service cap period (2017), respectively. To sum up, the pre-intervention period was in 2014, and the post-intervention period was in 2017. The quantitative measurements of each HF patient were important to identify the statistically significant differences within each hospital and between hospitals, and were also used to steer the in-depth qualitative study to explore the causes of these results. In-depth interviews were employed in the next qualitative phase of the study to explore the areas identified in the quantitative findings. As literature shows, what occurred in this research (the relationship between GBP and medical quality) are essentially subjective. A purely quantitative approach is insufficient for us to adequately understand the changes in medical quality after the GBP reform[19].

Data of quantitative study

A population-based cohort study was conducted using health administrative databases from January 1, 2014 to December 31, 2017, where information about more than 200 variables was collected. These data were extracted from the Wuhan Municipal Health Commission. Samples were collected from HF patients (ICD-10 code: I50) who were hospitalized in nine tertiary A public hospitals. Tertiary A designation is granted to the hospitals that rank ‘excellent’ on several indicators such as hospital structure, staffing, size and clinical capacity[22]. The hospitals where the cumulative number of HF inpatients was less than 100 from January 1, 2014, to December 31, 2017 were excluded in our study. The hospitals with major changes in the ability to diagnose and treat HF were also excluded as per advised by a group of clinical experts. Finally, HF patients from three hospitals were analyzed. Moreover, the following HF patients were excluded: HF patients under the age of 18, or whose information about age, gender, insurance, and discharge status was not available, or who were discharged alive within one day after admission or left the hospital without permission by doctors, or who were transferred from one hospital or community health service center to another.

The primary outcome was in-hospital mortality, which was defined as death rate at hospital discharge and was coded from the health administrative databases[23]. The in-hospital mortality was measured as the indicator of outcome quality. The secondary outcome was the length of stay (LOS), as determined from health administrative databases. The LOS was measured as the indicator of process quality. The variable of in-hospital mortality was recorded as a 0 unless the patient died when being hospitalized, in which case, it was recorded as a 1. Patient characteristics previously used to explain most of the changes in in-hospital mortality and LOS were measured including age, sex, admission source, medical insurance, and medical comorbidity[24, 25]. The Charlson Comorbidity Index (CCI) was used for comorbidity

adjustment for administrative data [26]. Hospital fixed effects were captured by dummy variables for all the hospitals except one as the reference group.

Data of qualitative study

In-depth interview was a highly appropriate way to get information from influential stakeholders, including area policymakers or practitioners, or experts in the field of GBP reform for this research[26]. Based on quantitative outcomes about the change in healthcare quality, the researchers wrote an in-depth interview outline for structuring an interview and ensuring that all important questions would be raised during the interviews. The in-depth interview outline included the changes in medical quality and influence factors. The researchers made appointments in advance to foster the image that there was plenty of time to talk about the topic, and let the interviewees respectively choose the location of the interview in which they felt most comfortable. It could be their home, workplace, or an appropriate public place (such as a quiet restaurant or coffee shop). All the interviews were recorded entirely by an audio recorder. Besides, the researchers who took detailed notes on interviewees' answers were asked to listen and rephrase what were said to ensure that they fully understood the interviewees' intentions.

Data analysis of quantitative study

We used a logistic regression model to estimate the relationship between in-hospital mortality and GBP. And the Chi-squared test was used to test an overall effect of year. We also tested additional hypotheses about the differences in the coefficients for the different years. The difference (subtraction) of the terms for year = 2015 and year = 2017, and that of the terms for year = 2016 and year = 2017 were also tested as below. The receiving operating characteristic (ROC) curve and area under the curve (AUC) were also drawn to evaluate the performance of the logistic model.

Zero-truncated negative binomial regression was used for data modeling (we fit a zero-truncated Poisson model and compare the two to test whether it is necessary to estimate over dispersion) because LOS was recorded as a minimum of at least one day and there were signs of over dispersion. In addition, robust error clustering was estimated by the levels of hospitals because the observation results within the same hospital are likely to be correlated. The incidence rate ratio (IRR), 95% confidence interval, and p-value were reported, and the main effect of categorical variable year after regression was tested. Notably, year = 2015 and year = 2016 as the base category for comparisons. The plot of the residuals versus fitted values was used to evaluate the performance of zero-truncated negative binomial regression model.

All analyses were performed using STATA statistical software version 15.0 and R Studio statistical software version 3.6.2 and a 2-sided type I error probability of 0.05.

Data analysis of qualitative study

The content analysis method was used to organize and analyze the records of in-depth interviews with key insiders. The units of analysis were the words, phrases, and sentences that were used to describe the influencing factors of medical quality after the GBP reform. The influencing factors were preliminarily

classified based on the principles of mutual exclusion, exhaustion, and independent classification, and existing literature, and then the classification was adjusted based on interview data.

In order to make coding in the research process more objective, three researchers were asked to code independently. Each coder was required to have a relatively high degree of familiarity and understanding of the interview contents and classification categories. Meanwhile, a standard coding table was presented for measurement. According to the sequence of interview numbers, ten samples were selected as analysis objects by a systematic sampling for reliability testing to check whether categories were clearly defined. "Holsti formula" was used to test whether content analysis was reliable or not. After content analysis was confirmed to be reliable, three coders interpreted the content based on categories and analysis units, classified the analysis units into the categories, and then performed descriptive statistics and key frequency analysis on the encoding results.

Results

Implementation Status of Global Budget Payment in Wuhan

In 2015, Wuhan issued a document to coordinate the medical expenses of basic medical insurance participants in central urban areas and set a global budget for the urban employee basic medical insurance (UEBMI), urban resident basic medical insurance (URBMI), and college student medical insurance (CSMI). In 2016, the GBP system was improved, and the total amount of medical insurance was separated from special insurances such as work-related injury insurance. For each designated hospital, the total amounts of UEBMI, URBMI, and CSMI were designated and paid monthly. After a two-year transition period, Wuhan has initially formed a payment system of "annual global budget, monthly advance payment, process supervision, index assessment, and year-end settlement" in 2017.

Quantitative analysis

The summary statistics for baseline characteristics of HF inpatients is shown in Table 1. A total of 4222 eligible HF patients were finally analyzed. Among them, 1576 patients (37.33%) were admitted before the implementation of GBP and 2646 (62.67%) after the implementation of GBP. The in-hospital mortality was 1.21%, 3.84%, 4.07% and 3.58% in 2014, 2015, 2016, and 2017, respectively. The median LOS of patients was 9 days (IQR = 5.0) in 2014, 8 days (IQR = 5.0) in 2015, 9 days (IQR = 4.0) in 2016 and 8 days (IQR = 4.0) in 2017.

Table 1
Baseline characteristics of heart failure inpatients

Variables	2014	2015	2016	2017
HF[1] inpatient volume, n	1 576	885	811	950
Dependent variables				
Death during hospitalization, n (%)	19(1.21)	34(3.84)	33(4.07)	34(3.58)
Length of stay, mean (SD[2])	9.65(5.44)	9.26(4.96)	9.57(4.52)	9.07(4.72)
Control variables				
Sex				
Male, n (%)	691(43.85)	369(41.69)	345(42.54)	445(46.84)
Female, n (%)	885(56.15)	516(58.31)	466(57.46)	505(53.16)
Age-year, mean (SD)	72.40(11.27)	75.72(10.12)	76.54(10.15)	74.80(12.27)
Medical insurance				
UEBMI[3]	1 365(86.61)	792(89.49)	728(89.77)	735(77.37)
URBMI[4]	89(5.65)	38(4.29)	37(4.56)	96(10.11)
Other	122(7.74)	55(6.21)	46(5.67)	119(12.53)
Admission source, n (%)				
Outpatient medical services	165(10.47)	111(12.54)	176(21.70)	385(40.53)
Emergency medical services	1 398(88.71)	768(86.78)	634(78.18)	561(59.05)
Transferred from other hospitals	13(0.82)	6(0.68)	1(0.12)	4(0.42)
CCI[5], mean (SD)	2.79(1.10)	3.09(1.00)	3.20(0.99)	3.03(1.11)

[1]HF indicates heart failure; [2]SD, Standard Deviation; [3]UEBMI, Urban Employment Basic Medical Insurance; [4]URBMI, Urban Residents Basic Medical Insurance; [5]CCI, Charlson Comorbidity Index.

The themes identified in these responses were displayed in Fig. 1. The odds ratio for year = 2017 was used to compared the in-hospital mortality after the implementation of GBP reform to that before the implementation of GBP reform (because the non-implementation of global budget payment reform was the reference group). The figure indicates that the odd of in-hospital mortality after the implementation of GBP reform is 2.197 times of that of the non-implementation of GBP reform. The differences between study groups are statistically significant ($P < 0.05$), respectively. The chi-squared test statistic of 14.30, with three degrees of freedom is associated with a p-value of 0.0025, indicating that the overall effect of years is statistically significant. [insert Fig. 1.]

The chi-squared test statistic of 0.73 with one degree of freedom is associated with a p-value of 0.39, indicating that the difference between the coefficient for year = 2015 and that for year = 2017 is statistically insignificant. The chi-squared test statistic of 0.07 with one degree of freedom is associated with a p-value of 0.80, indicating that the difference between the coefficient for year = 2015 and that for year = 2016 is statistically insignificant. The chi-squared test statistic of 0.40 with one degree of freedom is associated with a p-value of 0.53, indicating that the difference between the coefficient for year = 2016 and that for year = 2017 is statistically insignificant. The area under the receiver operating characteristic curve is 0.77(**Appendix B** for details about ROC curve).

The change in deviance is 1,979.55, and the p-value of chi-squared test statistic is less than 0.001. Thus, it was concluded that the negative binomial is a better fit to the data. The overall effect of year group is statistically significant (chi-squared = 11.26, $P = 0.004$). The results of the correlational analysis are shown in Table 2.

With respect to the secondary outcome of LOS, there is a significant difference between the first year (2015) after the implementation of GBP reform and the year (2014) before the implementation of GBP (IRR, 0.945; 95% CI, 0.933 to 0.957; $P < 0.001$). Two years after the implementation of GBP reform, patients' rate for hospitalization would be expected to decrease by a factor of 0.969 compared to the baseline period (95% CI, 0.931 to 1.009; $P = 0.123$) if other variables are constant in the model. Three years after the implementation of GBP reform, patients were expected to have a rate of 1.012 times greater for hospitalization compared to baseline period (95% CI, 0.997 to 1.027; $P = 0.107$) if other variables are constant in the model.

Table 2
Zero-truncated negative binomial analysis of length of stay

Variables	IRR[1] (95% CI[2])	P value
Age-year	0.999 (0.997–1.001)	0.354
Sex		
Male (reference group)		
Female	1.012 (0.990–1.035)	0.277
In-hospital mortality		
No (reference group)		
Yes	0.896 (0.809–0.993)	0.037
Medical insurance		
UEBMI[3] (reference group)		
URBMI[4]	0.930 (0.837–1.032)	0.172
Other	0.961 (0.937–0.985)	0.002
Admission source		
Outpatient medical services (reference group)		
Emergency medical services	1.058 (1.012–1.105)	0.012
Transferred from other hospitals	0.935 (0.858–1.019)	0.126
CCI[5]	1.052 (1.011–1.094)	0.012
Hospital		
Hospital A (reference group)		
Hospital B	1.171 (1.152–1.190)	< 0.001
Hospital C	1.334 (1.310–1.358)	< 0.001
Year		
2014 (reference group)		
2015	0.945 (0.933–0.957)	< 0.001
2016	0.969 (0.931–1.009)	0.123

[1]IRR indicates incidence rate ratio; [2]CI indicates confidence interval; [3]UEBMI, Urban Employment Basic Medical Insurance; [4]URBMI, Urban Residents Basic Medical Insurance; [5]CCI, Charlson Comorbidity Index.

Variables	IRR[1] (95% CI[2])	P value
2017	1.012 (0.997–1.027)	0.107

[1]IRR indicates incidence rate ratio; [2]CI indicates confidence interval; [3]UEBMI, Urban Employment Basic Medical Insurance; [4]URBMI, Urban Residents Basic Medical Insurance; [5]CCI, Charlson Comorbidity Index.

The cell mean of each year group was also compared with that of the other year's groups, respectively. The chi-squared test statistic of 60.80 with one degree of freedom is associated with a p-value less than 0.001, indicating that the difference between the coefficient for year = 2015 and that for year = 2017 is statistically significant. The chi-squared test statistic of 0.98 with one degree of freedom is associated with a p-value of 0.32, indicating that the difference between the coefficient for year = 2015 and that for year = 2016 is statistically insignificant. The chi-squared test statistic of 6.25 with one degree of freedom is associated with a p-value of 0.01, indicating that the difference between the coefficient for year = 2016 and that for year = 2017 is statistically significant. Besides, it is apparent that the mean is around zero across all the fitted levels **(Appendix C).**

Qualitative analysis

A total of 58 subjects were interviewed and 58 interview records were collected (**Appendix D ~ F** show the basic information of the interviewees, coding reliability testers and the results of coding reliability test respectively). The study started from the subjects involved in medical services, and constructs an influencing factor framework from the perspectives of medical service providers, medical service purchasers and regulators, and medical service receivers.

Table 3
Key frequency of content analysis of interview materials

Primary classification	Secondary classification	Tertiary classification	Frequency (times)	Proportion (%)
Healthcare purchasers and regulators	GBP implementation plan	Accounting and allocation of quotas	11	18.97
		Payment and settlement of quotas	18	31.03
	Medical insurance management	Regulatory standards for medical insurance	34	58.62
		Feedback on assessment results	6	10.34
		The professionalism of medical insurance management personnel	3	5.17
Healthcare Provider	Hospital strategic decision	Hospital development strategy	15	25.86
		Actual development of the hospital	14	24.14
		Hospital leaders' attitudes and decisions to GBP	37	63.79
		Hospital performance programs	24	41.38
	Quality control	Supervision of quality of healthcare	50	86.21
		Implementation of the core system in healthcare quality system	49	84.48
		Medical technology normative	23	39.66
		Implementation of clinical pathway or single disease quality management	48	82.76
	Medical cost control	Cost structure adjustment (medicine ratio, consumable ratio, etc.)	22	37.93
		Medical cost control requirements for departments or physicians	32	55.17

Primary classification	Secondary classification	Tertiary classification	Frequency (times)	Proportion (%)
	Other internal factors of hospital	Diagnosis and treatment technology level	50	86.21
		Resource allocation of personnel, equipment, drugs, etc.	23	39.66
		Management ability of department director	11	18.97
		Hospital culture	5	8.62
		Information system	5	8.62
Recipient of Medical Services	Characteristic factors of the insured	Condition of Patients	29	50.00
		Patient financial status	10	17.24
		Patient compliance	19	32.76
Other	Inspection of quality of healthcare	Health administrative department's inspection	6	10.34

The influencing factor framework was then adjusted and modified (**Appendix G**). Based on the average mutual agreement of the three coders (**Appendix H**), the reliability is 0.92, which indicates that the content analyses of the three coders are quite consistent, and the interview records can be analyzed on the basis of this category table. The frequency and proportion of each indicator are shown in Table 3.

Discussion

The first question in this study sought to determine the impact of the GBP reform on healthcare quality among patients with HF. The average LOS in the pre-budget and formal post-budget groups was 9.65 days and 9.07 days, respectively. And this difference is not statistically significant (IRR, 1.012; 95% CI, 0.997 to 1.027; P = 0.107), indicating that the process quality among inpatients with HF is not affected by the GBP reform. But according to current study, the GBP was associated with a significantly poorer outcome quality among patients with HF. The in-hospital mortality increased from 1.21–3.58% after the

implementation of the GBP reform (OR, 2.197; 95% CI, 1.153 to 4.229; $P < 0.05$). Besides, the compelling finding of the study was that hospital administration, especially quality control, was the most important factor affecting healthcare quality after the implementation of the GBP reform.

The drop-off of outcome quality could by possibly explained by medical insurance administration, mainly including "medical insurance management" and "GBP implementation plan". Under the medical insurance management dimension, the "regulatory standards for medical insurance" (34, 58.62%) were mentioned by almost every clinical director and physician interviewed. The public hospitals in the sample areas were uniformly equipped with an intelligent medical insurance monitoring system to monitor the entire process of diagnosis and treatment where medical expenses were generated. The automatic review and prompts set according to the regulatory standards aimed at each physician. But it was easy for doctors to develop a habit of “saving money” for diagnosis and treatment because a lot of settings were not completely reasonable or trapped in standards, and some quality risks of healthcare thus arose. The department of medical insurance management would adjust the regulatory indicators especially after the clinician adapted to the corresponding regulatory standards. Some hospital managers have criticized the design of Wuhan Medical Insurance, which was believed to be self-oriented. The medical behaviors could not be fundamentally regulated by such distorted relationship between “cat” and “mouse”.

In addition, regarding the dimensions of the GBP plan, the interviewed medical insurance and financial leaders believed that the current GBP plan has not yet matched the provision of medical services, which "payment and settlement of quotas" (18, 31.03%), and " accounting and allocation of Quotas" (11, 18.87%) have an impact on healthcare quality. In terms of budget quota and allocation, the lag of the historical law and the rapid expansion of hospitals resulted in a more intense contradiction, and the allocation plan has not yet been preferential to the hospitals with better cost control. The amount of medical insurance funds is usually allocated based on the inherent proportion of hospital quotas when its total amount is insufficient. It is increasingly difficult for hospitals with relatively weak service capabilities to obtain a certain percentage of medical insurance funds. Even if it is a tertiary hospital, the gap between the annual total medical insurance can be 10 times or even 20 times, and real patients’ needs are usually ignore when medical insurance resources are allocated[27]. The degrading outcome quality of healthcare shows that GBP has not become an ideal benchmark for hospital to control costs. Instead, it has become a shackle for the development of hospitals and a catalyst for widening the gap between hospitals, posing a threat to the healthcare quality of hospitals with smaller scales and weaker service capabilities. The implementation of the total payment and settlement is currently not satisfactory. The medical insurance leaders from most of the sample hospitals said that what was currently implemented was not what the GBP intended for. Besides, the payment was often delayed, thus causing a great burden on hospitals. Funds paid on a monthly basis can generally be settled on time, but the funds settled at the end of the year often delay for 3–5 months, and some sample hospitals even received some settlement funds of the year of 2014 for medical insurance redemption in 2017.The GBP system does not reflect the advantages of prepayment, but rather emphasizes the importance of strongly controlling budge. Therefore, outcome quality in the sample hospitals also declined in 2015 and 2016 when the transition policy of GBP was implemented. In the meantime, the increasingly accumulative delayed

medical insurance is a great potential danger to the long-term development of hospitals. Medical insurance agencies owe hospitals debts, and the hospital owes money to medicine providers and medical consumables vendors. As a result, there is no supply of drugs and consumables, and the hospital will thus find it difficult to sustain.

It can also be possibly explained by hospital administration mainly including “the strategic decisions” and “quality control of the hospitals”. In the dimension of quality control, "supervision of healthcare quality" (50, 86.21%), and "the implementation of the core system in healthcare quality system" (49, 84.48%), "implementation of clinical pathway or single disease quality management" (48, 82.76%) were the top three indicators. International experience shows that clinical pathways and single disease quality management can effectively improve healthcare quality. However, there is a significant lag in related work in China now, where clinical pathways are unevenly promoted and implemented. The clinical pathways are not highly accepted or complied by physicians[28]. In addition, the interviewees believed that “hospital leaders’ attitudes and decisions to GBP” (37, 63.79%), and “medical cost control requirements for departments or physicians” (32, 55.17%) were also the main factors affecting healthcare quality. Hospital leaders' attitudes and decisions to the GBP play a crucial role in the overall development direction and management philosophy of the hospital, and various internal initiatives of the hospital are thus launched, so it is also an important factor affecting healthcare quality.

Additionally, the hospital's requirements on cost control for departments or physicians have a more direct impact on the physician's behaviors, thus further affecting healthcare quality, but its impact is complex, and different cost control strategies may result in completely different results. The total amount issued by medical insurance administration is allocated to various departments according to their contributions, and the departments are required to control their costs in accordance with the indicators given by the hospital. This is the strategy adopted by most hospitals in the context of GBP. Some hospitals also evaluate department staff’s performance based on its departmental cost control, and deducted the performance of the over-excessive departments. Some departments of the hospital even decomposed the indicators again to each member, and passed down the pressure of cost control to departmental members. The cost can be effectively controlled by such a strategy, but it is likely to be overcorrect, so that clinicians will no longer firstly seek for the best treatment effect, and insufficient medical treatment will cause quality risks.

Our study was prone to several limitations. First, these results may not be applicable to all policy environments. Wuhan was selected as the sample area in the study. The GBP system may be different in different areas. In order to solve this problem, the research interviews included not only the managers and medical staff of the related departments in the sample hospital but also seven experts and scholars who have made great achievements in the field of medical insurance. In addition, the director of the Medical Reform Office of the Wuhan Health Commission and the person in charge of medical insurance policies who participated in this interview also fully understood the GBP policy of cities and other provinces. The research takes advantage of interviewees' rich background knowledge to make up for the limitations to a certain extent. Second, in hospital mortality was used as the main indicator of health-care quality in the

study, and there might be selection bias. The traditional quality measurement system covers three dimensions: structure, process, and outcome. The most used indicators of the outcome dimension also include 30-day mortality and unplanned 30-day readmission in addition to in-hospital mortality. At present, these two indicators are difficult to obtain in China's administrative database, which will be the focus of next research[29, 30]. Finally, the correlation between the implementation of GBP and the changes in healthcare quality can only be concluded in this study as a counterfactual-based control group is absent. Although the study failed to draw a causal relationship between them through qualitative analysis, it identified the path in which medical care quality might be affected by the GBP, thus making it more practical for all stakeholders to carry out the corresponding work.

Notwithstanding these limitations, the present results are significant in at least two major respects. One of the issues arising from these findings is a negative correlation between GBP and outcome quality, which was a supplement to the rare literature about this field in developing countries. It is suggested that with the continuous implementation of GBP, healthcare quality may decline not only in developed countries or regions, but also in developing countries, which is obviously contrary to the original intention of the policy. In addition, the study systematically combed the influencing factor of healthcare quality in the sample area in the context of GBP, which has not yet been studied. As the GBP policy continuously advances, various stakeholders need to focus on a lot of factors that may affect healthcare quality, in order to control medical cost without sacrificing healthcare quality. This research provides the right guidance of operation for stakeholders.

Conclusion

In conclusion, the outcome quality of healthcare provided to patients with HF appears to have degraded after the implementation of the GBP reform. According to the research results, medical insurance administration is advised to further improve GBP-related policies and strengthen medical insurance management. Most importantly, medical service providers need to strengthen quality control. Both parties should work together to ensure the medical care quality while curbing the excessive increases in medical costs.

Abbreviations

GBP
global budget payment
HF
heart failure
LOS
length of stay
DRG
diagnosis-related groups
AQC

Alternative Quality Contract
CCI
Charlson Comorbidity Index
ROC
receiving operating characteristic
AUC
area under the curve
IRR
incidence rate ratio
UEBMI
urban employee basic medical insurance URBMI:urban resident basic medical insurance
CSMI
college student medical insurance

Declarations

Ethics approval and consent to participate

Confidential information including name, ID card number, residential address, postal code, and insurance number were excluded from the database. Huazhong University of Science and Technology, which was not directly engaged with the data collection, exempted the study as human subject research for secondary analysis of data as defined by DHHS regulations 45 CFR 46.102.

Consent for publication

Not applicable.

Competing Interests

The authors declare that they have no competing interests

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Authors' contributions

Conceptualization, J.N. and J.Y.; Funding acquisition, H.T.; Investigation, J.N., Y.H., Y.P., H.X.; Methodology, J.N. and J.Y.; Project administration, H.T.; Writing – original draft, J. N. and J.Y; Writing – review & editing, Y.H. and H.T.

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Availability of data and materials

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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31. Appendices.

Figures

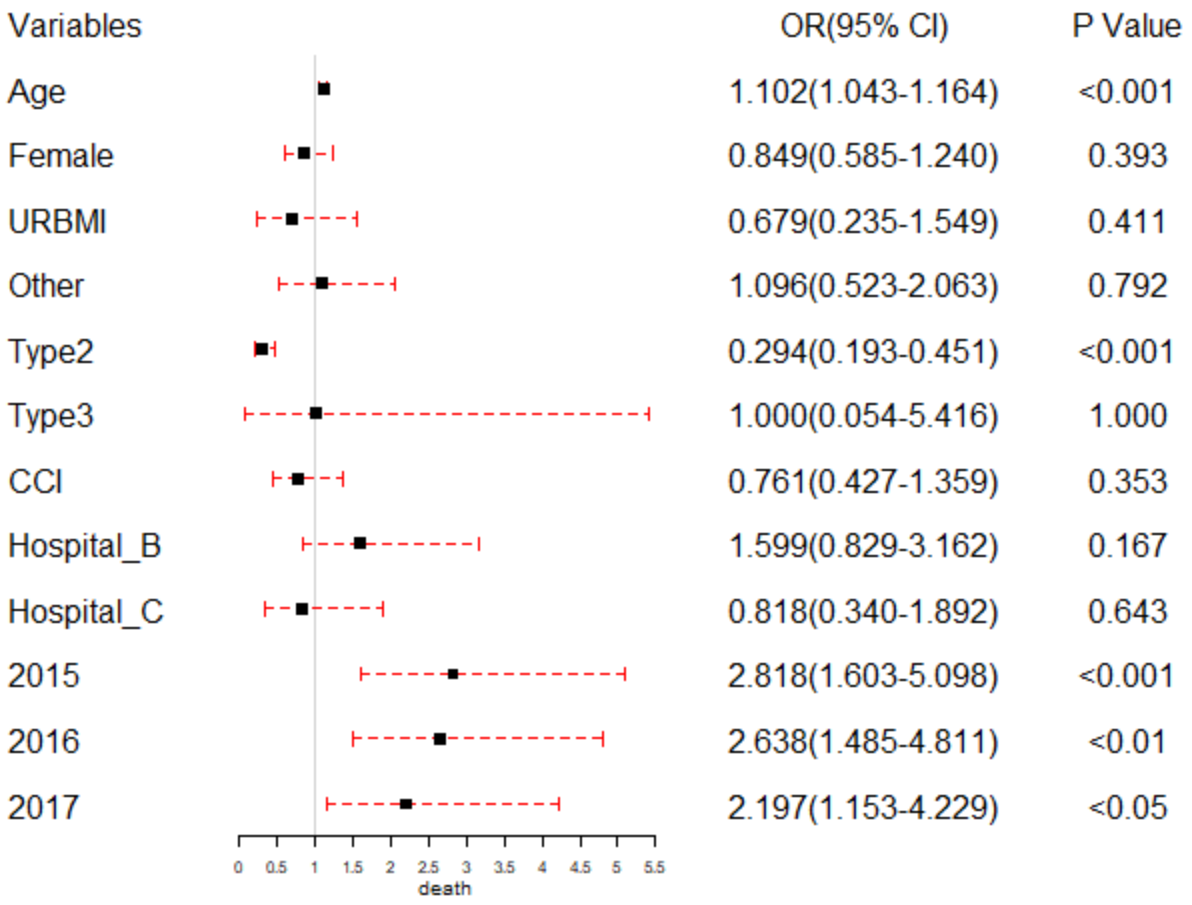

Figure 1

Logistic analysis of in-hospital mortality: URBMI indicated Urban Residents Basic Medical Insurance; The type2 variable indicated emergency medical services; The type3 variable indicated patients transferred from other hospitals; CCI indicated Charlson Comorbidity Index. (Appendix A for details about Logistic analysis)

Supplementary Files

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