

## Estimating cost of hospitalization for childbirth at a tertiary hospital in Mongolia

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### ABSTRACT

Health services for pregnancy and delivery at public health facilities are fully subsidized by the government in Mongolia. However, it has been reported that health financing, budget planning, and implementation processes are weak. Therefore, this study aims to estimate the costs per inpatient of vaginal delivery and cesarean section (C-section) by using data gathered from a tertiary hospital in Ulaanbaatar. Inpatient and financial data were collected from the Statistics and Finance, Economics Department of National Center for Maternal and Child Health. A top-down method was used for the calculation of unit costs. The total number of deliveries in 2016 were 11,033, including 7,777 vaginal deliveries and 3,256 C-sections. The cost per inpatient stay for vaginal delivery and C-section were USD 255 and USD 592, respectively. The average cost per bed-day of the six departments of the obstetrics and gynecology hospital was USD 80. The percentage that represents employees' salary in the cost per inpatient was as low as 12.4% for vaginal delivery and 18.5% for C-section, although the cost for salaries accounted for 51.2% of the total expenditure of the hospital. Results show that the cost per inpatient of C-section was two times higher than that of vaginal delivery. The cost of childbirths may account for approximately 9% of total health expenditure of the country. These results may be advantageous to the government in instituting a policy and controlling the health care budget to improve cost-effectiveness and equal access to all in health care services in Mongolia.

Keywords: cesarean section, cost per inpatient, Mongolia, vaginal delivery

#### Abbreviations:

C-section: cesarean section

NCMCH: National Center for Maternal and Child Health

OB-GYN: obstetrics and gynecology

SBA: skilled birth attendance

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## INTRODUCTION

Mongolia is a lower-middle income country with a population of approximately 3 million. The population grew by half a million in the last decade and the population growth rate is 2% per annum.<sup>1</sup> However, the total number of live births reached a peak in 2014 with 81,715 and then decreased to 78,194 in 2016.<sup>2</sup> This shows that the population growth rate has been increasing in conjunction with a series of governmental reforms and policies, but the country could still dramatically improve policies regarding maternal health. Mongolia achieved a number of targets stipulated in the Millennium Development Goals (MDGs), such as reducing child mortality, improving maternal health, and limiting the spread of HIV/AIDS.<sup>3</sup> The maternal mortality ratio (MMR) reduced from 186 to 44 per 100,000 live births, and skilled birth attendance (SBA) increased from 95.0% to 100.0% between 1990 and 2015.<sup>4</sup>

National Health Insurance was introduced in Mongolia in 1994.<sup>5,6</sup> However, emergency care, tuberculosis, cancer, mental illness, maternal and child health, and primary health care and services are fully financed from the state budget. Costs that are covered by health care insurance are classified into 115 Diagnosis Related Groups (DRGs). The cost of each DRG is defined by multiplying the basic fee and the corresponding coefficients of each group. However, the actual cost of health care services, which are financed by the state budget, are unclear. There is little information available on costs and expenditures of maternal health services in Mongolia, even though this information is necessary to make basic decisions on the national budget.<sup>7</sup> There may be discrepancies between the available financing and the actual costs of the services, which may lead to a financial burden on patients by increasing out of pocket expenses. In Mongolia, 3% of people have experienced catastrophic health care expenditure defined as out of pocket expenses exceeding 25% of their total household budget.<sup>8</sup>

The World Health Organization (WHO) reported that planning a budget along with the implementation, monitoring, and the evaluation process are relatively weak at all levels in Mongolia, with the national budget being the main source of health care financing.<sup>9</sup> Because the budget is limited, the proper allocation of resources is essential to ensure the delivery of accessible and qualified health care. It is crucial to have a clear understanding of the costs of health care to ensure rational allocation of resources and to improve health care financing.<sup>9,10</sup>

According to the Health Law of Mongolia, health care service for pregnancy and childbirth at public health facilities are fully subsidized by the government.<sup>11,12</sup> The institutional delivery rate is 99% at the national level.<sup>2</sup> In Ulaanbaatar, the capital city of Mongolia, there are the National Centre for Maternal and Child Health (NCMCH) and three maternal hospitals (75–390 beds) of the secondary level. There are 21 local maternal hospitals (50 beds) in provinces. The NCMCH is an only tertiary level hospital, which receives patients from all regions of the country and provides professional maternal and child health care service. Ulaanbaatar has 46% of the total population and 30% of the births in Ulaanbaatar were registered at the NCMCH, which accounted for approximately 14% of the total birth in Mongolia.<sup>2</sup>

In Mongolia, although the national health care expenditure has shown a moderate increase, the efficiency of the increasing budget is still controversial. One of the key objectives of the Mongolian health care policy is to increase cost effectiveness without undermining the quality of care.<sup>13</sup> Therefore, it is crucial to estimate the actual costs of health care services in relation to the government health care budget to improve planning and protect people from a financial burden associated with health problems. There have been past studies regarding costs at different levels of hospitals in Mongolia. However, there has been no English report regarding the cost of health care service for childbirth at a tertiary level hospital. This study aims to estimate unit costs of childbirth – both vaginal delivery and cesarean section (C-section) – using a top-down

method for appropriate allocation and management of budgets.

## MATERIALS AND METHODS

### *Study subjects*

This is a cross-sectional study that estimates the unit costs of vaginal deliveries and C-sections at the NCMCH using a top-down costing method. The NCMCH is a tertiary hospital with 680 beds in Ulaanbaatar and provides professional health care to mothers and children. The hospital was selected for this study due to it having the highest number of deliveries in the country and the accessibility of data from the hospital, including data on hospital expenditure.

### *Data collection*

The NCMCH consists of an Obstetrics and Gynecological (OB-GYN) hospital and a Pediatric hospital. The OB-GYN hospital consists of 11 inpatient and 13 outpatient departments, and the Pediatric hospital consists of 22 inpatient and 18 outpatient departments. OB-GYN hospital's six inpatient departments are Delivery, Postpartum Care, High Risk Pregnancy, Preterm Delivery, OB-GYN Intensive Care, and Gynecological Pathology. The data of patients who delivered babies at the NCMCH from January to December 2016 were collected from health indicators of the NCMCH.<sup>2</sup> The total number of deliveries was 11,033, of which 7,777 were vaginal deliveries and 3,256 were C-sections. The data on patients included age, gravidity, parity, gestational weeks at delivery, and length of stay.

The data regarding hospital expenditure for the fiscal year of 2016 (from January to December) were collected from the Finance and Economics Department of the NCMCH. The collected data included direct costs (salaries, social insurance contributions, medicine and medical supplies, hospital meals, bedding, and other materials) and indirect costs (maintenance, utilization, depreciation, renovation, and bank fees). Total expenditure was USD 10,532,332.6 (26,220,558,000 tugriks, as 1 USD = 2,489.53 tugriks), which was broken down into the items of the total salary and bonus (USD 5,394,172.0), social insurance contributions paid by employers (USD 593,358.9), fixed expenses related to office buildings (USD 459,571.0), office supplies and inventory (USD 157,889.8), standard cost (USD 3,504,560.8), furniture and current repair expenses (USD 50,631.9), purchase of other goods and services (USD 143,803.2), current transfer (USD 166,405.5), and others (USD 61,939.4).

### *Calculation of cost per bed-day of each department in OB-GYN hospital*

A top-down costing method was used for the calculation of the cost per inpatient stay for vaginal deliveries and C-sections respectively. The top-down method calculates the unit costs by allocating the total hospital expenditure with five main steps.<sup>7,14</sup> The five steps are 1) specifying the cost centers, 2) describing the direct and indirect cost, 3) allocating the overhead cost center and intermediate cost center to the final cost center, 4) calculating the unit cost per bed-day by dividing the total allocated cost by the number of bed-days of each inpatient department, and 5) estimating the cost of inpatient stay for vaginal delivery and C-sections by multiplying the average cost per bed-day by mean day of length of stay for vaginal and cesarean deliveries respectively.

First, the cost per bed-day of each of the inpatient departments in the OB-GYN hospital was calculated. All departments and units of the NCMCH were divided into the cost centers based on their activities and roles within the hospital. The cost centers are divided into intermediate cost centers, overhead cost centers, and final cost centers. Overhead cost centers include departments of administration, quality management, human resources, financing and accounting, and information

technology and engineering. The intermediate cost centers consist of seven departments: Statistics, surveillance, laboratory, sterilization, medical equipment, diagnostic, and dietetics. The final cost centers are responsible for direct patient medical services, such as the inpatient and outpatient departments of the hospital.

In the next step, the total cost of resources was classified into direct and indirect costs. Direct costs are costs that are directly related to final products and include mainly costs for direct labor and materials, such as salaries, medicines, and medical supplies. Direct costs are consistent with specific 'cost objects', which is used to calculate the costs of products, services, customers, and activities. Indirect costs are costs that are not directly associated with a single activity, but connected to multiple activities.<sup>13</sup> Indirect costs pertain to administrative activities and are usually constant for a wide output. Examples of indirect costs are utilities, office and stationary costs, communication expenses, depreciation expenses, and service payments such as banking service fees and insurance service fees.

For the next step, the direct and indirect costs were allocated into cost centers. For example, direct costs such as salary expenses were allocated to a department of each cost center based on the number of regular staff. The allocation of indirect costs included all possible parts of the hospital services. For example, the cost of heating, electricity, and water supply was allocated to the outpatient departments, inpatient departments, and the entire office space. The total floor space of the NCMCH building is 38,780 m<sup>2</sup>. Of this, 6,380 m<sup>2</sup>, 2,400 m<sup>2</sup>, and 30,000 m<sup>2</sup> belong to overhead cost centers, intermediate cost centers, and final cost centers respectively. After allocating each input cost to the relevant cost centers, all costs were allocated to final cost centers by a step down process. For example, the cost of the pharmacy department (intermediate cost center) was allocated to the cost of each inpatient department (final cost center). The total cost of inpatient departments were calculated according to the hospital statistical data such as number of inpatient days or number of inpatients. Finally, the cost per bed-day for each of the inpatient departments was estimated.

#### *Calculation of cost per inpatient stay for vaginal delivery and C-section*

The Delivery Department, Department of Preterm Delivery, and Department of Postpartum Care were used to determine the costs for patients who gave births. First, the average cost per bed-day of the three departments was calculated. The cost per inpatient stay for vaginal delivery was calculated by multiplying the average cost per bed-day by the average length of stay for vaginal deliveries. The cost per inpatient stay for C-section was calculated by multiplying the average cost per bed-day and the average length of stay for C-sections, and then adding the cost per surgical patient of the Department of Anesthesia and the Department of Post-anesthetic Recovery.

#### *Ethical issues*

An approval of the national ethical review board was not required for this study, since the health indicators and financial information were secondary data that were collected by authorized personnel of each department of the NCMCH for the annual reporting system to the Ministry of Health.

## RESULTS

#### *Basic performance indicators of the NCMCH*

Table 1 shows the basic performance indicators of the Mongolian NCMCH in 2016. The center provides two main types of service, obstetrics and gynecological service and pediatric service.

**Table 1** Basic performance indicators of National Center for Maternal and Child Health in Mongolia in 2016

Indicators	N
Total number of beds	680
OB-GYN bed	256
Pediatric bed	424
Total number of staff	1,128
Doctors	259
Nurses/midwives	491
Administrative and others	378
Bed occupancy rate (%)	108.5
Total outpatient visits	174,354
Total number of in-patients	39,564
Total number of births	11,033
Vaginal delivery	7,777
Cesarean section	3,256
Total inpatient days	243,446
Average length of stay (days)	6.2
Total expenditure of hospital (USD)	10,532,332.6
Salary, wages and supplementary (USD)	5,394,172.0
Drug expenses (USD)	3,030,190.4
Other expenses (USD)	2,107,190.4

All expenditures are shown in USD.

1 USD=2,489.53 Mongolian tugriks (on 31st December, 2016)

The total number of beds was 680, and 1,130 staff were employed by the hospital, including 259 doctors, 433 nurses, and 58 midwives. The bed occupancy rate was 108.5%. The average length of stay was 6.2 days. In 2016, the total number of deliveries were 11,033, of which 7,777 were vaginal deliveries and 3,256 were C-sections. The total expenditure of the hospital was USD 10,532,332.6 in 2016, and the financing sources were the state budget (USD 7,062,707.9, 76.1%), the social insurance fund (USD 3,189,939.1, 30.3%), and the operating income (USD 279,685.6, 2.6%). The salary expenses accounted for 51.2 % of the total expenditure.

#### *The characteristics of maternal delivery*

The average age of the 11,033 mothers was 29 years, and the majority were in the age group of 20–29 years old (57.8%), followed by the age group of 30–39 years old (32.9%). The percentage of mothers under 19 and 40 years and older were 5.5% and 3.9% respectively. The average of gestational weeks at delivery was 38.5 weeks, and most deliveries took place at 37–40 weeks (76.9%). The percentage of deliveries before 36 weeks and after 41 weeks were 13.8% and 9.3% respectively. The length of stay of most vaginal deliveries (58.0%) was 1–3 days, as opposed to mothers who underwent C-sections, who stayed for 4–6 days on average in 51.2% of the cases (Table 2). Mothers discharge at 24 hours after vaginal deliveries or at 4 days after C-sections when both of mothers and their babies had no problems. However, when either of them has some problems, they stay at the hospital until both can discharge (Table 1).

**Table 2** Characteristics of mothers who had childbirths at the National Center for Maternal and Child Health in Mongolia in 2016 (N=11,033)

Characteristics	Vaginal delivery (N=7,777)		Cesarean section (N=3,256)		Total (N=11,033)	
	N	(%)	N	(%)	N	(%)
<b>Age (years old)</b>						
≤19	517	6.6	81	2.5	598	5.4
20–24	2,479	31.9	789	24.2	3,268	29.6
25–29	2,354	30.3	756	23.2	3,110	28.2
30–34	1,366	17.6	893	27.4	2,259	20.5
35–39	827	10.6	541	16.6	1,368	12.4
40≤	234	3.0	196	6.0	430	3.9
<b>Gravidity</b>						
1	2,192	28.2	596	18.3	2,788	25.3
2–4	4,787	61.6	2,130	65.4	6,917	62.7
5≤	798	10.3	530	16.3	1,328	12.0
<b>Parity</b>						
1	2,836	36.5	860	26.4	3,696	33.5
2–4	4,711	60.6	2,326	71.4	7,037	63.8
5≤	230	3.0	70	2.1	300	2.7
<b>Gestational age (weeks)</b>						
≤36	950	12.2	570	17.5	1,520	13.8
37–40	5981	76.9	2,506	77.0	8,487	76.9
41≤	846	10.9	180	5.5	1,026	9.3
<b>Length of stay (days)</b>						
≤3	4,514	58.0	451	13.9	4,965	45.0
4–6	1,825	23.5	1,667	51.2	3,492	31.7
7–10	867	11.1	674	20.7	1,541	14.0
11≤	571	7.3	464	14.3	1,035	9.4

*The cost per bed-day of inpatient departments of Obstetrics and Gynecological hospital*

Inpatients of the OB-GYN hospital stay at six departments, regardless of whether they deliver babies or not. Total cost of each department was calculated and direct cost accounted for 97.4–99.8% of the total cost of the six departments (Table 3). Table 4 displays the cost per bed-day of all six inpatient departments as well as the differences between the departments. The highest and lowest cost per bed-day were USD 144 at the Department of OB-GYN Intensive Care and USD 36 at the Department of Postpartum Care respectively. The average cost per bed-day of all inpatients departments in the OB-GYN hospital was USD 80 (Table 4).

*The cost per inpatient stay of vaginal delivery and C-section*

The Delivery Department, Department of Preterm Delivery, and Department of Postpartum Care were used for patients who had childbirths. Patients with pregnant complication such as threatened delivery and baby's anomaly stayed and delivered babies at Department of Preterm Delivery. Patients who had term deliveries had a childbirth at Delivery Department and moved

## Hospitalization cost for childbirth in Mongolia

**Table 3** Direct and indirect cost of inpatient departments in OB-GYN hospital

OB-GYN inpatient departments	Direct cost (USD)	Indirect cost (USD)	Total (USD)
Delivery Department	366,710.9	2,503.9	369,214.7
Department of Preterm Delivery	390,338.6	1,868.1	392,206.7
Department of Postpartum Care	311,868.8	4,619.2	297,518.3
Department of OB-GYN Intensive Care	311,868.8	1,145.1	313,013.9
Department of High Risky Pregnancy	439,337.8	1,082.0	440,419.8
Department of Gynecological Pathology	251,455.3	7,16.9	252,172.2

1USD=2,489.53 Mongolian tugriks (on 31st December, 2016)

**Table 4** The cost per bed-day of inpatient departments in OB-GYN hospital

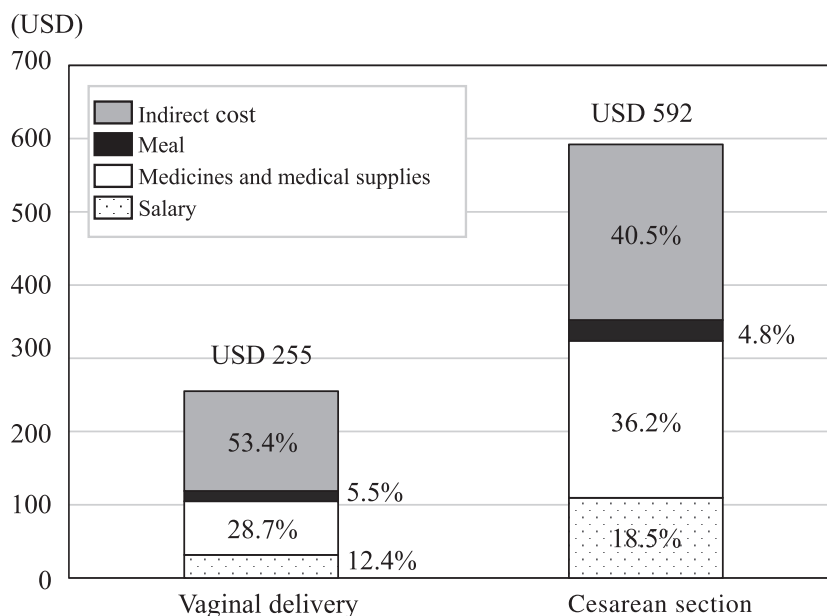
OB-GYN inpatient departments	Number of bed	Number of inpatient	Average length of stay (day)	Cost per bed-day (USD)
Delivery Department	12	3,605	0.8	140.0
Department of Preterm Delivery	25	1,352	7.2	70.7
Department of Postpartum Care	74	5,335	6.0	36.0
Department of OB-GYN Intensive Care	9	527	5.4	144.0
Department of High Risky Pregnancy	64	2,811	6.6	45.8
Department of Gynecological Pathology	72	3,440	5.9	42.0
Average				80.0

1USD=2,489.53 Mongolian tugriks (on 31st December, 2016)

to Department of Postpartum Care. The average cost per bed-day of three departments was USD 82.2. The average length of stay for patients who had vaginal deliveries was 3.1 days and the cost per inpatient stay was estimated to be USD 255. To calculate the cost per inpatient stay for vaginal delivery, we multiply the average cost per bed-day by the mean length of stay for vaginal delivery. For example, the average cost per bed-day is USD 82.2 multiplied by 3.1 days. Conversely, the average length of stay for patients who had C-section was 6.2 days. The cost per surgical patient of Department of Anesthesia and Department of Post-anesthetic Recovery were USD 57.1 and USD 25.4 respectively. The cost per inpatient stay of C-section was estimated to be USD 592. To calculate the cost per inpatient stay for C-section, we multiply the average cost per bed-day by the mean length of stay for C-section, plus the average cost per inpatient of Department of Anesthesia and Post-anesthetic Recovery. For example, the average cost per bed-day is USD 82.2 multiplied by 6.2 days, plus USD 82.5 (average cost per inpatient of Department of Anesthesia and Post-anesthetic Recovery).

#### *The components of the cost per inpatient stay*

Figure 1 shows the components of the cost per inpatient stay, and that the indirect cost represents the largest portion for both vaginal delivery and C-section (53.4% and 40.5% respectively), followed by the cost of medicines and medical supplies (28.7% and 36.2% respectively). However, the portion of the salary was as low as 12.4% for vaginal delivery and 18.5% for C-section (Fig. 1)



**Fig. 1** Components of the cost per inpatient stay for vaginal delivery and cesarean section. The numbers in the bars or next the bars represent the percentage of each component's cost in the cost per inpatient for vaginal delivery and cesarean section (C-section). The indirect cost represents the largest portion for both vaginal delivery and C-section (53.4% and 40.5% respectively), followed by the cost of medicines and medical supplies (28.7% and 36.2% respectively). The portion of the salary was as low as 12.4% for vaginal delivery and 18.5% for C-section.

## DISCUSSION

In this study, we estimated the cost per inpatient stay for vaginal delivery and C-section, and the costs were USD 255 and USD 592, respectively. The cost for C-section was 2.3 times higher than that of vaginal delivery. The costs related to operations and anesthesia, medicines and medical supplies, and length of stay at the hospital were the main causes for the difference. Compared to other lower-middle income countries, the difference between the costs for vaginal delivery and C-section seems to be smaller in Mongolia. The costs of vaginal delivery and C-section respectively were USD 31.9 and USD 117.5 in Bangladesh (2010), USD 119 and USD 336 in Pakistan (2011), and USD 59 and USD 270 in Lao PDR (2012).<sup>15-17</sup> The cost per inpatient for C-section was between 2.8 and 4.7 times higher than that that of vaginal delivery in these countries.

The cost per bed-day for each of the inpatient departments in the OB-GYN hospital was calculated in this study. Although the average cost per bed-day for inpatient departments was USD 80, there were differences in the costs per bed-day among departments. The unit cost of the Delivery Department and the Department of OB-GYN Intensive Care were much higher than that of other departments. These results are understandable, since delivery and intensive care have a high cost due to the higher cost of medical professionals, medical equipment, and more human resources. The unit cost of the Department of Postpartum Care was the lowest, which may be due to most patients in this department being stable and only needing care mostly from midwives and nurses but not from doctors.

The rate of C-sections at the NCMCH was 29.5%, while the national average rate in 2016 was



25.4%.<sup>2</sup> The WHO recommends the average rate of C-sections should not be over 10–15%.<sup>18,19</sup> The leading causes of C-sections at the NCMCH were uterine scarring, pre-eclampsia, intrauterine hypoxia, and cephalo-pelvic disproportion. However, the C-section rate has been increasing in Mongolia. It has gone from 22.4% in 2012, to 24.7% in 2014, and 25.4% in 2016.<sup>2,20,21</sup> Vaginal delivery has been proven to be much more beneficial for mothers' bodies than C-section,<sup>22,23</sup> and the cost per inpatient of vaginal delivery was revealed to be cheaper than that of C-section. These results support that vaginal delivery is a cost-effective method for delivery to assist in reducing the total health care cost of the country. Decreasing the rate of C-sections may simultaneously benefit maternal health and health care expenditure for delivery.

The percentage of the cost for salaries in the cost per inpatient was as low as 12.4% for vaginal delivery and 18.5% for C-section. However, salary costs accounted for 51.2% of the total expenditure of the NCMCH. This may be because the majority (83%) of the personnel in the Delivery Departments are full time working nurses, midwives, and assistant health care workers, and their salaries are lower than those of doctors. Another reason may be that the salaries of medical professionals in Mongolia are lower than the true market level. Higher investments in human resource, such as higher salaries or workforce, is necessary for improving hospital performance, because higher investments in human resource were related to better performance but not higher health care cost.<sup>24</sup>

The total cost of childbirths in Mongolia can be estimated to be around USD 26,488,775.0 using the estimated costs per inpatient of this study and the total number of deliveries – including 58,073 vaginal deliveries and 19,730 C-sections – in 2016. The cost was approximately 9% of the total health care expenditure in Mongolia. It is difficult to judge whether it is high or low or to compare the data with that of other countries. To improve maternal health, the health care expenditure for childbirths as well as the salaries of medical professionals should be increased. However, it is assumed that the cost for delivery at health care facilities are cheaper in rural areas due to the cost of real estate and the salaries of health care workers. The results of this study showed the estimated cost of childbirth at the tertiary level hospital, which has the highest level of capacity and capabilities, the highest number of beds, the higher salary of doctors, and more skilled healthcare staff than regional hospitals. Moreover, many mothers opt for childbirth at private clinics that are not supported financially by the government. Further studies are needed to calculate a more accurate cost of childbirth in the whole country.

There are some limitations in this study. First, we did not include the cost of pediatric service in the calculation for the inpatient stay, although a pediatrician before discharge at the hospital checked all babies. Calculation in this study was based on inpatient data and financial information of inpatient department of the OB-GYN hospital. Secondly, the unit costs might be slightly higher than actual costs due to the renovation of some medical equipment in 2016 and allowances from the government for retired physicians and nurses. Thirdly, the estimated unit cost of childbirth in this study may not represent those of all hospitals in Mongolia and it may be different even at NCMCH in different years. The unit cost was calculated using the number of childbirth and healthcare staff, the salary of staff, and the total health expenditure of the hospital and these factors can change year by year. The trend of unit cost at the same hospital is also needed to be studied.

In conclusion, this study showed that the cost per inpatient stay at the NCMCH in Mongolia for vaginal delivery and C-section were USD 255 and USD 592 respectively. The costs per bed-day of six departments of OB-GYN hospital ranged from USD 36 to USD 144, and the average was USD 80. The portion of the salary in cost per inpatient was as low as 12.4% to 18.5%, although salary costs accounted for 51.2% of the total expenditure of the hospital. The cost of childbirths seems to account for approximately 9% of the total health care expenditure.

The present study provided the basic cost information to the hospital. It will support the planning of health expenses and to enable the efficient use of financial resources. The results could be helpful to the government to implement a policy and to control the health care budget to improve cost-effectiveness and equal access to health care services in Mongolia.

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## CONFLICT OF INTEREST

The authors declared no conflicts of interest for this study.

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