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# Hospital billing for birthing services: an alternative model to fee-for-service

Faturamento Hospitalar aplicado ao serviço de parto: modelo alternativo ao *fee-for-service*

Facturación Hospitalaria aplicada al servicio de parto: modelo alternativo al *fee-for-service*

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## Descritores

Custos hospitalares; Administração hospitalar; Faturamento; Parto; Saúde da mulher

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## Descriptores

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## Abstract

**Objective:** To propose an alternative model to hospital fee-for-service billing by using bundled service charges.

**Methods:** This was documentary, exploratory, descriptive research based on secondary data, using a quantitative approach, conducted in three stages: I - hospital cost survey; II - choice of caring protocols; III - development of bundled services. The hospital costs of the birthing service in a public maternity hospital were analyzed from 2014 to 2016. Protocols were also considered to create bundled services, based on the birth indications of the Ministry of Health and the National Commission for Incorporation of Technologies (Conitec), in the quality-adjusted life-year indicators (QALY and patient safety indicators).

**Results:** Considering the patient's state of health, three bundles were developed, classified as Bundle 1, 2 and 3. The normal risk pregnant woman was classified as Bundle 1, with a mean cost of R\$9,652.63; the high-risk pregnant woman was classified as Bundle 2, presenting a mean cost of R\$18,557.99; and, the extreme-risk pregnant woman was classified as Bundle 3, with a mean cost of R\$41,386.49.

**Conclusion:** When hospitalized, the parturient is classified according to the level of risk present. Therefore, both the patient and the health providers can estimate the costs associated with specific levels of care. This strategy can reduce the amount of documentation, allowing more time for patient care, following standardized care protocols. The methodology can be replicated in any public or private institution, taking into account its costs, and the quality indicators for care.

## Resumo

**Objetivo:** Propor modelo alternativo ao faturamento hospitalar de pagamento por procedimento para pagamento por pacotes de serviço.

**Métodos:** Trata-se de uma pesquisa exploratório-descritiva, documental, baseada em dados secundários, de abordagem quantitativa, realizado em três etapas: I-levantamento de custos hospitalares; II-escolhas dos protocolos de atendimento; III-elaboração de pacotes de serviço. Para isso, foi analisado o comportamento dos custos hospitalares do serviço de parto de um hospital materno infantil público no período de 2014 a 2016. Também foram considerados protocolos para formar pacotes de serviços, com base nas indicações de parto do Ministério da Saúde e Conitec, nos indicadores QALY e de segurança do paciente.

**Resultados:** Considerando o estado de saúde da paciente, foi possível montar 3(três) pacotes de serviços, classificados como pacotes 1, 2 e 3, sendo a gestante de risco habitual classificada como pacote 1 com um custo médio de R\$9.652,63; a gestante de alto risco, classificada como pacote 2 apresentou um custo médio de R\$ 18.557,99; e a gestante de risco extremo, classificada como tipo 3 apresentou um custo médio de R\$ 41.386,49.

**Conclusão:** Ao entrar em um hospital, a parturiente será classificada conforme o grau de risco apresentado. Com isso, tanto a paciente quanto os provedores de saúde saberiam o custo estimado do seu atendimento. Isso diminuiria a quantidade de procedimentos registrados pela assistência, permitindo dedicar mais tempo para a paciente, seguindo protocolos de atendimento padronizados. O caso pode ser replicado em qualquer instituição pública ou privada, levando-se em consideração os seus custos e os indicadores de qualidade da unidade.

## Resumen

**Objetivo:** Proponer un modelo alternativo a la facturación hospitalaria por procedimientos de paquetes de servicios.

**Métodos:** Investigación exploratorio-descriptiva, documental, basada en datos secundarios, de abordaje cuantitativo, realizada en tres etapas: I-relevamiento de costos hospitalarios; II-elección de protocolos de atención; III-elaboración de paquetes de servicio. Se analizó el comportamiento del costo hospitalario del servicio de parto de un hospital Materno-infantil público entre 2014 y 2016. También se consideraron protocolos para conformar paquetes de servicio según indicaciones de parto del Ministerio de Salud y el Conitec, en los indicadores QALY y de seguridad del paciente.

**Resultados:** Considerando el estado de salud del paciente, pudieron elaborarse 3 (tres) paquetes de servicios, clasificados como 1, 2 y 3, habiéndose considerado a la parturienta con riesgo normal como paquete 1 con costo promedio de R\$9.652,63; la parturienta de alto riesgo fue clasificada como paquete 2, presentando costo promedio de R\$18.557,99; la parturienta con riesgo extremo fue clasificada como paquete 3, presentando costo promedio de R\$41.386,49.

**Conclusión:** En su admisión, la parturienta será clasificada según el grado de riesgo. Así, tanto la paciente como los proveedores de salud conocerán el costo estimado de su atención. Eso disminuiría la cantidad de procedimientos registrados en la atención, permitiendo dedicarle mayor tiempo a la paciente, siguiendo protocolos de atención estandarizados. El caso puede replicarse en cualquier institución pública o privada, considerando sus costos y los indicadores de calidad de la unidad.

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## Introduction

Fee-for-service billing covers 90% of the contracts between healthcare plans and service providers, such as hospitals, clinics, laboratories, and physicians.<sup>(1,2)</sup> This model was developed in the United States, in the 1930s, as a basis for an emerging private insurance system, characterized by the “open account”; hospitals, laboratories, and physicians treat a specific patient according to her needs, and pass on to the health insurer a detailed invoice of all human and material resources used during the delivery of care.<sup>(3)</sup>

In the fee-for-service billing model, values charged for the same types of procedure vary widely across different providers and clients. The outcomes of care are not taken into account, the actual costs rarely are, and fees are the result of bargaining power. The quantity of services, not the quality, is reimbursed; re-hospitalizations due to clinical development or medical errors are also remunerated.<sup>(4-6)</sup>

This proposal recommends an alternative to the current payment model: billing for bundled services, based on cost analysis and standardized protocols. This study follows the methodology developed by Porther and Kaplan, called Bundled Services,<sup>(4,5)</sup> or service packages. The first step in proposing improvements in the billing tables in this study was to know the hospital costs. An economic cost analysis is an essential tool for achieving this objective.<sup>(4,5)</sup>

Bertó and Beulke<sup>(7)</sup> noted that bundled services allow for standardization of care, enabling an estimated length of hospitalization, which medications will be administered, and which series of tests the patient would have. In addition, the presence of electronic patient records and, subsequently, the development of protocols, facilitate the task of evaluating the costs of bundled services.<sup>(7)</sup>

In order to identify costs, a data system and organized information are essential factors. According to Conover,<sup>(8)</sup> compared to other industries, the health care field is flooded with data: we have much more information and transactions, inputs, prices, and even outcomes for health care than other areas. And yet, that amount of data is often underutilized, and insufficient to satisfy managers, political analysts, or external critics.<sup>(8)</sup>

The study was conducted in a maternal and child hospital in the Federal District, a reference site in the care of women and newborns, particularly those with high-risk pregnancy, extreme prematurity, and congenital malformations. It is a public hospital, qualified to provide Auxiliary Services of Diagnosis and Treatment, Ambulatory, and Hospital (SADT - Serviço Auxiliar de Diagnóstico e Terapia, Ambulatorial e Hospitalar). It has 310 beds, 173 beds inpatient, 45 in emergency care and 92 in intensive care (ICU) (eight maternal, 16 pediatric, and 68 neonatal ICU). Data provided by the Center for Hospital Statistics reported that, in the year 2016, there were 74,815 outpatient visits, 17,251 hospitalizations, and 3,975 deliveries. The Center for Control and Cost Management of the hospital was implemented through the SES/DF Ordinance no. 288 of 10/25/2013 and the Ordinance SES / DF nº79 of 04/29/2015 in its 2nd Article, which designated the Planning Secretariat of SES/DF as having responsibility for the implementation of cost management in the Federal District.

The cost information was provided by the Cost Management Center of the hospital. The basis for preparing the entire new billing proposal used data for the period of 2014 to 2016, and was the framework for preparing bundled service proposals. Therefore, the aim of this study is to propose a new alternative-billing model to the fee-for-service model: changing payment-for-procedure to payment-for-bundled services, using the delivery procedure as an example.

## Methods

This was an exploratory, descriptive, documentary research, based on secondary data, with a quantitative approach, performed in three stages: 1 - survey of hospital costs; 2 - selection of service protocols; 3 - preparation of bundled services. Because the research was based on secondary data, and did not involve research with human beings or analysis of medical records, there was no need for approval by the Ethics Committee in research. Only the authorization of the area and unit managers was obtained.

**STAGE 1: Survey of hospital costs:** This consisted of identification of the expenses of the entire hospital and its cost centers. The survey and treatment of cost data considered the total cost of absorption, a method used by the Ministry of Health to calculate costs involved in health services and actions, in order to make efficient use of resources. According to the methodology developed by the Ministry of Health, for the National Program of Cost Management (Programa Nacional de Gestão de Custos - PNGC),<sup>(9)</sup> the chosen costing model - costing by absorption - is simple and succinct; it is the most commonly used by health institutions, and provides indicators and information of extreme importance for the management of costs. The absorption costing system makes full appropriation of all costs (direct, indirect, fixed, and variable) including all the products/services for the entire period of care. This costing method controls the cost and performance of the entity and its cost centers (specific activity areas), and can compare the estimated costs with the budgeted amounts. This will generally indicate when the institution's costs will exceed the budgeted amounts.

The hospital expenses were collected monthly, using the control of invoices, execution reports of insurer contracts, computerized personnel and material systems, as well as contract information. The production of the areas (which produces each cost center) was provided by the hospital's Center of Statistics. The PNGC<sup>(9)</sup> separates expenditure into four major groups, namely:

- **Personnel costs:**<sup>(9)</sup> collected from the computerized personnel system - items that are directly related to the payroll, that is, salaries and charges, holiday pay, the 13th month's salary, overtime, employer's costs, without cost-sharing. Thus, it is looking at the direct costs.
- **Consumption Costs:**<sup>(9)</sup> obtained from the computerized materials management system - items consumed per cost center, classified on a monthly basis, without cost-sharing, into: office supplies, fabrics and garments, maintenance and preservation materials, medical gases, radiological materials, laboratory materials, articles for hygiene and cleaning, fuels and lu-

bricant, medical and surgical equipment, instruments, chemicals, etc. Thus, it is looking at the direct costs.

- **Third Party Costs:**<sup>(9)</sup> corresponds to the purchase of specific services not provided by the institution's employees in a given period, such as surveillance and security, hygiene and cleaning, laboratory, clinics, and other services. The payment occurs through the presentation of invoices, receipts, etc. It is necessary to make cost-sharing, since these are indirect costs.
- **General costs:**<sup>(9)</sup> other expenses, such as water, utility charges, electricity, insurance, telephone, financial expenses (interest on arrears, bank fees), etc. It is necessary to account for these fees, as these are indirect costs.

Considering the four large cost groups, it was possible to calculate the total average costs at the Maternal and Child Hospital, for the years 2014 to 2016 (Table 1):

It is important to highlight that 80% of the total costs of the public hospital is dedicated to personnel, already accrued in all charges: 6% of consumption materials, 13% of third party services, and 1% of general costs. After surveying the total expenses of the hospital, it was possible to calculate how much cost the product generated by each cost center: the value of the physician consultation, the daily value of hospitalization on the unit, the daily stay in the ICU, etc. Thus, from the calculation of costs of individual cost centers, we obtained the costs of the Obstetric Center, where the delivery of this service occurs. The hospital studied has an monthly average cost of approximately R\$22.5 million, and the total Obstetric Center cost center represents approximately 12% of this total amount. These data are presented in table 2.

The cost of a normal risk delivery at the reference hospital is, a mean R\$ 8,113.77. The value of a surgical delivery corresponds to the value of delivery, plus surgery type 2 (plus surgical expenses), which is R\$ 2,881.38. Therefore, if the pregnant woman requires a surgical delivery, the average cost per surgical delivery is R\$ 10,995.15. It is important to emphasize that, in the field of production, the more one produces, the lower the cost of the product and

**Table 1.** Monthly Average Costs at the Maternal and Child Hospital

Monthly Average Costs at the Maternal and Child Hospital – 2014 to 2016				
Cost item	Monthly average value 2014	Monthly average value 2015	Monthly average value 2016	Monthly average
Direct costs				
Personnel	R\$17,678,191.03	R\$ 18,257,335.57	R\$18,185,669.95	R\$18,040,398.85
Consumption material	R\$ 1,967,692.60	R\$ 1,293,758.34	R\$ 1,129,771.60	R\$ 1,463,740.85
Indirect costs				
Third Party Service	R\$ 2,702,103.83	R\$ 2,665,402.81	R\$ 2,830,178.29	R\$ 2,732,561.64
General costs	R\$ 252,819.86	R\$ 306,235.09	R\$ 343,188.56	R\$ 300,747.84
General total	R\$22,600,807.32	R\$22,522,731.81	R\$22,488,808.39	R\$22,537,449.17

**Table 2.** Costs of the Obstetric Center of the Hospital

Monthly Average Costs of the Obstetric Center - 2014 to 2016				
Cost item	Monthly Average Costs – 2014	Monthly Average Costs – 2015	Monthly Average Costs -2016	Monthly Costs
1-Personnel	R\$1,471,661.88	R\$1,764,916.52	R\$1,627,355.17	R\$1,621,311.19
2 -Consumption material	R\$70,263.83	R\$48,519.86	R\$51,254.50	R\$56,679.40
3-Third Party Services	R\$184,878.76	R\$167,949.62	R\$177,484.20	R\$176,770.86
4- General Costs	R\$21,677.58	R\$21,955.44	R\$24,651.24	R\$22,761.42
Total Direct Costs=(1+2)	R\$1,541,925.71	R\$1,813,436.38	R\$1,678,609.67	R\$1,677,990.59
Total Indirect Costs= (3+4)	R\$206,556.34	R\$189,905.06	R\$202,135.44	R\$199,532.28
Cost-sharing received	R\$1,254,157.88	R\$886,902.33	R\$907,125.74	R\$1,016,061.98
5- Total cost=(direct cost + indirect + assessment)	R\$3,002,639.92	R\$2,890,243.78	R\$2,787,870.84	R\$2,893,584.85
6- Productivity (number of deliveries)	441	320	331	364
7- Average cost- Normal delivery = (5/6)	R\$6,808.71	R\$9,032.01	R\$8,500.59	R\$8,113.77
8- Average cost – Surgical delivery (7 + surgery type 2)	R\$9,690.09	R\$11,913.39	R\$11,381.97	R\$10,995.15

vice versa. Based on these values, bundled services were designed, considering the protocols involved.

### STAGE 2 – selection of service protocols:

This was divided into three modalities: patient with a normal-risk pregnancy, patient with a high-risk pregnancy and patient with extremely high-risk pregnancy. According to a Technical Note from the Government of Minas Gerais and the Association of Gynecologists and Obstetricians of Minas Gerais (SOGIMIG),<sup>(10)</sup> the stratification of the perinatal population by risk strata is central to the organization of the women's and children's health care network, allowing differentiated attention according to the health needs; that is, the right care, in the right place, with the right cost, and with the right quality.

According to the Ministry of Health,<sup>(11)</sup> a high-risk pregnancy is one in which the life or health of the mother, and/or the fetus, and/or the newborn are more likely to be affected than when considering the average population. Using some factors, it can be predicted whether the patient will be classified as a normal risk or high-risk.<sup>(11)</sup> Regarding this prevalence, it is estimated that 85% of pregnant women are normal risk and medium risk; 11.2% are high risk; and 3.8% are extremely high risk (including 0.7% of malformation).

The Technical Manual on High Risk Pregnancy of the Ministry of Health<sup>(11)</sup> provides the markers and gestational risk factors present before pregnancy, as well as situations that may occur during any period of the pregnancy, according to the degree of risk, advised by the National Commission for Incorporation of Technologies - SUS – CONITEC.<sup>(12)</sup> The Commission has the responsibility, among others, for establishing or amending Clinical Protocols and Therapeutic Guidelines.<sup>(12)</sup> The Protocol of Guidelines for Caring for the Pregnant Woman was prepared by a multidisciplinary group composed of obstetricians, family physicians, general practitioners, a neonatologist, an anesthesiologist, and obstetrical nurses invited by CONITEC and the General Coordination of Women's Health (CGSM - Coordenação Geral da Saúde da Mulher) of the Ministry of Health. Its goal was to guide health professionals and managers, in the public or private sphere, on important issues related to the pathways for delivery, their indications, and conduct, based on the best scientific evidence available.<sup>(12)</sup>

Therefore, the first protocol chosen was the markers and gestational risk factors present prior to pregnancy, as well as situations that may occur

during pregnancy - beginning to the end, as classified by the Ministry of Health and Conitec:<sup>(11,12)</sup>

- Existence of prenatal care;
- Individual characteristics and favorable / unfavorable sociodemographic conditions;
- Previous reproductive history;
- Prenatal care adequate for identifying obstetric risk;
- Consultations performed according to schedule;
- Pre-existing clinical conditions;
- Obstetric illness during the current pregnancy;
- Clinical comorbidities;
- Factors related to the current pregnancy.

The choice of the second protocol considered the quality-adjusted life-year indicators - QALY. According to Vergel and Sculpher,<sup>(13)</sup> countries such as the United Kingdom, Australia, Canada, the Netherlands, and Scandinavia use more than a cost-effective analysis. Their methodology is a cost-utility model, by which the health outcome is measured using the QALY indicator.<sup>(13)</sup>

This method analyzes the estimated costs of the investment in health, compared to the means that are currently being used, and whether or not this investment is worthwhile. This methodology was developed according to Ferreira<sup>(14)</sup> in the 1970s, as a manner of analyzing health gains and their changes both in quality of life and in time of life gained (mortality). The QALY is an indicator of how a person's health status has evolved, analyzing five dimensions, in three levels, according to Phillips and Thompson,<sup>(15)</sup> as follows:

- Mobility;
- Pain/discomfort ;
- Personal care;
- Anxiety/depression;
- Usual activities (working, studying, housework, recreation and activities).

One year of perfect health for QALY generates an indicator of 1. Death is considered equivalent to an indicator of 0. However, according to Phillips and Thompson,<sup>(15)</sup> some states of health can be considered worse than death, therefore these would be considered negative indicators (-1).

When associated with costs, this indicator enables the analysis of not only quality and effective-

ness of an intervention, compared with another, but also the costs of the intervention - whether it is high or low, based on the QALY. That is, QALY is based on two components - quantity and quality of life.<sup>(13-15)</sup>

In the second stage of protocols, the patient safety indicators and possible triggers were considered. A report entitled, *To Err is Human: Building a Safer Health System*, was published in 1999, in which the main errors associated with health care were presented to the world. For Wachter,<sup>(16)</sup> adverse health events are divided into avoidable and non-avoidable events. Wachter,<sup>(16)</sup> cites that the Institute for Healthcare Improvement (IHI) defined the term, which is, "unintentional bodily injury resulting from or promoted by medical care (including the absence of indicated medical treatment) that demands an additional care, treatment or hospitalization, or resulting in death." Based on the same study by the IHI, possible triggers that could suggest an outcome generated by adverse events were identified, as shown below:<sup>(16)</sup>

- Care Module Triggers;
- Medication Module Trigger
- Surgical Module Trigger;
- Intensive Care Module Trigger;
- Perinatal Module Trigger;
- Emergency Module Trigger

According to Wachter<sup>(16)</sup>, the major impact of errors associated with health care and adverse events falls on patients and their loved ones. For Wachter,<sup>(16)</sup> in the fee-for-service system, part of the problem is that caregivers and institutions are usually compensated for unsafe care, providing little financial incentive to make necessary investments in safer systems.

**STAGE 3: Preparation of bundled services:** in order to establish the value of the bundled services, the clinical conditions of the pregnant woman were considered (risk factors) first. Subsequently, the value of the delivery (either normal or surgical) was calculated, together with the cost of the hospitalization of the pregnant woman, either in the unit, in the high-risk sector (where there are more dedicated teams, equipment, and patient monitoring), and/or ICU. The average hospitalization time in

each sector was considered in this analysis, based on the average time of hospitalization provided by the Hospital Statistics Unit.

The synthesis of the calculation of the bundle can be visualized in the equation below:

$$\text{Birth cost} + \text{Cost of hospital stay} = \text{Total cost of bundle}$$

It is important to highlight that all other expenses involved (outpatient care, examinations, food, medical and hospital supplies, etc.) are already included in the expenses involved, directly or indirectly. With information on the patient's profile and cost data, depending on the type of delivery to be performed, it will be possible to create the bundles. It is important to highlight that the institution can have a predefined patient profile, if she performs prenatal follow-up at the same institution that will perform the delivery, and has the data recorded in an electronic medical record. This would make it easier to classify.

## Results

The following is an approximate profile of the patients, classified according to the degree of risk presented, QALY indicator, and patient safety. It is important to highlight that the risk factors defined are broad. Here we present a short version that can be seen in chart 1.

**Chart 1.** Bundle 1 – Cost of Patients at Normal Risk

Risk factors – Patient at normal risk – Bundle 1
Age between 16 and 34 years
Planned or desired pregnancy
Absence of clinical and / or obstetrical complications in the previous pregnancy, and / or in the current pregnancy
Beginning of prenatal care prior to the 12th week of gestation
Have performed the exams recommended in prenatal care:
Up to 28 weeks –monthly
From 28 to 36 weeks – every two weeks
From 36 to 41 weeks –weekly
Interval between visits: the total number of visits should be at least 6 (six), with follow-up between physician and nurse. Oral health care.
No problems ambulating
Little pain or discomfort
No problems with personal care
Low anxiety or depression
Few problems with customary activities

**Bundle 1 – Normal risk:** this bundled service includes pregnant women who do not present any of the essential clinical conditions related to high risk or extreme risk bundles. This means that they will only fit into the clinical conditions that characterize normal risk.

The patient with normal risk can present up to two probable outcomes, as explained below:

a) **Costs for pregnant women with a normal risk for routine delivery:** in this possible outcome, in addition to the cost of a routine delivery, there is added the cost of hospitalization for the rooming-in accommodations. According to information from the Center for Hospital Statistics, the normal risk patient stays for up to two days in the rooming-in, a unit where the mother and the child recover from childbirth. See calculations in table 3.

Thus, the average total cost of routine delivery plus hospitalization will be R\$ 9,652.63 (nine thousand, six hundred and fifty-two reais, and sixty-three cents). The patient with this outcome stays, on average, two days at the hospital.

b) **Costs for the pregnant woman at normal risk with surgical delivery:** in this possible outcome, in addition to the cost of the surgical delivery, the costs of hospitalization for the rooming-in accommodation are calculated together. According to information from the Center of Statistics of the Hospital, the normal risk patient stays for up to two days hospitalized in the rooming-in-unit. The cost data is shown in table 4.

Thus, the total average cost of the surgical delivery plus hospitalization will be R \$ 12,534.01 (twelve thousand, five hundred and thirty-four reais, and one cent). The patient with this outcome remains, on average, two days in the hospital.

**Bundle 2 – High Risk:** patient who presents clinical conditions in at least one of the following areas: cardiovascular, respiratory, hematologic, endocrine, infectious, immune, renal, neurological, gastrointestinal, psychiatric, previous complications, or problems in the current pregnancy, which are listed in chart 2.

The high-risk patient can presents up to two likely outcomes, as explained below:

**Table 3.** Costs for pregnant women with a normal risk for routine delivery

Bundle 1: Costs for pregnant women with a normal risk for routine delivery				
Cost Item	Monthly Average Costs – 2014	Monthly Average Costs – 2015	Monthly Average Costs -2016	Monthly Costs
Average costs- Routine delivery	R\$6,808.71	R\$ 9,032.01	R\$ 8,500.59	R\$ 8,113.77
Average cost – Unit hospitalization (two days)	R\$ 932.05	R\$ 2,110.33	R\$ 1,574.20	R\$ 1,538.86
Total average cost – routine delivery of normal risk	R\$ 7,740.76	R\$ 11,142.34	R\$ 10,074.79	R\$ 9,652.63

**Table 4.** Costs for the pregnant woman at normal risk - surgical delivery

Bundle 1: Costs for the pregnant woman at normal risk - surgical delivery				
Cost Item	Monthly Average Costs – 2014	Monthly Average Costs – 2015	Monthly Average Costs -2016	Monthly Costs
Average Costs - Surgical delivery	R\$ 9,690.09	R\$ 11,913.39	R\$ 11,381.97	R\$10,995.15
Average Costs - Unit Hospitalization (two days)	R\$ 932.05	R\$ 2,110.33	R\$ 1,574.20	R\$1,538.86
Total Average Costs - Surgical Delivery for Normal-Risk	R\$ 10,622.14	R\$ 14,023.72	R\$ 12,956.17	R\$12,534.01

**Chart 2.** Bundle 2 – Patients with high risk

Risk factors – High risk – Bundle 2	
Age older than 35 years	Recurrent urinary infection, or two or more episodes of pyelonephritis
Nulliparity and great multiparity	Positive Test for <i>Clostridium difficile</i> in stool sample
Pelvic Presentation	Explained and unexplained perinatal death
Multiple gestation	Gestational diabetes
Some problem with ambulation	Arterial hypertension
Moderate pain or discomfort	Pneumopathies
Some problem for bathing or dressing by herself	Nephropathies
Moderate anxiety or depression	Endocrinopathies (mainly diabetes and thyroid disease)
Some problems performing usual activities	Homeopathies
Specialist consultation	Psychiatric illnesses requiring follow-up (psychoses, severe depression, etc.)
Time in the emergency unit of more than six hours	History of deep vein thrombosis or pulmonary embolism
Dependence on legal or illicit drugs	Gynecopathies (uterine malformation, myomatosis, adnexal tumors, and others)
Previous preterm childbirth	Carriers of infectious diseases such as hepatitis, toxoplasmosis, HIV infection, tertiary syphilis (USG with fetal malformation), other STDs (condyloma), neoplasias
Sterility/infertility	Pre-eclampsia and eclampsia
Previous uterine surgery (including two or more previous cesareans)	Premature amniorrhexis
Cardiac disease	Bleeding gestational
Maternal genetic alteration	Isthmus-cervical insufficiency
Leprosy	Alloimmunization
Tuberculosis	Fetal death (stillbirth)
Severe maternal malnutrition	Polydammnium or oligohydramnios (amniotic fluid quantity)
Absence of prenatal control	Fetal malformations or fetal arrhythmia
Habitual miscarriage	Placenta previa, complete or partial
Infectious diseases (consider the local epidemiological situation)	Placental acreta - pregnancy with prior caesarean section
Undue or accidental exposure to teratogenic factors.	Infections such as rubella and cytomegalovirus acquired during the current pregnancy
Deviation in uterine growth, number of fetuses, and volume of amniotic fluid	Patient fall
Preterm labor, or prolonged pregnancy	Diagnosis of pneumonia
Twin pregnancy	

**a) Costs of high-risk pregnant women with routine delivery:** in this possible outcome, the costs of hospitalization in the high-risk unit, plus the cost of routine delivery, and the cost of returning to the unit for recovery, are calculated together. According to information from the Center for Statistics of the Hospital, the high-risk patient stays, on average, five days in the unit, in addition to up to two days in the rooming-in unit. The costs of this bundle are presented in table 5.

Thus, the total average cost of a routine, high-risk delivery plus hospitalization will be R\$ 15,676.01 (fifteen thousand, six hundred and seventy-six reais and one cent). The patient with this outcome stays in the hospital, on average, seven days.

**Cost of high-risk pregnant women with surgical delivery:** with this possible outcome, the cost of hospitalization in the high-risk unit, plus the cost of the surgical delivery, plus the cost of returning to the unit for recovery are calculated to-

**Table 5.** Cost of high risk pregnant women – normal delivery

Bundle 2: Cost of high risk pregnant women – normal delivery				
Cost item	Monthly Average Costs – 2014	Monthly Average Costs – 2015	Monthly Average Costs – 2016	Monthly Costs
Average costs - High risk hospitalization- (5 days)	R\$ 4,581.50	R\$ 4,970.35	R\$ 8,520.10	R\$ 6,023.98
Average costs - routine delivery	R\$6,808.71	R\$ 9,032.01	R\$ 8,500.59	R\$ 8,113.77
Average costs – nursing unit hospitalization- (2 days)	R\$ 932.05	R\$ 2,110.33	R\$ 1,574.20	R\$ 1,538.86
Total average cost - Routine delivery of high risk	R\$ 12,322.26	R\$ 16,112.69	R\$ 18,594.89	R\$ 15,676.61

**Table 6.** Cost of high-risk pregnant women - surgical delivery

Bundle 2: Costs of High-Risk Pregnant Women - Surgical Delivery				
Cost item	Monthly Average Costs – 2014	Monthly Average Costs – 2015	Monthly Average Costs -2016	Monthly costs
Average costs - high risk hospitalization (five days)	R\$ 4,581.50	R\$ 4,970.35	R\$ 8,520.10	R\$ 6,023.98
Average costs – surgical delivery	R\$ 9,690.09	R\$ 11,913.39	R\$ 11,381.97	R\$ 10,995.15
Average costs – unit hospitalization (two days)	R\$ 932.05	R\$ 2,110.33	R\$ 1,574.20	R\$ 1,538.86
Total average cost – surgical delivery for high risk	R\$15,203.64	R\$18,994.07	R\$21,476.27	R\$18,557.99

**Chart 3.** Bundle 3– Extremely High-Risk Patients

Risk Factors – Extremely High-Risk Pregnancy – Bundle 3	
Hemorrhagic or hypertensive syndrome	Elevation in urea or serum creatinine twice (2x) the baseline
Laboratory evidence of proteinuria	Administration of Vitamin K
Patient confined in bed	Return to surgery
Extreme pain or discomfort	Admission to a post-operative intensive care unit
Unable to bathe or dress by him/herself	Intubation, reintubation, or BiPAP in post-anesthesia recovery
Extremely anxious or depressed	Elevation at Troponin level >1.5 nanogram/mL during post-operative period
Unable to perform usual activities	Occurrence of any operative complication
Blood transfusion or use of hemocomponents	Readmission to the intensive care unit
Code activation (blue, red, yellow, etc.), cardiac or respiratory arrest, or Fast Response Unit activation	Intubation/reintubation
Acute dialysis	Use of Terbutaline
Radiography or Doppler Ultrasonography to assess embolism or deep venous thrombosis	3rd or 4th degree laceration
Decrease in hemoglobin or hematocrit by ≥25%	Platelet count <50,000
Health care associated infection	General anesthesia administration
Glycaemia <50 mg/dL	Emergency readmission within 48 hours after discharge

gether. According to information from the Center for Hospital Statistics, the high-risk patient stays, on average, five days in the unit, in addition to up to two days hospitalized in the rooming-in unit. The data on the costs of this bundle is presented in table 6.

Thus, the total average cost of the surgical delivery - high risk plus hospitalization - will be R\$ 18,557.99 (eighteen thousand, five hundred fifty-seven reais, and ninety-nine cents). The patient with this outcome stays, on average, seven days at the hospital.

**Bundle 3 – Extremely High-Risk:** this bundle includes patients who present at least one of the conditions indicated in chart 3.

The extremely high-risk patient can presents up to two probable outcomes, as explained below:

a) **Cost of the extremely high risk pregnant woman with surgical delivery and ICU stay:** with this possible outcome, in addition to the surgical delivery cost, the cost of hospitalization in the maternal ICU, and the return to the unit for recovery are calculated together. According to statistics from the hospital, extremely high-risk pregnant women are hospitalized for five days in the maternal ICU, plus rooming-in recovery, on average two days in the rooming-in – unit. Table 7 shows the costs of the pregnant woman at extremely high risk, Type I.

Thus, the total average cost of the extremely high-risk surgical delivery, plus the hospitalization, will be R\$ 41,386.49 (forty-one thousand, three hundred and eighty-six reais, and forty-nine cents). The patient with this outcome stays, on average, seven days at the hospital.

**Table 7.** Costs of the pregnant woman at extremely high risk, Type I

Bundle 3: Cost of the pregnant woman at extremely high risk, Type I				
Cost item	Monthly Average Costs – 2014	Monthly Average Costs – 2015	Monthly Average Costs -2016	Monthly Costs
Average costs – surgical delivery	R\$ 9,690.09	R\$ 11,913.39	R\$ 11,381.97	R\$ 10,995.15
Average costs – ICU hospitalization (five days)	R\$25,491.65	R\$ 32,271.65	R\$ 28,794.15	R\$ 28,852.48
Average costs – Unit hospitalization (two days)	R\$ 932.05	R\$ 2,110.33	R\$ 1,574.20	R\$ 1,538.86
Total average costs – surgical delivery of extremely high risk - Type I	R\$36,113.79	R\$ 46,295.37	R\$ 41,750.32	R\$ 41,386.49

**Table 8.** Costs of the pregnant woman at extremely high risk – Type II

Bundle 3: Costs of the pregnant woman at extremely high risk – Type II				
Cost item	Monthly Average Costs – 2014	Monthly Average Costs – 2015	Monthly Average Costs -2016	Monthly Costs
Average costs – high risk hospitalization (five days)	R\$ 4,581.50	R\$ 4,970.35	R\$ 8,520.10	R\$ 6,023.98
Average costs- surgical delivery	R\$ 9,690.09	R\$ 11,913.39	R\$ 11,381.97	R\$ 10,995.15
Average costs – ICU hospitalization (five days)	R\$ 25,491.65	R\$ 32,271.65	R\$ 28,794.15	R\$ 28,852.48
Average costs – unit hospitalization (two days)	R\$ 932.05	R\$ 2,110.33	R\$ 1,574.20	R\$ 1,538.86
Total average costs – surgical delivery for extremely high-risk, Type II	R\$40,695.29	R\$51,265.72	R\$51,270.42	R\$ 47,743.81

**b) Costs of the pregnant woman at extremely high risk, with surgical delivery and ICU stay:** with this possible outcome, the cost of hospitalization in the high risk unit is added in cases where the patient was hospitalized prior to childbirth, the cost of surgical delivery, in addition to ICU stay for stabilization, plus the cost of return to the unit for recovery. According to information from the Center for Hospital Statistics, the extremely high-risk patient stays, on average, five days in the unit, in addition to up to five days in the maternal ICU, plus two days hospitalized in the rooming-in unit for recovery.

The costs of the pregnant woman at extremely high risk – Type II - demonstrated in table 8.

Thus, the total average costs of the surgical delivery of extremely high-risk, plus hospitalization, will be R\$47,743.81 (forty-seven thousand, seven hundred and forty-three reais, and eighty-one cents). The patient with this outcome stays, on average, twelve days at the hospital.

After patient classification into one of the bundled services described above, the patient, health plan providers, and other interested parties can be informed about the degree of gestational risk into which the patient has been classified, as well as the predicted value for the procedure, regardless of any further complications, within the established average timeframes.

## Discussion

However great the challenge of proposing a new hospital billing system, it is understood that this subject is of a pressing nature, and needs to be studied in all its nuances. The search for transparency in the health area no longer allows us to hide the real costs behind a per-procedure spreadsheet. The fee-for service model needs to be reviewed. New proposals need to be made available to all stakeholders in the health area. The costs presented here are real, and can bring light to all those who have doubts about this subject. Regardless of the fact that this model has been applied here to a single service, the same techniques can be replicated in other public and private healthcare facilities.

In the aforementioned study, when hospitalized in a health unit, the pregnant woman would be classified according to the degree of risk presented. With this, both the patient and the health service would know the estimated cost of care. This strategy would reduce the number of procedures recorded during care, allowing more time to be spent on patient care, following standardized care protocols. The concern with the quality of service will be greater, as the billing will occur for that defined package.<sup>(2)</sup> These factors, in addition to affecting patient safety, have a direct impact on the length of hospital stay, 15 and may have an impact on the

patient's classification as high risk or extremely high risk. Therefore, it is important to focus more on the quality of care than on the number of procedures.

The case was applied within the birthing service of a public hospital, but it can be replicated in any institution, whether public or private, considering its costs and unit quality indicators. It should be noted that the case presented does not take profit into account. Only the cost data are presented. If applied by health plans or private hospitals, the peculiarities of each institution must be considered. The values vary to a greater or lesser extent, depending on resource management.

Other relevant information to be considered is that in the study presented here, the care with the baby is not included, only that of the mother. Thus, it is necessary to complement these studies with the costs of the binomial - mother and child - and to verify the real impact, if a bundled service is established. Because they are different cost centers, we understand the need to create separate bundles for each patient.

It is important to emphasize that the same methodology used in this study can be applied to other institutions, but considering specific data and indicators of the institution, especially its hospital costs. Standardized protocols are essential to reduce costs and increase the quality of care for the patient. This ensures uniformity of actions and reduction of waste. Multidisciplinary work of health professionals is fundamental.

However, it is necessary to recognize that the proposed billing model has provoked controversies in the literature of the area. Bichuetti and Ali Mere<sup>(6)</sup> understand that simply changing the remuneration model, without the awareness that it is necessary to have a change of attitude and a caring business culture, is to seek a short-term solution that would drag the same problems of the present system into the future.

Bailey<sup>(17)</sup> also emphasizes that value-based health care alone, such as the Bundled Service model, does not reduce spending or improve outcomes. For the author, the transition to this approach implies additional infrastructure, training costs, and the complexity of delivering health care in an environment

that combines fee-for-service with value-based compensation. In addition, in order to deliver on the promise of improving health and reducing costs, Bailey<sup>(17)</sup> believes that this methodology needs to be improved by means of a structured approach to waste elimination, and implemented together with extensive efforts to deal with factors that go beyond the traditional limits of health care.

## Conclusion

It was possible to achieve a new billing table, associating hospital costs and specific service protocols to develop bundled services. In addition to greater control of the costs involved in the treatments, this same classification can be used to plan the therapeutic possibilities that the patient will need to receive care that focuses on quality. In addition, this proposal, applied to the public health service, offers opportunities for the Ministry of Health to better control the costs of its units by size, by means of the application of protocols, and to unify the standard of care in the units. And, in the private sector, the health plans could better manage the reimbursement to hospitals, as well as control the quality of care with application of standards to be achieved, through the bundles.

This study presents potentialities, but also points of improvement. Even studying the costs and the development of protocols, there was not enough time to apply the bundled services model in the institution, which would allow for further improvement of the indicators of the bundles. Tests were only performed on a prototype, which allowed us to classify the patient, according to her degree of gestational risk, but which requires improvement to become a system to be implemented in hospitals. Given this, we believe that this new model demands complementary studies, and it is suggested that future studies contemplate these stages of implementation and concrete evaluation of the proposal. However, we defend its viability and implementation as a real alternative to the existing billing. This study can be extended to other services of a health institution, and serve as an inspiration for other scholars and managers to apply in their institutions.

## Collaborations

Costa EP and Arrais AR contributed to the study design, data analysis, article writing, relevant critical review of the intellectual content, and final approval of the version to be published.

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