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Effect of patient risk on the volume–outcome relationship in obstetric delivery services☆

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ABSTRACT

Health care organizations that offer more delivery services are assumed to provide better quality of care, and a higher rate of cesarean section (CS) is generally assumed to be an indicator of poor quality of care. This study analyzed whether the volume–outcome relationship in delivery services, measured by the rate of CS, differed depending on the risk status of delivery patients.

Delivery claims were identified in the National Patient Sample (NPS) for 2009. The study hospitals were categorized into low and high delivery-volume groups, and patients were categorized into three risk groups (below average, medium, and high) based on their risk status. Risk factors were included in the adjustment model to identify differences among patients and produce risk-adjusted CS rates.

Risk-adjusted CS rates did not differ significantly between patients in low- and high-volume hospitals when the sample was not divided according to risk status. However, when the sample was divided according to patient risk status, significant differences in risk-adjusted CS rates in the below-average- and medium-risk groups were revealed between low- and high-volume hospitals. No such significant difference was observed for the high-risk group. The largest difference in CS rates between low- and high-volume hospitals was observed in the medium-risk group, and the high-risk group showed the smallest difference between the two volume groups. The high-risk group had the highest CS rates, and the below-average-risk group had the lowest CS rates.

Although we found the traditional volume–outcome relationship in delivery patients, the data also revealed that patient risk status influenced this relationship. Policies and interventions based on volume–outcome theory should differ according to patient risk status.

1. Introduction

Research has provided empirical evidence supporting volume effects on patient outcomes for several surgical and medical conditions [1–5]. Various programs based on this relationship have been implemented to improve patient outcomes, including the regionalization of patient referrals [6,7] and the public reporting of data on volume and outcomes [8]. The Korean government has publicized data on

☆ This study used the national patient sample of the Health Insurance Review and Assessment Service (HIRA-NPS-2009-0067). The study result is not related to the Ministry of Health and Welfare or the Health Insurance Review and Assessment Service of Korea.

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hospital delivery volumes, medical costs, hospitalization durations, and risk-adjusted cesarean section (CS) rates to enable patients to make informed choices about where to obtain healthcare. Compared with other countries, the CS rate in Korea (>38%) is high [9–11].

Previous empirical research has produced inconsistent results on the volume–outcome relationship in delivery services. Some studies have found that hospitals with more deliveries had higher levels of perinatal care [12], lower maternal complication rates [13], and less mortality and morbidity compared with lower-volume hospitals [5]. However, a larger number of studies have found no such volume–outcome relationship in hospitals [14–20].

Volume–outcome theory implies that the volume of hospital deliveries is positively associated patient outcomes. However, previous studies have not provided clear evidence that higher volume is associated with better outcomes in hospital delivery services. In the absence of such a clear relationship, programs that refer delivery patients to hospitals with minimum numbers of deliveries or provide delivery-related data will not achieve their objective of improving outcomes.

The inconsistent results regarding the volume–outcome relationship in delivery patients may be attributed to the exclusion of some patient groups from study samples and the inclusion of others (e.g., low-risk or high-risk patients) [14,17,18].

Various studies have used the CS rate as a quality indicator to judge the performance of delivery services in hospitals. The CS rate has become one of the most commonly used indicators and better represents the true differences in provider performance than random variation [21]. The Health Insurance Review and Assessment Service (HIRA) in Korea, which is a quasi-governmental agency, has used this indicator to evaluate the performance of delivery services in health care organizations for over 10 years. The HIRA reported CS rates exceeding 35% in 2012, which exceeds the rate recommended by the World Health Organizations. There was also large variation, with CS rates from 6.0–81.0% [22]. The variation in CS rates among healthcare organizations suggests that there is a quality issue in delivery services, and delivery patients may not receive quality care depending on their risk status. Reducing the CS rate has become a health policy issue to improve patient outcomes.

Studies analyzing whether patient volume has consistent effects on patient outcomes according to patient risk status have documented variation in the relationship between patient outcomes and volume as a function of patient risk status [23,24]. However, few studies have analyzed the effects of the hospital delivery volume on CS rates according to patient risk status. One study [17] examined the effects of delivery volume on patient outcomes using the CS rate in high-risk women with gestational and type 2 diabetes mellitus. They found no volume–outcome relationship. Such results suggest that there is no variation in the effect of volume on outcomes in delivery patients in hospitals related to patient risk.

This study analyzed whether the volume–outcome relationship in hospital delivery services varied according to patient risk status by calculating risk-adjusted CS rates and comparing these rates among groups defined according to patient risk status. Based on previous studies, we hypothesized that the volume–outcome relationship for delivery patients depends on the patient risk status and that high-risk delivery patients have a different volume–outcome relationship compared with other risk groups.

2. Methods

2.1. Data sources

This study used the delivery claims of all hospitals, with the exception of those providing tertiary care, identified in the National Patient Sample (NPS) and submitted in 2009. The NPS was drawn from the Korean National Health Insurance (NHI) Program, which includes all hospitals and individuals. The NPS, which is stratified by age and sex, consists of 13% (n = 700,000) of all inpatient claims from hospitals participating in the NHI Program. Delivery patients <16 years or >49 years of age were excluded from the analysis. To control for the effects of a small number of deliveries, providers with <10 claims during the study period were excluded. A total of 105 hospitals were included in the final sample.

2.2. Measurement of variables

We defined delivery claims in the NPS using a modified version of the definition employed in a previous study [9], according to the procedure codes of the HIRA of Korea and the Korean diagnosis-related group (DRG) codes for delivery services. The HIRA reviews all claims generated by the NHI Program, and these reviewed claims are used to provide reimbursement for medical services in Korea. After applying the codes to the 2009 NPS claims, 21,807 claims with at least one HIRA procedure code or DRG code for delivery services were identified, and CSs were identified using HIRA procedure codes.

Hospitals were classified into low- and high-volume delivery facilities based on the annual volume of deliveries. Hospitals were initially divided into quartiles according to delivery volume; after the initial analysis, these were collapsed into low- and high-volume groups.

2.3. Risk-adjustment model

A risk-adjustment model was used to quantify patient risk status and to produce risk-adjusted outcome indicators for hospitals. International Classification of Disease 10 diagnostic codes and HIRA procedure codes from claims data were used to define comorbidity indicators for each patient to distinguish the main reason for CS. The following 16 factors were identified [9]: malignancy, cord prolapse, bleeding, malpresentation, dysfunctional labor, fetal distress, diabetes, eclampsia, fetal abnormalities, multiple pregnancies, polyhydramnios/oligohydramnios, problems in the placenta, previous CS, sexual disease, older mother (>35 years), and preterm delivery.

Although dysfunctional labor and fetal distress are known risk factors for CS, providers can influence these factors [9,25,26]. Thus, these two factors were not included in the model because of measurement problems. Because no