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Cesarean Delivery Rates Vary 10-Fold Among US Hospitals; Reducing Variation May Address Quality, Cost Issues

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Abstract

Cesarean delivery is the most commonly performed surgical procedure in the United States, and cesarean rates are increasing. Working with 2009 data from 593 US hospitals nationwide, we found that cesarean rates varied tenfold across hospitals, from 7.1 percent to 69.9 percent. Even for women with lower-risk pregnancies, in which more limited variation might be expected, cesarean rates varied fifteen-fold, from 2.4 percent to 36.5 percent. Thus, vast differences in practice patterns are likely to be driving the costly overuse of cesarean delivery in many US hospitals. Because Medicaid pays for nearly half of US births, government efforts to decrease variation are warranted. We focus on four promising directions for reducing these variations, including better coordination of maternity care, more data collection and measurement, tying

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In this month's issue of *Health Affairs*, Katy Kozhimannil and coauthors report on their study revealing a tenfold variation in cesarean rates across US hospitals – and fifteen-fold variation for women with relatively low-risk pregnancies, in which more limited variation might be expected. They argue that differences in practice patterns are likely driving the variation and potentially producing costly misuse of cesareans. Because Medicaid pays for nearly half of US births, government efforts to decrease variation are warranted, the authors contend. They focus on four promising directions for doing so, including tying Medicaid payment to quality improvement. Kozhimannil is an assistant professor in the Division of Health Policy and Management at the School of Public Health, University of Minnesota. Her research informs the development, implementation, and evaluation of health policy that affects reproductive-age women and their families. Kozhimannil has a particular interest in institutional and government policies affecting maternal and neonatal health and policy impacts among vulnerable populations. She earned a master's degree in public affairs from Princeton University and a doctorate in health policy from Harvard University.

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Medicaid payment to quality improvement, and enhancing patient-centered decision making through public reporting.

Cesarean delivery is the most common operating room procedure performed among all patients in US hospitals,[1] and its use is growing. Cesarean rates increased from 20.7 percent of all deliveries in 1996 to 32.8 percent in 2011.[2,3] In international comparisons, US cesarean rates exceed those for similar countries, without measurable clinical benefit.[4,5]

The rise in the cesarean rate is commonly attributed to several factors, including a higher rate of conditions that may necessitate cesarean delivery--such as multiple gestation, maternal obesity, preterm labor, gestational diabetes, or hypertension--as well as physicians' concerns about liability and malpractice.[4,6,7] But evidence indicates that these factors do not fully account for the wide differences in cesarean rates observed across states and countries.[8–11]

Cesarean delivery is an important, potentially lifesaving intervention.[12,13] Although common, cesarean delivery is major abdominal surgery that carries distinct risks compared with vaginal delivery: greater chance of infection, injury, blood clots, and need for emergency hysterectomy.[12–14] It also can cause persistent pain, compromise the establishment of breastfeeding, and complicate later deliveries.[15–17] Cesarean delivery is often performed to improve neonatal outcomes and mitigate risk; however, it is associated with a greater risk of asphyxia, respiratory distress, and other pulmonary disorders in infants.[3,18,19]

The widespread use of cesarean delivery has important policy implications. Cesarean delivery is much more costly than vaginal delivery ($12,739 versus $9,048 for private health insurers in 2010).[20] Adverse outcomes and complications have substantial cost implications for delivery systems and health insurers, both public and private.[21]

This fact is particularly salient for maternal and neonatal health interventions, as hospital charges for these services exceed those for any other condition.[22] The state and federal budget impacts are particularly notable, as public insurance programs finance nearly half of all US births: In 2009, state Medicaid programs paid more than $3 billion for cesarean deliveries.[23]

The National Institutes of Health, policy leaders, and clinicians have expressed concern over increasing cesarean rates.[24] For example, a leading obstetrician recently issued a call to curb the "relentless rise" of cesarean deliveries.[6] Similarly, in its in Healthy People 2020 initiative, the Department of Health and Human Services put forth clear, authoritative public health goals recommending a 10 percent reduction in both primary and repeat cesarean rates, from 26.5 percent to 23.9 percent, and from 90.8 percent to 81.7 percent, respectively.[25]

A targeted approach to achieving such reductions might focus on hospitals with exceptionally high cesarean rates. However, adopting such a strategy requires quantification of hospital-level variation in cesarean delivery rates.

Health care providers, patients, and policy makers recognize that variation in procedure rates is an important indicator of health care quality. Such variation may signal potential underuse or overuse of a service, both of which may be clinically harmful and costly.[26] Understanding the extent of variation and its causes may provide opportunities for identifying policy options to improve care. However, the majority of prior research on US

variations in care has focused on the Medicare population and conditions affecting older adults; thus, it does not commonly include women of reproductive age.[27,28]

The limited available evidence documenting variations in cesarean delivery rates points to differences in practice patterns as a primary driver of these variations.[9,10,29] Prior research on this topic looks at variations across geographic areas--states and counties--rather than among health care facilities, and existing research on hospital-level variations in cesarean rates uses a nonrepresentative sample.[9,10] No prior study has reported hospital-level variations in cesarean delivery rates using recent, nationally representative data. The goal of this analysis is to do so.

Study Data And Methods

Data And Study Population

We used data from 1,050 hospitals in 44 states from the 2009 Nationwide Inpatient Sample, part of the Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project. The 2009 Nationwide Inpatient Sample is designed to approximate a 20 percent stratified sample of all US hospitals, drawing from an all-payer inpatient claims database. It has been regularly used in health services research, including previous studies examining variations in care.[30]

Our analyses started with hospitals that reported one or more discharges with neonatal or maternal diagnoses and procedures ($N = 675$). From these hospitals, we identified obstetric deliveries using a validated methodology,[31] then excluded hospitals with fewer than 100 deliveries in 2009 (82 hospitals). This cutoff is consistent with prior research and ensured that hospitals had rates stable enough to enable meaningful comparisons.[32] Our final data set included 817,318 deliveries that occurred in 2009 at 593 different hospitals.

Measuring Variables

We focused on two outcomes calculated at the hospital level: overall cesarean rates, and cesarean rates for lower-risk deliveries. Consistent with validated methods and prior research using the Nationwide Inpatient Sample, we identified cesarean delivery using *International Classification of Diseases,* Ninth Revision (ICD-9) procedure codes (740.X, 741.X, 742.X, 744.X, 749.9) as well as diagnosis-related group payment codes 370 and 371.[31] We calculated each hospital's cesarean delivery rate as the percentage of all obstetric deliveries in each hospital in 2009 that were cesareans.

Recognizing that unadjusted cesarean rates probably differ across hospitals because of differences in patient populations, we also calculated hospital-specific rates of cesarean delivery among women who were at lower risk for cesarean delivery. To determine which pregnancies were lower risk, we followed the recommendations of the American College of Obstetrician-Gynecologists as closely as our data allowed.[13]

We identified this subset by excluding pregnancies with any of the following characteristics: preterm delivery (prior to thirty-seven weeks gestation, ICD-9 644.2, 644.20, 644.21), multiple gestation (ICD-9 651, 651.0X, 651.1X, 651.2X, 651.3X, 651.4X, 651.5X, 651.6X, 651.8X, 651.9X), fetal malpresentation (ICD-9 652.X, 660.0X), and prior cesarean delivery (ICD-9 654.20, 654.21, 654.23). Thus, our measure of the lower-risk cesarean delivery rate at each hospital represents the rate of cesarean deliveries for women with term, singleton, and vertex pregnancies (those that are not in breech position) and no prior history of cesarean.

In our analysis we also used hospital-specific data on bed size, teaching status, and rural versus urban location. For bed size we used the categories defined by the Agency for Healthcare Research and Quality. Thirteen hospitals (2 percent of our sample) were missing data on bed size and were included in overall totals and plots but not in stratified estimates. Hospital teaching status is based on information from the American Hospital Association's Annual Survey of Hospitals. Finally, classification of hospitals as either urban or rural was based on Core Based Statistical Area codes from 2000 census data.

Data Analysis And Presentation

We calculated the rate of both cesarean deliveries and lower-risk caesarean deliveries across all hospitals in our sample and stratified them by hospital bed size, teaching status, and geographic location. For each stratum we calculated the minimum, maximum, and mean rate values, as well as the interquartile ranges (the difference between the twenty-fifth and seventy-fifth percentiles). To graphically display variations in cesarean rates, we grouped hospitals into 1 percent bands and plotted the distribution using circle symbols representing each hospital (Exhibits 1 and 2).

Data for this analysis were de-identified. As a result, the study was granted exemption from review by the University of Minnesota Institutional Review Board.

Limitations

Several limitations of our analysis merit discussion. Although the Nationwide Inpatient Sample is reliably coded and has many strengths for analysis of obstetric care outcomes,[31] it is not possible to identify first-time mothers in this data set. Nor can we measure gestational age beyond distinguishing preterm delivery. Having such information would aid our discussion and understanding of the use of cesarean among subpopulations of interest, but it is not likely to explain the variations we reported or to alter our interpretation.[24]

To ensure sufficient volume for comparison, we excluded hospitals with fewer than 100 deliveries in 2009. Thus, our findings might not generalize to hospitals with small-volume obstetrical units. Also, rural and urban designations for hospitals are based on the 2000 census. Some formerly rural hospitals might have experienced urbanization by 2009, the year for which we analyzed data; however, we detected substantial variation across both rural and urban hospitals (Exhibit 3), and we do not expect that any changes in geographic designation over time would appreciably alter our findings.

A final limitation is that discharge data do not contain clinical details on reasons for cesarean delivery or hospital-level information on obstetric care guidelines and policies. These gaps constrain our ability to assess accurately the appropriateness of care or many possible clinical explanations for variations across hospitals.

Study Results

We found much variation in both overall and lower-risk cesarean delivery rates (Exhibits 1 and 2). The mean hospital-level rate of cesarean delivery in our sample was 32.8 percent, with rates that ranged nearly tenfold, from a low of 7.1 percent to a high of 69.9 percent. Hospital rates of cesarean delivery among lower-risk mothers, which we would expect to show less variation compared with overall rates, in fact varied even more widely. The mean rate of cesarean delivery among women with term, singleton, vertex pregnancies and no prior cesarean delivery was 12.0 percent, with fifteen-fold variation, from a low of 2.4 percent to a high of 36.4 percent.

Across all hospitals in our analysis, the mean number of deliveries in 2009 was 1,378 and ranged from 100 (the minimum for our analysis) to 11,971 (Exhibit 3). Small, medium, and large hospitals represented 22 percent, 30 percent, and 48 percent of our sample, and averaged 581, 1,151, and 1,926 deliveries, respectively. About one-quarter of the hospitals were teaching hospitals, and about one-third were located in rural areas.

The mean hospital-level overall cesarean delivery rate was similar across bed size, teaching, and location categories, and rates varied widely within each category. The interquartile range was 9.4 percentage points for overall cesarean delivery rates. Small and rural hospitals showed slightly more variability compared with the whole sample, and teaching hospitals showed less.

The mean lower-risk cesarean delivery rates were similar across all hospital categories, and the interquartile ranges followed a similar pattern to those for overall cesarean rates: Small and rural hospitals had slightly more variability, and teaching hospitals, less variability, in lower-risk cesarean rates, compared with the overall sample.

Discussion

Reasons For Variation In Hospital Cesarean Rates

Cesarean delivery rates should be expected to vary across hospitals based on patients' clinical conditions and choices, hospital capacity, and degree of obstetric and neonatal care specialization, among other factors.[3,13] The number of clinical indications for cesarean has increased in recent years. However, these changes alone cannot explain the rising rates.

As a result, more attention has been paid to nonmedical determinants of a cesarean delivery.[7,33] Maternal requests for cesarean delivery may vary across hospital patient populations, but available data suggest that such requests are responsible for a very small percentage of all cesarean deliveries and are not likely drivers of the wide variations we detected.[11]

Our data did not allow explicit assessment of all potential reasons underlying variation in hospital cesarean rates. However, we were able to determine that variation was not explained by hospital bed size, teaching status, or geographic location. Cesarean rates varied slightly more widely among small and rural hospitals, but that may be driven in part by the overall volume of deliveries.

The striking variation we documented in hospital cesarean rates for lower-risk pregnancies indicates that clinical risk factors probably do not provide a full explanation for these differences across hospitals. Our results are consistent with prior research on variations in cesarean delivery rates, and they indicate that practice patterns are a likely driver of variations in delivery mode and ought to be the focus of policy interventions to slow or reverse the rise in cesarean delivery rates overall and to decrease variations across hospitals.[6,9]

Potential Policy Action To Reduce Variation

The Department of Health and Human Services, the Centers for Medicare and Medicaid Services, and Congress have both the greatest degree of power to influence practice patterns for cesarean delivery and the most at stake in efforts to improve maternal and infant health. At the nonfederal level, each state has parallel structures that can make policy through changes in regulations, financing, or statute, with the goal of decreasing unnecessary variations.

There are few documented policy successes in achieving these goals in the current maternity care environment. However, our study and prior research suggest that there is an urgent need to address maternity care quality in general and rising cesarean rates and variations in practice patterns in particular.[6,9,34,35]

Based on emerging evidence and interprofessional dialogue, we are aware of four promising directions for reducing variations in cesarean rates across hospitals.[24,34] For each of these general directions, we describe specific policy interventions currently under way at federal and state levels. These efforts and any future policy strategies to reduce variations in hospital cesarean rates must be rigorously evaluated for intended and unintended impacts.

Improve Specialization And Triage For Maternity Care—Wide variation in cesarean rates among women with similar clinical conditions is medically unwarranted.[12,13] Whether such wide variation in cesarean rates persists across facilities depends in part on whether system-level changes that accompany the Affordable Care Act--accountable care organizations, for example--and the state-level statutes that support cost containment measures--such as the recently passed Improving the Quality of Health Care and Reducing Costs through Increased Transparency, Efficiency, and Innovation Act (Chapter 224, 2012) in Massachusetts--will allow for bundled payments across settings and providers to encourage coordination of care and health promotion.

In the context of childbirth, better care coordination could include more effective risk-based triage for maternity care. Such triage could take the form of high-risk hospitals with the capacity to manage extremely complex patients alongside obstetric care settings, such as licensed birth centers, which focus on physiologic childbirth for lower-risk women.[36] Better triage may reduce overall cesarean rates, but some rate variation across facilities would remain, although this would be by design rather than happenstance. Indeed, in other areas, such as cardiac care, some have argued that hospital specialization can increase both quality and variability.[37]

Data Collection And Measurement Of Maternity Care Quality—The clinical evidence base in obstetrics has advanced rapidly in recent years. However, clinicians and institutions cannot improve maternity care--and payers cannot pay for such improvement--if clear, consistently reported measures do not exist.[34,38]

Both the Joint Commission and the National Quality Forum have recently undertaken efforts to identify maternity care quality measures. One challenge is that many data elements relevant to maternity care quality are not routinely or systematically collected, but policy efforts at both the state and federal levels have begun to address this deficit.

In 2010, Rep. Eliot Engell (D-NY) introduced H.R.6437--the Partnering to Improve Maternity Care Quality Act. This proposed legislation would amend Title XIX of the Social Security Act to improve the quality, health outcomes, and value of maternity care under Medicaid and the Children’s Health Insurance Program. It would do so by developing a maternity care quality measurement program, identifying payment mechanism improvements, and enumerating essential evidence-based maternity care services.

In addition, professional associations, advocacy groups, and nonprofit organizations -- including the American College of Obstetrician-Gynecologists and the March of Dimes -- have partnered with state public health agencies to improve measurement and practice to reduce elective delivery prior to thirty-nine weeks gestation. Such a partnership has met with great success in Ohio, where establishment of a quality collaborative was associated with a decrease in scheduled births without medical indication.[39]

The Medicaid agencies of seven states--California, Florida, Illinois, Louisiana, North Carolina, Oklahoma, and Texas--participated in a recent peer-to-peer learning project that focused on birth outcomes.[40] These states reviewed their existing programs, policies, and infrastructures to inform efforts to improve maternity care. They then produced a policy checklist to help leaders in other states identify improvement opportunities that fit within their programs' eligibility requirements, quality improvement objectives, and health system resources.[40]

The first item on the checklist focuses on measurement, encouraging states to collect data on the number of women covered by Medicaid, the birth outcomes they experience, and the associated costs. Illinois is laying the groundwork for a real-time Medicaid perinatal data system, linking Medicaid administrative data and vital statistics in a new approach to monitor adverse pregnancy outcomes and encourage primary care providers, including obstetrician-gynecologists, internists, family practice physicians, midwives, and nurse-practitioners, to take advantage of prevention opportunities.

If found to be successful, this model may also be applied to improve data collection and policy and public health programs for evidence-based maternity care in other state Medicaid programs.

Use Medicaid Policy To Improve Hospital Management Practices In Labor And Delivery Units—Relatively little maternity care research has focused on management practices in hospital labor and delivery units, where care is often marked by rapid changes in patient status and transitions in care teams. A recent meta-analysis of hospital-based policies and programs designed to reduce cesarean rates indicated that the most effective interventions were those that employed audit and feedback methods--that is, those that provided clinicians with feedback on their performance based on data derived from their routine practice; focused on continuous quality improvement; or used a combination of these strategies alongside education for both patients and clinicians.[41]

State-led quality improvement programs tied to Medicaid payment policies or reporting requirements are a potential means by which policy could influence hospital policies and practices.[35] For example, in January 2012 the State of Minnesota adopted a policy requiring all hospitals receiving Medicaid funds for childbirth either to have in place an official hospital protocol disallowing elective labor induction prior to thirty-nine weeks gestation or to submit extensive documentation regarding reasons for obstetric services provided for such deliveries.[42]

Enhance Patient-Centered Decision Making For Maternity Care Through Public Reporting—Some pregnant women may face limited care options and lack full information on risks, benefits, and alternatives associated with medical care at the time of childbirth. As evident in a recent groundswell in consumer-driven efforts to calculate and disseminate hospital cesarean delivery rates, there is growing public interest in clear performance reporting to guide choices in maternity care providers and institutions--for example, www.cesareanrates.com, www.choicesinchildbirth.org, and ican-online.org.

Patient-centered care and informed decision making are an increasing focus of policy discussions. However, pregnant women are not always full partners with clinicians in decision making, but rather report experiencing care paths based on institutional routines or provider practice patterns.[43]

State or federal public health agencies or licensing and accreditation boards can increase transparency and information availability through public reporting requirements for hospital

cesarean delivery rates among lower-risk women, for example. Careful, rigorous evaluation would be particularly important in this context, because prior public reporting efforts have met with mixed success.[44,45] In the case of obstetric care, such a strategy may be more promising as a result of rising public demand and the fact that pregnant women have many months to plan for and make decisions about childbirth care.[34]

Policy makers and public health agencies can address variations in hospital cesarean rates through both financial and nonfinancial strategies. Financial strategies might include establishing policies that allow purchase of only a certain type, level, or quality of care; issuing a tax on institutions that perform undesirable actions or produce undesirable outcomes; or financially rewarding institutions that perform desired actions and produce desirable outcomes.

Nonfinancial means might include instituting public reporting requirements, altering clinical or facility licensing requirements, or implementing educational campaigns.[46] Although certain policy efforts may be undertaken immediately, our analysis also underscores the need for more detailed data and comprehensive understanding about the causes of variation in cesarean delivery rates across hospitals and the associated maternal and neonatal health and cost impacts of these variations.

Conclusion

The variations in hospital cesarean rates that we uncovered were striking in their magnitude and remain large even after stratification by hospital size, teaching status, and geographic location. Examining hospital cesarean rates among lower-risk mothers may address, at least in part, differences in hospital rates resulting from patients' clinical conditions.[38] One would expect rates to vary less among women with similar clinical characteristics, yet our findings revealed even greater variation in cesarean rates among lower-risk mothers.

Although some variation would reasonably be expected given differences in patient populations, the scale of the variation in hospital cesarean delivery rates--most notably, a fifteenfold variation among the lower-risk subgroup--indicated a wide range in obstetric care practice patterns across hospitals and signaled potential quality concerns.

These variations have important health and cost implications for state and federal public health agencies, the Centers for Medicare and Medicaid Services, state Medicaid programs, Medicaid managed care plans, hospitals, health care providers, and the four million American families that brought a newborn home from the hospital in 2009.

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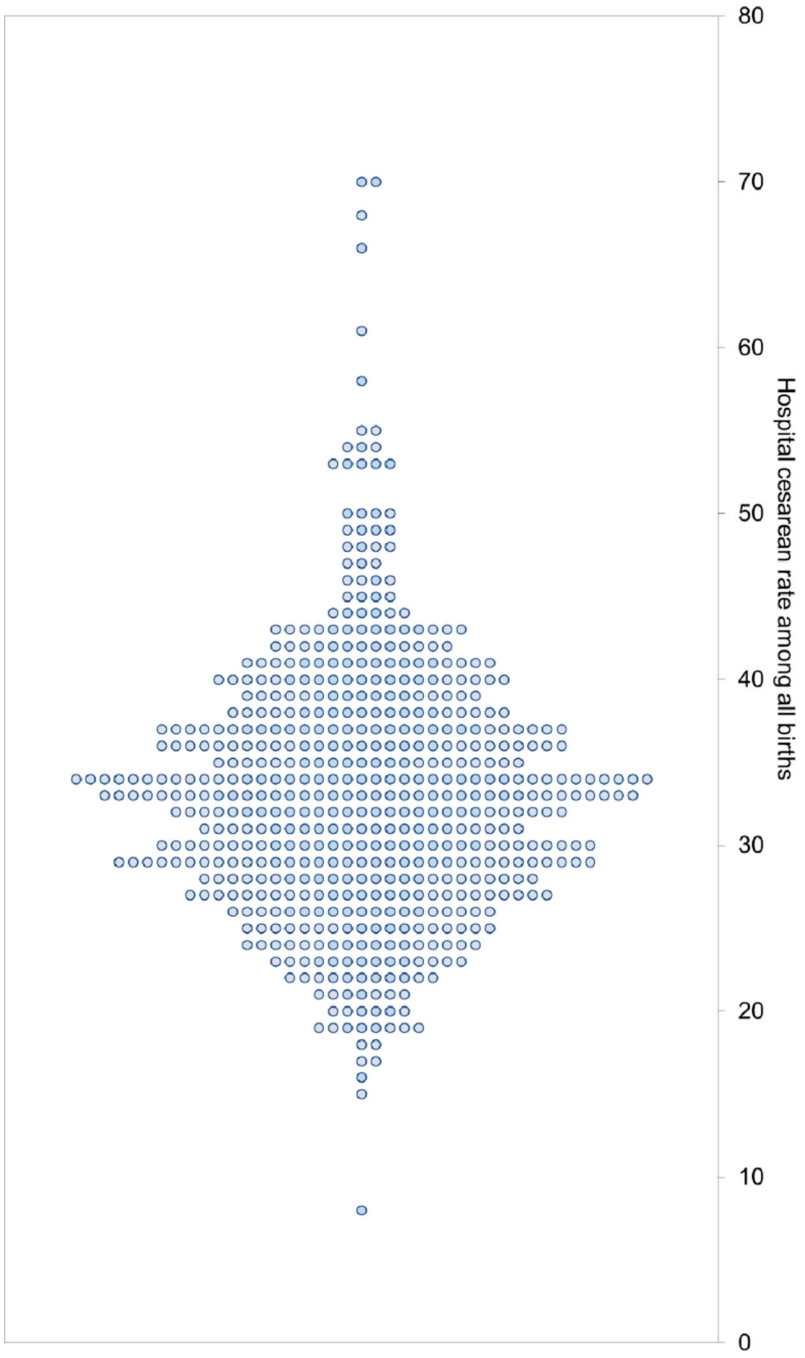

EXHIBIT 1.
Caption: Distribution Of Hospital Cesarean Rates In The United States, 2009
Source/Notes: SOURCE Authors' calculations based on data from the 2009 Nationwide Inpatient Sample of the Healthcare Cost and Utilization Project (HCUP). NOTES Distribution of cesarean delivery rates in a representative sample of US hospitals with at least 100 births in 2009 (N = 593). Hospital cesarean rates ranged from 7.1 percent to 69.9 percent--a tenfold variation across hospitals.

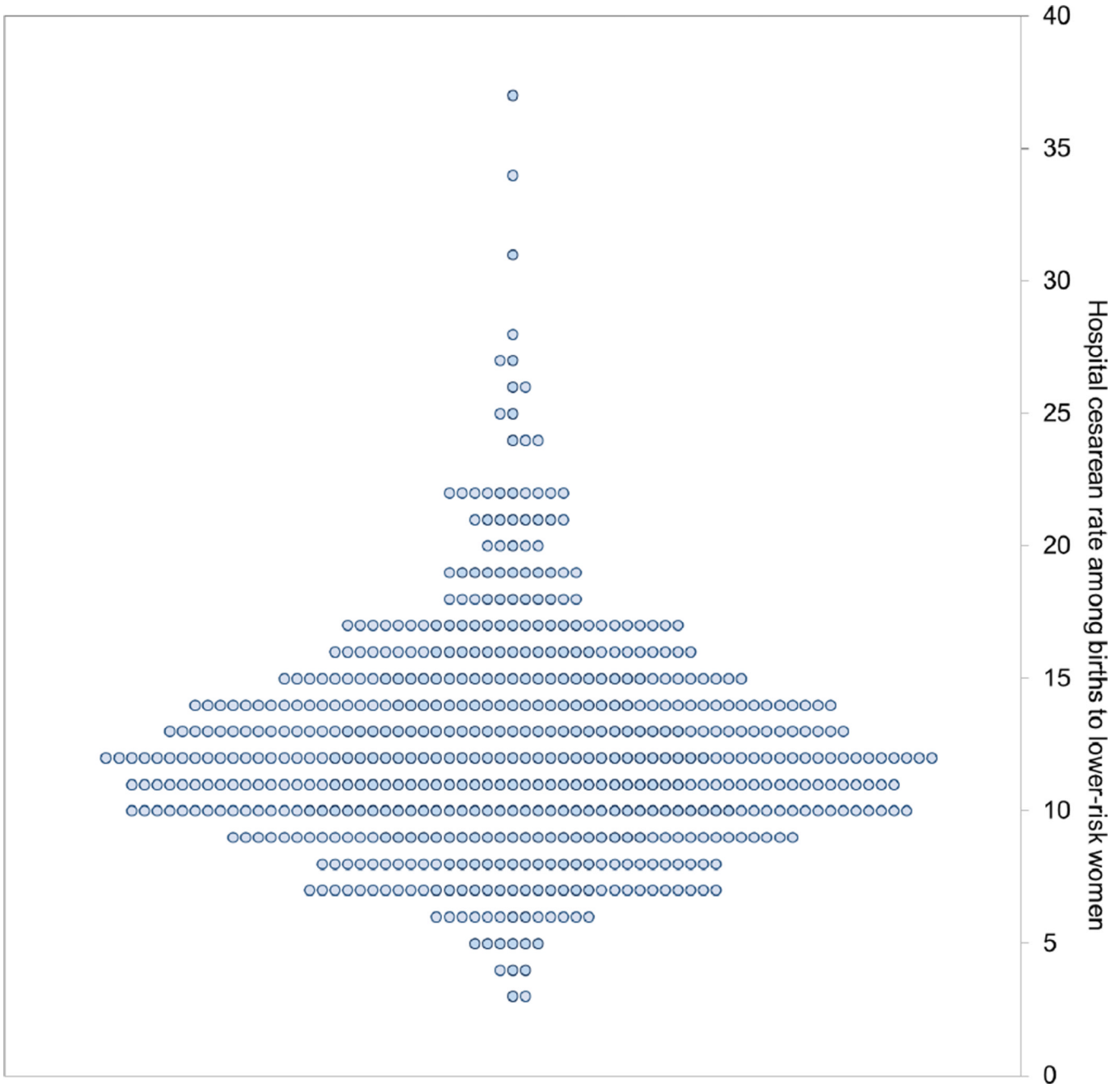

EXHIBIT 2.

Caption: Distribution Of Hospital Cesarean Rates In US Hospitals Among Lower-Risk Pregnancies, 2009

Source/Notes: SOURCE Authors' calculations based on data from the 2009 Nationwide Inpatient Sample of the Healthcare Cost and Utilization Project (HCUP). NOTES Distribution of lower-risk cesarean delivery rates in a representative sample of US hospitals with at least 100 births in 2009 (N = 593). "Lower-risk cesarean" is calculated as the percentage of cesareans among women with term, singleton, and vertex pregnancies with no prior cesarean deliveries. Hospital lower-risk cesarean rates ranged from 2.4 percent to 36.4 percent--a fifteenfold variation across hospitals.

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Exhibit 3

Delivery Volume And Cesarean Rates In US Hospitals, Overall And By Size, Teaching Status, And Location, 2009

	All hospitals (*N* = 593)	Small hospitals[a] (*n* = 131)	Medium hospitals [a] (*n* = 179)	Large hospitals[a] (*n* = 270)	Teaching hospitals[b] (*n* = 142)	Rural hospitals[c] (*n* = 195)
Number of obstetric deliveries						
Mean	1,378	581	1,151	1,926	2,682	450
Min	100	100	108	145	177	100
Max	11,971	4,381	8,543	11,971	11,971	1,514
IQR[d]	1,498	499	1,351	2,026	2,478	383
Total cesarean delivery rate (%)						
Mean	32.8	32.0	32.3	33.4	32.6	31.7
Min	7.1	14.0	18.8	7.1	16.3	7.1
Max	69.9	60.1	68.0	69.9	49.1	69.9
IQR[d]	9.4	10.9	9.5	9.3	8.5	10.7
Lower-risk cesarean delivery rate[e] (%)						
Mean	12.0	12.1	11.9	12.1	11.4	11.9
Min	2.4	3.8	3.0	2.5	4.6	2.4
Max	36.4	33.6	27.4	36.4	24.3	30.6
IQR[d]	4.9	5.9	4.8	4.9	4.2	5.5

SOURCE Authors' calculations based on data from the 2009 Nationwide Inpatient Sample of the Healthcare Cost and Utilization Project (HCUP).

[a]Hospital bed size categories are defined by HCUP, based on number of short-term acute hospital beds, and are specific to the hospital's US region, rural-urban designation, and teaching status. Bed-size information is missing from thirteen hospitals.

[b]Hospital teaching status was obtained by HCUP from the American Hospital Association Annual Survey of Hospitals.

[c]Classification of urban or rural hospital location used Core Based Statistical Area (CBSA) codes based on 2000 census data.

[d]IQR is interquartile range, calculated as the difference between the 75th and 25th percentiles.

[e]The lower-risk cesarean rate is calculated as the percentage of cesarean deliveries among women with term, singleton, and vertex pregnancies and no history of cesarean delivery.