Using Administrative Data to Identify Indications for Elective Primary Cesarean Delivery

Kimberly D. Gregory, Lisa M. Korst, Jeffrey A. Gornbein, and Lawrence D. Platt

Objective. To develop a methodology to identify indications and normative rates for elective primary cesarean delivery using administrative data.

Data Sources/Study Setting. All delivery discharges in 1995, as reported to the California Office of Statewide Health Planning and Development (secondary data).

Study Design. Retrospective population based study.

Data Collection/Extraction. Data were entered into a recursive partitioning algorithm to develop a hierarchy of conditions by which patients with multiple conditions could be sorted with respect to the binary outcome of labor or elective primary cesarean without labor. This hierarchy was examined for its clinical consistency, validated on a second sample, and compared with results obtained from logistic regression.

Principal Findings. Four percent (19,664) of delivery discharges in 1995 underwent elective primary cesarean. Twelve clinical conditions contributed to the hierarchy, and accounted for 92.9 percent of all women experiencing elective primary cesarean delivery. The remaining 7.1 percent of the elective primary cesarean cases were classified as “unspecified.”

Conclusions. A standardized methodology (utilizing recursive partitioning algorithms) for assigning indications for elective primary cesarean is presented. This methodology relies on administrative data, classifies women with complex comorbidity patterns into clinically relevant subpopulations, and can be used to establish normative rates for benchmarking specific indications for cesarean delivery.

Key Words. Cesarean section, case mix, risk adjustment, classification and regression trees, recursive partitioning

National interest in cesarean rates stems from the National Institutes of Health Consensus Conference in 1981 (National Institutes of Health 1981). At that time, policymakers and health care advocates were concerned about the wide variation in cesarean delivery based on clinical and nonclinical factors. Since repeat cesarean delivery was the second largest contributor to the cesarean rate, much energy was focused on fostering vaginal birth after cesarean (VBAC) as a significant intervention to decrease the national cesarean rate

(American College of Obstetricians and Gynecologists 1982, 1988, 1995, 2000). However, the rare but potentially catastrophic risks associated with VBAC have caused physicians, patients, and liability carriers to condemn "mandatory" VBAC policies, favoring "informed choice" for this procedure (American College of Obstetricians and Gynecologists 1998). As such, VBAC rates are declining and clinicians and investigators are now advocating that the way to decrease the repeat cesarean rate is to avoid the primary cesarean delivery (Paul and Miller 1995; Sachs et al. 1999). Hence labor management, and objective criteria for diagnosing dystocia are the new mainstays for institutional improvement regarding cesarean delivery practices (Paul and Miller 1995; Lopez-Zeno et al 1992; Flamm, Berwick and Kabrenell 1998; Merrill and Zlanik 1999; O'Driscoll, Foley, and MacDonald 1984). Third-party payors and health system accrediting bodies have begun monitoring cesarean rates as a measure of hospital performance and as a measure of maternal health care quality (National Institutes of Health 1981; National Committee for Quality Assurance 2000; Joint Commission on the Accreditation of Healthcare Organizations 1994; Public Health Service 2000; American College of Obstetricians and Gynecologists 2000). Unfortunately, data are being monitored and reported with little evidence to indicate what an ideal rate should be. *Healthy People 2000* proposed a national rate of 15 percent, which was widely criticized because it appeared to be arbitrary and did not attempt to address issues related to patient safety or case mix (Sachs et al. 1999). *Healthy People 2010* was revised to reflect the importance of case mix, by focusing the national reduction goal to low-risk nulligravid women (Healthy People 2010). To make further monitoring meaningful, clinicians and researchers are now faced with the challenge of determining which clinical conditions constitute low versus high risk. When evaluating cesarean

Address correspondence to Kimberly D. Gregory, M.D., M.P.H., Director, Maternal Fetal Medicine and Women's Health Services Research Cedars Sinai Medical Center, Department of Obstetrics and Gynecology, 8700 Beverly Boulevard, Suite 160 West, Los Angeles, CA 90048.

Dr. Gregory and Lisa M. Korst, M.D., Ph.D., are with Cedars Sinai Medical Center and Burns Allen Research Institute, Department of Obstetrics and Gynecology, Division of Maternal Fetal Medicine and Women's Health Services Research (where Dr. Korst is Director, Evaluation Sciences). Dr. Gregory is an Associate Professor at the University of California, Los Angeles, School of Medicine and Public Health and Dr. Korst is an Assistant Professor, University of California, Los Angeles, School of Medicine. Jeffrey A. Gornbein, Dr. P.H., is Senior Statistician, UCLA School of Medicine, Department of Biomathematics. At the time of the writing of this article, Lawrence D. Platt, M.D., was Chairman, Cedars Sinai Medical Center, and Vice Chairman, University of California School of Medicine, Department of Obstetrics and Gynecology.

rates as a performance measure, it is important to keep in mind that not all primary cesareans occur after labor, and in fact, in some clinical situations, labor is contraindicated. This suggests that there is a proportion of cesarean deliveries that are not preventable, or that there is a minimum rate beyond which underutilization might be suspected.

We hypothesized that women who undergo elective primary cesarean delivery represent a “high-risk” group for whom there would be relative consensus about the clinical conditions mitigating against allowing labor to proceed. The purpose of this study is to develop a standardized methodology to identify indications for elective primary cesarean, and to describe normative rates for these indications as calculated from routinely collected administrative data. This information would inform the policy debate regarding a bottom-line benchmark for primary cesarean rates.

METHODS

The study population consisted of all delivery discharges in calendar year 1995, as reported to the California Office of Statewide Health Planning and Development (OSHPD). These data include up to 25 clinical conditions per patient as identified by ICD-9-CM codes. Patients with a history of previous cesarean delivery (code 654.2) were excluded from the study. We also excluded patients delivering at hospitals with fewer than two hundred deliveries in the study year because these extremely low-volume hospitals (<1 delivery/day) were likely to have different operational structures and processes than hospitals with a larger and dedicated delivery service. Because no ICD-9-CM code exists for labor, and because elective primary cesarean deliveries occur in the absence of labor, we used an algorithm based on the presence of specific ICD-9-CM codes to stratify the study patients into labor and nonlabor groups (Henry et al. 1995). This published algorithm had been validated using medical charts as the gold standard. Patients who had a vaginal delivery or discharge codes representing fetal distress, labor abnormalities, cord prolapse, and breeches converted to vertex presentation (ICD-9-CM codes: 653.x, 660.x, 661.x, 662.x, 652.1, 659.0, 659.1, 656.3, 663.0) were categorized as having labored.

All ICD-9-CM codes that represent potential indications for elective primary cesarean delivery were abstracted from the coding manual (Table 1; Public Health Service 1998). If the ICD-9-CM code was present for any condition for any given patient, the patient was labeled with that condition.

Table 1: ICD-9-CM Codes for Potential Clinical Indications for Elective Primary Cesarean Delivery

a	Maternal cerebral hemorrhage	431.x-434.x
b	Asthma	493.x
c	Antepartum bleeding or placental abruption	641.x.656.0
d	Other types of hypertension	642.x (and all other 642.x except 642.5,6)
e	Severe hypertension: eclampsia and severe pre-eclampsia	642.5,6
f	Preterm gestation	644.2
g	Maternal renal abnormalities	646.2
h	Herpes	054.x, 647.6
i	Maternal liver abnormalities	646.7
j	Diabetes or abnormal glucose tolerance	648.0,8
k	Maternal thyroid abnormalities	648.1
l	Maternal substance use	648.3
m	Mental disorder	648.4
n	Maternal congenital and other heart disease	648.5,6
o	Multiple gestation	651.x
p	Malpresentation	652.2 (and all other 652.x except 652.1 and 652.5)
q	Unengaged fetal head	652.5
r	Maternal soft tissue disorder	654.0,1,4,5,6,7
s	Uterine scar unrelated to cesarean delivery	654.9
t	Congenital fetal CNS anomaly or chromosomal abnormality	655.0,1
u	Isoimmunization	656.1,2
v	Intrauterine fetal demise	656.4
w	Intrauterine growth restriction	656.5
x	Macrosomia	656.6
y	Oligohydramnios	657.x
z	Polyhydramnios	658.0
aa	Ruptured membranes greater than 24 hours	658.2
bb	Chorioamnionitis	a. 658.4
cc	Other maternal infection	659.2,3
dd	Advanced maternal age	659.5,6 (This was also calculated by actual ages: < or ≥ 35 years.)
ee	Uterine rupture	665.0,1
ff	Maternal hypotension or obstetrical shock	669.1,2
gg	Pulmonary embolism	673.0,1,3,8

A patient could thus be labeled with multiple clinical conditions or comorbidities. Data were then entered into a recursive partitioning algorithm to develop a hierarchy of clinical conditions by which patients with multiple conditions could be sorted with respect to the binary outcome of labor versus elective primary cesarean without labor. A random sample representing half

of the patients was used to develop the hierarchy, which was subsequently validated on the remaining half. The Exhaustive CHAID method (Chi-Square Automatic Interaction Detector) was used, allowing up to four levels of interaction among the indicators. If fewer than one hundred patients were included in any subgroup, further partitioning of that subgroup was halted. Conditions in the hierarchy were listed in the order by which the greatest statistical difference was found between those who labored and those who underwent elective primary cesarean without labor. By definition, the hierarchy is mutually exclusive such that patients with conditions lower in the hierarchy did not have any of the previously specified conditions. Those who did not fit into any of the final categories identified by the recursive partitioning algorithm hierarchy were identified as having an “unspecified” indication for delivery. The clinical investigators examined this empirically derived hierarchy for its clinical consistency with regard to conventionally recognized obstetrical conditions for elective primary cesarean, and based on clinical experience and literature review, accepted it as representative of “reasonable” indications for elective primary cesarean delivery.

Descriptive data were then calculated for the proportions of patients undergoing elective primary cesarean delivery for each indication assigned by the hierarchy. Categorical variables were analyzed using chi-square analysis with Yates correction, and continuous variables were analyzed with nonparametric testing as appropriate. Means are expressed $\pm$ the standard deviation, and statistical significance was defined at the $p < 0.05$ level. Relative risks (RR) and 95 percent Confidence Intervals (CI) are reported. All analyses were performed using SAS statistical software (SAS Institute Inc. 1989–1996), with the exception of the recursive partitioning algorithm specifying the clinical hierarchy, which was constructed using the Answer Tree module of SPSS (SPSS Incorporated 1998). This study was approved by the Cedars-Sinai Burns Allen Research Institute Institutional Review Board.

RESULTS

After excluding women with a history of previous cesarean delivery (66,026), the final study population consisted of a total of 463,196 discharge deliveries: 443,532 (95.75 percent) who labored, and 19,664 (4.25 percent) who underwent elective primary cesarean delivery without labor. The total number of hospitals involved was 288, and the mean number of deliveries per hospital among women with no previous cesarean was $1,608 \pm 1,193$

(range 190–7,211). Per hospital, the mean elective primary cesarean rate was 4.08 ± 1.61 percent (range 0.53–11.33 percent).

The absolute proportions of patients with each potential indication listed in Table 1 are described and compared for those with and without elective primary cesarean delivery in Table 2, which also includes the associated relative risk (RR) and *p* value. All of the conditions listed were statistically significant clinical risk factors for elective primary cesarean delivery except for intrauterine fetal demise (RR = 1.00, 95 percent CI 0.82–1.22). There were no reported cases of maternal cerebral hemorrhage, hence its importance as a risk factor for elective primary cesarean delivery could not be evaluated. Of all potential indications, malpresentation was the strongest risk factor for cesarean delivery (RR = 24.86, 95 percent CI 24.24–25.49), followed by uterine scar unrelated to cesarean delivery, multiple gestation, antepartum bleeding, and isoimmunization.

As previously noted, the clinical conditions listed in Table 2 are not mutually exclusive. Since patients could have multiple comorbidities, we wanted to establish a clinical hierarchy in which each patient had a “single” and most compelling clinical indication for elective primary cesarean delivery. Therefore, the data were entered into a recursive partitioning algorithm as previously described. The developed and validated clinical hierarchy is described in Table 3. The validation set supported the hierarchical findings demonstrated in the derivation set. The hierarchy yielded 12 conditions that accounted for 92.9 percent of all women with elective primary cesarean delivery. The remaining women were grouped into a thirteenth category labeled “unspecified.” When all conditions were allowed to compete simultaneously with regard to the outcome of labor versus no labor, malpresentation, which had the largest RR, was the most important clinical condition associated with elective primary cesarean delivery. However, the remaining hierarchy was slightly different than that which would have been suspected based on relative risk alone. Specifically, the effect size (RR) was not the only determinant of the hierarchical order. Conditions of very low prevalence and high effect size were relegated to the bottom of the hierarchy. For example, more common conditions such as antepartum bleeding (RR = 8.73), herpes (RR = 2.43), and severe hypertension (RR = 7.69) superseded uterine scar unrelated to cesarean delivery (RR = 15.38), and anomalies (RR = 8.73), which were quite rare. Also, the presence of common comorbidities, such as prematurity and multiple gestation, among some of the first hierarchical conditions, diminished their role in the hierarchy (see Table 4). For example, 11,202 (46.7 percent) of patients with malpresentation

Table 2: Prevalence and Relative Risk of Potential Clinical Indications for Elective Primary Cesarean Delivery

Risk Factor	N (% of Women with Risk Factor) All Patients (463, 196)	N (% of Women with Risk Factor and EPC = Yes* (19,664)	EPC* Rate for Women with Risk Factor	Crude Relative Risk for EPC* among Women with Risk Factor (95% CI)	P Value
Cerebral hemorrhage	0.00 (0.00%)	0.00 (0.00%)	—	1.00	<0.001
Asthma	3,076 (0.66%)	205 (1.04%)	6.66%	1.58 (1.38–1.80)	<0.001
Antepartum bleed	7,495 (1.62%)	2,468 (12.55%)	32.93%	8.73 (8.42–9.04)	<0.001
Other hypertension	19,992 (4.32%)	1,663 (8.46%)	8.32%	2.05 (1.95–2.15)	<0.001
Severe hypertension	3,523 (0.76%)	1,095 (5.57%)	31.08%	7.69 (7.31–8.10)	<0.001
Preterm	25,919 (5.60%)	4,043 (20.56%)	15.60%	4.37 (4.23–4.51)	<0.001
Renal condition	495 (0.11%)	51 (0.26%)	10.30%	2.43 (1.87–3.15)	<0.001
Herpes (all)	4,087 (0.87%)	1,204 (6.12%)	29.46%	7.40 (7.04–7.77)	<0.001
Liver condition	419 (0.09%)	31 (0.16%)	7.40%	1.74 (1.24–2.45)	0.002
Abnormal blood sugar	14,254 (3.08%)	1,229 (6.25%)	8.62%	2.10 (1.99–2.22)	<0.001
Thyroid condition	2,069 (0.45%)	164 (0.83%)	7.93%	1.87 (1.62–2.17)	<0.001
Substance use	2,690 (0.58%)	165 (0.84%)	6.13%	1.45 (1.25–1.68)	<0.001
Mental disorder	6,798 (1.47%)	358 (1.82%)	5.27%	1.24 (1.12–1.38)	<0.001
Maternal cardiac condition	2,207 (0.48%)	182 (0.93%)	8.25%	1.95 (1.70–2.24)	<0.001
Multiple gestation	4,768 (1.03%)	1,716 (8.73%)	36.00%	9.19 (8.83–9.57)	<0.001
Malpresentation	23,986 (5.18%)	11,323 (57.58%)	47.24%	24.86 (24.24–25.49)	<0.001
Unengaged fetal head	2,901 (0.63%)	396 (2.01%)	13.65%	3.26 (2.97–3.58)	<0.001
Maternal soft tissue condition	5,846 (1.26%)	1,391 (7.07%)	23.79%	5.96 (5.68–6.25)	<0.001
Other uterine scar	419 (0.09%)	270 (1.37%)	64.44%	15.38 (14.30–16.53)	<0.001
Anomaly or abnormal chromosomes	466 (0.10%)	83 (0.42%)	17.81%	8.73 (8.42–9.04)	<0.001
Immunization	9,346 (2.02%)	455 (2.31%)	4.87%	1.15 (1.05–1.26)	0.003
Intrauterine fetal demise	2,144 (0.46%)	91 (0.46%)	4.24%	1.00 (0.82–1.22)	1.00
Intrauterine growth restriction	5,478 (1.18%)	756 (3.84%)	13.80%	3.34 (3.12–3.57)	<0.001
Macrosomia	10,432 (2.25%)	1,213 (6.17%)	11.63%	2.85 (2.70–3.01)	<0.001
Oligohydramnios	9,842 (2.12%)	969 (4.93%)	9.85%	2.39 (2.25–2.54)	<0.001
Polyhydramnios	1,467 (0.32%)	217 (1.10%)	14.79%	3.51 (3.10–3.97)	<0.001
Ruptured membranes >24 hours	7,462 (1.61%)	372 (1.89%)	4.99%	1.18 (1.07–1.30)	0.002
Chorioamnionitis	9,790 (2.11%)	630 (3.20%)	6.44%	1.53 (1.42–1.66)	<0.001
Maternal infection (other than chorio)	20,713 (4.47%)	954 (4.85%)	4.61%	1.09 (1.02–1.16)	0.009
Advanced maternal age (≥ 35 years)	57,155 (12.34%)	3,865 (19.66%)	6.77%	1.74 (1.68–1.80)	<0.001
Uterine rupture	104 (0.02%)	16 (0.08%)	15.38%	3.14 (1.99–4.96)	<0.001
Obstetrical shock	53 (0.01%)	14 (0.07%)	26.42%	6.23 (3.97–9.76)	<0.001
Pulmonary embolism	31 (0.01%)	7 (0.04%)	22.48%	5.32 (2.77–10.21)	<0.001

*EPC = elective primary cesarean delivery

Table 3: Final Hierarchical Classification: Derivation and Validation

<i>Clinical Classification</i>	<i>Derivation Set: Number of Patients Undergoing Elective Primary Cesarean (%)</i>	<i>Validation Set: Number of Patients Undergoing Elective Primary Cesarean (%)</i>
Malpresentation	5,641 (57.10%)	5,682 (58.10%)
Antepartum bleed	1,062 (10.75%)	917 (9.37%)
Herpes	549 (5.56%)	530 (5.42%)
Severe hypertension	391 (3.96%)	397 (4.06%)
Other uterine scar	110 (1.11%)	116 (1.12%)
Multiple gestation	226 (2.29%)	212 (2.17%)
Macrosomia	446 (4.51%)	442 (4.52%)
Unengaged fetal head	167 (1.70%)	138 (1.41%)
Maternal soft tissue disorder	151 (1.53%)	164 (1.68%)
Hypertension, other	282 (2.85%)	315 (3.22%)
Preterm gestation	164 (1.66%)	129 (1.32%)
Fetal congenital anomaly	11 (0.11%)	19 (0.19%)
Unspecified	680 (6.88%)	723 (7.39%)
Total	9,880 (4.27%)	9,784 (4.22%)

Derived and confirmed on a random division of all data: $N = 463,196$. $N = 231,430$ primary cesarean deliveries for derivation dataset and $N = 231,766$ primary cesarean deliveries for validation dataset.

had other conditions in the hierarchy (i.e., additional potential indications for cesarean delivery). However, when evaluated in the context of these coexisting conditions, assigning malpresentation as the primary condition for delivery is clinically consistent with obstetrical practice, and assists in the subsetting and analysis of clinically homogenous populations.

To further validate the hierarchy, we performed traditional logistic regression methods using the same hierarchical variables, and found that the model fit well. The area under the receiver operating characteristic curve, the c statistic, was 0.93, the Hosmer R square was 0.45, and the Hosmer-Lemeshow Goodness of Fit statistic was 1.0, with a corresponding p value of 0.98.

DISCUSSION

The purpose of this study was to develop a standardized methodology using readily available administrative data to identify indications for elective primary cesarean and to describe normative rates for these indications. Our findings suggest that elective primary cesarean delivery accounts for approximately 4 percent of all births to women without a previous cesarean. We were able to explain 93 percent of elective primary cesarean deliveries

with 12 specific clinical indications. It is noteworthy that many of the indications were strongly associated with cesarean (i.e., strong RR); however, for all indications evaluated (except uterine scar unrelated to cesarean), a trial of labor was still more likely than elective primary cesarean delivery. This suggests that there are very few absolute indications for elective primary cesarean delivery. This has important implications when evaluating variation in cesarean rates, when determining which factors should be considered for case-mix adjustment to make comparisons meaningful, and when developing a consensus regarding what constitutes an appropriate rate (or an appropriate indication) for cesarean delivery.

The “unspecified” group ranks third in the proportion of women who undergo elective cesarean delivery (7.1 percent of all elective primary cesarean procedures). While it is possible that this category represents cases where there was inaccurate or suboptimal coding, it is also possible that this category represents cases associated with no medical condition, and therefore truly reflects elective or “patient choice” procedures. There is speculation that this may be a growing trend, and warrants further monitoring (Showalter and Griffin 1999; Harer 2000; Tranquilli and Garzetti 1997; Shelton 1999).

The utilization of such methods should increase the face validity of the cesarean rate for clinicians, and begin to illustrate the complexity of normative rates by clinical and nonclinical conditions. In particular, the 12 indications for elective primary cesarean assigned within the hierarchy are supported by both clinical evidence and standards of practice (Henry et al. 1995). However, the indications found farthest down in the hierarchy may have less evidence to support them as absolute indications and/or have such a low prevalence that they carry little importance with respect to general obstetrical practice. For example, data regarding the optimum method of delivery for breech presentation, while still controversial, appears to favor cesarean delivery (Hannah et al. 2000), and this is clearly the normative standard in the United States, where 90 percent of infants with breech presentation are born via cesarean (Ventura et al. 2000). On the other hand, the data to support cesarean delivery to optimize outcome for preterm infants is minimal, and even with regard to selected fetal anomalies, the benefits have not been clearly demonstrated (How et al. 2000; Lurie, Sherman, and Bukovsky 1999).

Other factors contributing to the variation in elective primary cesarean among the clinical categories may relate to temporal issues with coding, and uncertain severity of disease. For example, suspected macrosomia is presumed to be a “prelabor” diagnosis, but could have been assigned by the coder based on actual infant birthweight. Additionally, ICD-9-CM codes

often do not reflect the severity of disease, and the severity of the condition, and range of delivery options for antepartum hemorrhage is likely to vary based on the timing, severity, and cause of the bleeding. Furthermore, the proposed hierarchy is not sensitive to the clinical judgment likely to be exercised when patients have more than one clinical diagnosis. Delivery options for women with severe hypertension may vary depending on their previous obstetrical history, gestational age, and cervical exam at time of diagnosis, and on their physician's clinical experience and hospital resources. None of these factors is considered in the models presented.

Recursive partitioning algorithms have been in use since the mid-1970s. They were integral to the development of diagnosis related groups (DRGs) for the Medicare Prospective Payment System (Fetter et al. 1980). The goals of DRG models include the following: The patient groups have to make good clinical sense, they have to be based on routinely collected data, and there has to be a manageable number of groups (Fetter et al. 1980). Although DRGs were developed to provide a basis for uniform payment across hospitals, the attempt to use similar methodologies to measure the quality of care is becoming increasingly popular (Fetter et al. 1980; Feinglass et al. 1998).

We feel the technique has added value to traditional regression methods because of the opportunity to create clinically homogeneous groups for comparison of rates of cesarean delivery. Such cohorts can then be examined for variation in practice across regions, populations, and hospital organizational factors. Traditional risk-adjustment methodology has focused on interhospital comparisons, and has relied on the definition of a standard "low-risk" patient as a reference. Specifically, such methodology is intended to "level the playing field" among hospitals with varying proportions of patients at risk for cesarean delivery (Iezzoni 1994). Some investigators have proposed reporting cesarean rates by parity, or have argued for "labor-adjusted" cesarean rates, which would exclude patients at "high risk" for cesarean (Elliott, Russell, and Dickason 1997). Many of the "high-risk" conditions that would be excluded on the basis of clinical "reasonableness" proposed by other investigators are represented in the clinical hierarchy derived here. However, we found the cesarean rates for these "high-risk" conditions varied widely (4–64 percent), with none approaching 100 percent. In fact, apart from malpresentation, the relatively low prevalence of each of the remaining conditions illustrates the difficulty encountered by obstetricians as they try to interpret the appropriateness of cesareans represented by a single overall rate. Hence we propose that it is necessary to monitor cesarean rates for these "high-risk" conditions as well as for low-risk conditions if one hopes to identify

normative rates for specific indications. Such methods should encourage consensus regarding those conditions that are both statistically and clinically meaningful. Subsequent efforts can then be directed toward understanding factors contributing to the variation in these rates.

Compared with traditional risk-adjustment techniques, recursive partitioning algorithms can more easily allow for multiple simultaneous comparisons within large datasets to identify relatively homogeneous subgroups of patients at various levels of risk. The overlap among clinical conditions shown in Table 4 is substantial among obstetrical patients, yet the final classification of cases into the hierarchy appears clinically consistent and acceptable. The tradeoff for creating these clinically homogeneous groups of patients is notable. The parameters in the model do not need to remain fixed. Rather, they can vary as needed by the population. Because the groups are mathematically independent, they can be examined separately, the definition of an "average" rate by which to adjust all others is not necessary, and the nonclinical variation in the use of elective primary cesarean for that clinically identifiable group can be examined across hospitals. Reference groups can be identified by hospital organizational factors and structures, such as public versus corporate hospitals, and are not hampered by the concept of a "standard" patient (Gregory, Korst, and Platt 2001).

In conclusion, we set out to establish a method whereby normative rates for specific indications for elective primary cesarean delivery could be reported from readily available administrative data. An increased understanding of the reasons for elective primary cesarean delivery should improve our knowledge regarding normative practices, and identify an "at risk" subgroup of patients for whom the use of cesarean delivery is considered to be appropriate. Although this study does not solidify the link between normative rates and quality of care, the ability to determine clinically applicable normative rates should provide a foundation for benchmarking best practices and identifying outliers. Admittedly, it is unclear how identification of hospital-based differences in rates of elective primary cesarean might impact decision making that occurs prior to hospitalization. Theoretically, examination across hospitals of the maternal and neonatal morbidities associated with each of the clinical cohorts could lead to refined assessments of the costs of care and impact contract negotiations among insurers and hospitals. Additionally, given recent interest in the use of elective primary cesarean delivery because of patient preference, this methodology may assist women and their physicians in the identification of hospitals that are more likely to be supportive of this option. The current national primary cesarean rate is 16

percent (Ventura et al. 2000). Based on this study's findings, we can extrapolate that a quarter of these patients are "high risk," do not experience labor, and undergo elective primary cesarean delivery. Hospitals that vary widely (range 0.53–11.33 percent) from the mean elective primary cesarean rate (roughly 4 percent) may represent hospitals with under- or overutilization, and an opportunity for improved patient outcomes (Brook et al. 1984). As cesarean rates are examined, an effort must be made to focus the analysis so that it applies to clinical decision making. The development of clinically appropriate denominators in conjunction with a greater understanding of normative rates should have the potential to improve the clinical response desired from the surveillance of maternal health care quality indicators.

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