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Cesarean Delivery Uptake Trends Associated With Patient Features and Threshold for Labor Anomalies

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The cross-sectional study by Frappaolo and colleagues[1] describes cesarean delivery trends across 2 decades among US patients deemed at low risk for cesarean delivery according to the *International Classification of Diseases, Ninth Revision, Clinical Modification* and *International Statistical Classification of Diseases, Tenth Revision, Clinical Modification* algorithms. The authors collected a sizable study group including 40 517 867 deliveries, of which 4 885 716 (12.1%) were cesarean deliveries,[1] with the aim of determining temporal trends in cesarean delivery and specific related indications. There was an increase in cesarean delivery rates among low-risk women from 9.7% to 13.9% between 2000 and 2009, and then a decrease from 13.0% to 11.1% in 2019.[1] Indications for cesarean delivery because of nonreassuring fetal status increased from 3.4% in 2000 to 5.1% in 2019, and those for labor arrest increased in the first half of the study period and decreased in the second half (from 3.6% in 2000 to 4.8% in 2009 to 2.7% in 2019).[1] The overall trend of cesarean delivery rates across the study period showed a decrease, with a change in the frequency of the various indications for cesarean delivery over time, with decreasing rates of labor arrest widely exceeding the increasing rates of nonreassuring fetal status.[1] The authors note that the use of administrative data is a major limitation of their study, because it includes the risks of diagnostic discrepancy with clinical files and a lack of standardization of intrapartum diagnoses among different centers, both of which are challenging in similar studies and represent nonnegligible sources of bias and heterogeneity. However, these limitations do not hinder the extensive merit and importance of the present study.[1]

Frappaolo et al[1] used the Society for Maternal-Fetal Medicine's criteria for low risk of cesarean delivery, which include full-term, singleton, vertex live births with no prior cesarean delivery and without specific high-risk diagnoses.[2] This definition is more comprehensive and advantageous than others but still presents a few limitations in that it cannot assess the cumulative effect of numerous risk factors (that independently may not be sufficient to define high risk) and it cannot include all clinical conditions that increase the risk of cesarean delivery.

Frappaolo et al[1] described an age range of their low-risk population between 15 and 39 years, and we agree with this choice. In fact, although maternal age alone is not a recognized absolute indication for cesarean delivery, it is difficult to classify a patient of advanced age (eg, >45 years) as having low risk for cesarean delivery. In fact, the authors found a progressively increasing odds ratio for cesarean delivery with advancing maternal age (from 1.07 at 30-34 years to 1.30 at 35-39 years) vs the reference category (25-29 years).[1] This knowledge should be reconciled with the definition of risk by reassessing criteria for low-risk patients, including mode of conception with homologous or heterologous in vitro fertilization (IVF), assessment of uterine and pelvic anatomy, maternal chronic morbidities, fetal abnormalities, and abnormal fetal growth (both reduced and increased). In recent decades in most developed countries, the use of IVF has increased greatly, with particular interest in oocyte donations for patients of advanced age. Pregnancies after IVF typically occur in older patients with higher rates of associated risk factors, such as placental dysfunction, including preeclampsia, fetal growth restriction, small for gestational age, and low birth weight. Maternal age remains a major risk factor associated with the risk of cesarean delivery, both from results of this study[1] and those of previous analyses assessing its independence from other related risk factors.[3] Moreover, different

phenotypes of hypertensive disease in pregnancy may produce additional risk of cesarean delivery because of their association with reduced fetal growth.[4]

The definition of labor dystocia was recently reviewed by the Society for Maternal-Fetal Medicine after demonstration that labor progresses at a rate substantially slower than what was traditionally taught. Consequently, during the second half of the study by Frappaolo and colleauges,[1] longer standards for labor duration were allowed by individual clinicians, according to these indications. However, longer labor duration may increase maternal and fetal risks. On the fetal side, recently published data[5-7] found an increased risk of neonatal acidemia in longer second stages of labor, to different degrees depending on the normality or abnormality of cardiotocographic traces. Increased rates of abnormal intrapartum fetal monitoring can be expected owing to prolongation of labor, particularly the second stage, justifying both the finding of increased risk of cesarean delivery for nonreassuring fetal status and lower rate of labor arrest in the second phase of the study by Frappaolo and colleauges.[1] On the maternal side, the benefits of prolonged labor on the reduction of cesarean delivery rates should be cautiously weighed against long-term risks of obstetric anal sphincter injury and pelvic floor dysfunctions, as well as uterine atony and postpartum hemorrhage. These observations are not opposing the concept of allowing longer labor duration per se, because on balance, it can reduce the cesarean delivery rate, but the possible fetal-neonatal and maternal collateral damage for this achievement should be carefully considered, within an individual case assessment.

To be sure that the described trend of cesarean delivery rate reduction can be considered positive, there would be the theoretical need to analyze other maternal-fetal-neonatal outcomes (eg, rates of operative deliveries, neonatal acidemia, intensive care unit use, maternal hemorrhage, pelvic floor trauma and dysfunction, and psychological distress). In other words, the decreasing trend in cesarean delivery rates in the study of Frappaolo and colleagues[1] will need to be explored by further research stratified according to maternal-neonatal outcomes (at least demonstrating noninferiority of current vs historical rates). In summary, besides recognizing the value of this study, it would also be appropriate to avoid qualitative comment on the direction of the cesarean delivery trend found and to suggest caution, along with a call for future research. This study nicely shows that the trend of cesarean delivery uptake can be lowered by improving diagnostic quality of labor abnormalities, indicating later interventions; however, this action is not devoid of consequences because procrastinated cesarean delivery may imply an increased risk of fetal and perhaps maternal concerns.

The rate of cesarean delivery in each clinical setting ideally should be adjusted at least by the extent of risk of that specific population. In fact, universal cutoffs for acceptable cesarean delivery rates fail to consider all important population and patient characteristics, even in the limited group of low-risk patients. In other words, within any dichotomic definition of low risk, there is still a considerable amount of heterogeneity. Can we truly assess today the risks and benefits of cesarean delivery in individual patients? This would be a compelling research question for future research, to be designed on the basis of the results of the study of Frappaolo and colleagues.[1] We are picturing an optimization of cesarean delivery uptake based on patient-specific risks, rather than population-specific risks, with a personalized risk evaluation defined with a continuous approach. This may be possible by shifting from paradigms and general definitions of risk to a patient-specific quantitative risk assessment and adjusting our estimates to this parameter. Should future research be able to assess the hazards and benefits of vaginal birth vs cesarean delivery for a specific individual patient with a mathematical modeling integrating risk and protective factors? A patient-specific approach and risk assessment may possibly minimize cesarean delivery rates in lower-risk cases or avoid labor when hazards exceed predefined thresholds, thus stabilizing or improving maternal-fetal outcomes. This may lead to cesarean delivery uptake based on a standardized method including guidelines indications, as well as specific characteristics and maternal-fetal risk factors.

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