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Quality Assurance Practices in Obstetric Care: A Survey of Hospitals in California

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Abstract

Objective: To assess hospital practices in obstetric quality management activities and identify institutional characteristics associated with utilization of evidence-supported practices.

Methods: Data for this study came from a statewide survey of obstetric hospitals in California regarding their organization and delivery of perinatal care. We analyzed responses from 185 hospitals that completed quality assurance sections of the survey to assess their practices in a broad spectrum of quality enhancement activities. Association between institutional characteristics and adoption of evidence-supported practices (i.e., those supported by prior literature or recommended by professional organizations as beneficial for improving birth outcome or patient safety) was examined using bivariate analysis and appropriate statistical tests.

Results: Most hospitals regularly audited adherence to written protocols regarding critical areas of care; however, 77.7% and 16.8% reported not having written guidelines on diagnosis of labor arrest and management of abnormal fetal heart rate, respectively. Private non-profit hospitals were more likely to have written protocol for management of abnormal fetal heart rate ($p=0.002$). One in ten hospitals (9.7%) did not regularly review cases with significant morbidity or mortality, while only 69.0% regularly tracked indications for cesarean delivery. Moreover, 26.3%, 14.3% and 8.7% of the hospitals reported never performing interprofessional simulations for eclampsia, shoulder dystocia, and postpartum hemorrhage, respectively. Teaching status was associated with more

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frequent simulations in these three areas ($p = 0.04$ for all); while larger volume was associated with more frequent simulations for eclampsia ($p=0.04$).

Conclusion: Hospitals in California engage in a wide range of practices to assure or improve quality of obstetric care, but substantial variation in practice exists among hospitals. There is opportunity for improvement in adoption of evidence-supported practices.

Précis:

Hospitals engage in a range of quality assurance efforts in obstetric care; however, practices vary among hospitals, and several areas warrant improvement and further evaluation.

INTRODUCTION

Quality and safety assurance in obstetric care are of vital importance given the large annual volume of births (3.98 million births in the U.S. in 2015).¹ Moreover, obstetrics is unique as it involves two patients (mother and fetus) and unexpected adverse maternal and newborn outcomes such as postpartum hemorrhage and neurological damage can have significant and often long-term health consequences on previously healthy individuals.^{2,3} Nevertheless, 1.0% of mothers and 2.3% of newborns experience severe morbidities during birth,^{3,4} suggesting potential room for improvement and need for continued attention to perinatal care quality.^{2,5,6}

Hospitals play a pivotal role in ensuring quality of obstetric care as 98.5% of U.S. births occur within hospitals.¹ However, research evaluating hospital practices of quality management activities pertaining to obstetrics is sparse and has been limited to several selected areas of care (e.g., postpartum hemorrhage,⁷ shoulder dystocia,⁸ or obstetric emergencies⁹), rather than assessing the broad spectrum of obstetric care. A more comprehensive assessment of hospital quality assurance activities will help identify areas of current practices needing improvement.

Moreover, research has shown wide variability in intrapartum practices across hospitals (e.g., elective induction of labor and cesarean delivery).^{10,11} This suggests potential difference in approaches to and perceptions about risk among hospitals and possible variation in quality management activities. Identifying institutional characteristics associated with different quality assurance practices can inform types of hospitals that may benefit from enhanced efforts. To address these issues, we evaluated quality management activities among obstetric hospitals in California and examined variation in adoption of evidence-supported practices.

MATERIALS AND METHODS

Data for this study came from a larger project (the California Hospital Survey of Maternity and Newborn Care) in which a statewide cross-sectional survey of hospitals in California was conducted to understand their practices of perinatal care. With an overarching hypothesis that hospitals vary in practice of obstetric care which could result in differences in resource utilization and birth outcomes, development of the questionnaire for the California Hospital Survey of Maternity and Newborn Care was informed by a thorough

review of the relevant literature. In particular, we reviewed published articles on hospital variation in practice, resource utilization, and outcomes of obstetric care, as well as factors that might contribute to such variation. A medical librarian conducted a comprehensive search of three bibliographic databases (Ovid MEDLINE, PubMed, and Embase) using combinations of controlled vocabulary and textwords (see Appendix 1). Our research team (GVD, HCL, JLI, LSL, XX) reviewed the identified 2,270 articles, the results of which guided selection of topic areas and questions to be included in the survey. We also reviewed the design and content of questionnaires used in other relevant surveys examining hospital efforts in improving quality of perinatal care and culture of patient safety,^{12–14} and adopted and adapted some questions into our survey instrument.

Based on these assessments, we developed a draft survey instrument. We then convened 11 clinicians and one patient representative to participate in an open-ended discussion (in the format of focus groups) to review and refine survey questions and ensure comprehensiveness of survey content. The clinicians had expertise in obstetrics, perinatology, anesthesiology, midwifery, family medicine, and obstetric nursing. We pilot tested the refined survey instrument at two hospitals affiliated with the authors' institutions and five hospitals in California. These pilot test hospitals represented diverse characteristics in size, teaching status, and level of care and pilot test respondents had different roles and backgrounds in their obstetric unit. We revised, added, and deleted survey questions based on pilot testing feedback. The final instrument included 148 questions covering a wide range of topics assessing obstetric unit infrastructure and staffing, organization and delivery of intrapartum care, cost containment initiatives, and quality assurance and improvement efforts. The final version questionnaire was offered in both hard copy and web-based format using the Qualtrics software platform (Qualtrics, Provo, UT).

The survey was launched in September 2015. Non-military hospitals throughout California that provided obstetric delivery services at the time of the survey were eligible to participate. We identified these hospitals using a comprehensive list of maternity hospitals maintained by the California Maternal Quality Care Collaborative (CMQCC) supplemented by our review of delivery volume (i.e., having ≥ 1 delivery) in annual financial report submitted by all hospitals in California to the Office of Statewide Health Planning and Development.¹⁵ Working in collaboration with the CMQCC and the California Perinatal Quality Care Collaborative (CPQCC), we identified labor and delivery nurse managers, directors of maternity services, or other individuals knowledgeable about obstetric unit practices as potential survey respondents. An initial introductory email explained the purpose and process of the survey followed by a separate email inviting participation with an electronic link to the web-based survey. Recognizing that a single person might not be familiar with all topics assessed in the questionnaire, respondents were encouraged to obtain input from other knowledgeable staff as needed. Email reminders were sent to enhance response rate, and non-respondents were followed-up with a phone call and hard copy mailings of the survey instrument. If there was no response after these reminders, we collaborated with CMQCC and CPQCC or contacted hospital labor and delivery units to identify an alternative individual to respond to the survey. A \$25 gift card was provided to respondents in appreciation of their time.

We downloaded responses from the survey website electronically to a study database. Completed hard copy surveys were reviewed and manually entered in the database (entered by one research staff member and quality checked by a second). The Yale University Human Investigation Committee and the Stanford University Administrative Panel for the Protection of Human Subjects reviewed this study protocol and determined the California Hospital Survey of Maternity and Newborn Care exempt from Institutional Review Board review because it involved a survey of public behavior. Survey participants were provided study information at the beginning of the questionnaire and their survey response indicated consent to the study. Additionally, the Stanford University Administrative Panel for the Protection of Human Subjects approved the focus group part of the study. All focus group members provided verbal consent.

This current study focused on hospital quality management practices and analyzed data from the relevant sections of the survey, including use of clinical protocols, tracking of quality indicators, credentialing requirements, training and interprofessional simulation, review of cases with significant morbidity or mortality, infrastructure and systems in gathering feedback, and other quality improvement efforts (see Appendix 2, for these survey questions). We paid particular attention to several practices that were reported in prior research as effective in improving birth outcomes or patient safety or were recommended by the American College of Obstetricians and Gynecologists and the Society for Maternal Fetal Medicine as useful steps to safely reduce primary cesarean delivery.¹⁶ These evidence-supported quality assurance or quality improvement practices included: multidisciplinary team training and simulations for shoulder dystocia,^{8,17,18} postpartum hemorrhage,¹⁹ and eclampsia⁹; tracking and review of severe maternal morbidity cases;²⁰ assessment of indicators for cesarean delivery;¹⁶ and clarification and standardization of diagnosis for labor dystocia and heart rate interpretation.¹⁶

We tabulated hospital quality assurance practices as well as respondent and institutional characteristics using frequencies and percentages for categorical variables and median and interquartile range (IQR) for continuous measures. We also estimated 95% confidence intervals for the proportion of hospitals practicing each specific activity (with finite population correction since our sample included most obstetric hospitals in California). For each individual variable, our reported estimate reflected the corresponding statistic among hospitals with non-missing data on that variable. To inform potential non-response bias, we compared characteristics of hospitals that completed survey sections on quality assurance with hospitals that did not complete these sections or did not respond to survey using Chi-square or Fisher's exact test as appropriate.

Additionally, we performed bivariate analysis to examine the association between institutional characteristics and a hospital's likelihood of adopting evidence-supported practices. Cochran-Armitage test and Spearman correlation were used to assess ordering in frequency of interprofessional simulations with institutional characteristics, while chi-square, Fisher's exact, and Wilcoxon rank sum tests were used to evaluate the relationship of hospital characteristics with other evidence-based practices. Institutional characteristics of teaching (versus non-teaching) status, urban (versus rural) location, and type of ownership (government non-Federal, private for-profit, and private non-profit) were obtained from the

2015 American Hospital Association annual survey.²¹ Hospital annual delivery volume was ascertained from survey response. Statistical analysis was performed using SAS 9.4 (SAS Institute, Cary, NC).

RESULTS

The California Hospital Survey of Maternity and Newborn Care contacted 253 hospitals initially (see Appendix 3). Seven hospitals did not or no longer provided labor and delivery service, and one was closed. Of the remaining 245 hospitals actively providing labor and delivery service, 191 responded to our survey as of August 2016, yielding an overall response rate of 78.0%. The present study focused on a subset of 185 hospitals that completed survey sections on quality assurance practices. These hospitals were similar in teaching status, volume, and type of ownership and more inclusive of rural institutions when compared to non-responding hospitals or hospitals that did not complete quality assurance sections of the survey (see Appendix 4). Among the 185 hospitals, some quality practice responses were missing; reported statistics for each practice reflect estimates among those providing data on the corresponding variable.

Survey respondents of the 185 included hospitals were primarily directors of maternity, women's, or perinatal services (42.4%) or labor and delivery or perinatal nurse managers (29.4%). Median respondent tenure in their current position was 4 years (IQR:1.5–10) and median tenure in current obstetric unit was 12.5 years (IQR:5–22). These hospitals had a median annual birth volume of 1,600 (IQR:700–2,885) and were diverse in characteristics (Table 1).

Figure 1A and Appendix 5, summarizes hospital practices related to audit and review of written clinical protocols. Seventy-seven percent (77.7%) reported not having written guidelines for diagnosis of labor arrest, and another 4.9% reported having such guidelines but did not regularly audit adherence. For management of abnormal (non-reassuring) fetal heart rate, 16.8% of the hospitals did not have written protocols and 20.7% did not regularly audit them. Additionally, 77.1% and 3.3% of the hospitals reported not having or not regularly auditing protocols related to diagnosis of anal sphincter injury and perineal repair, respectively. For other areas of care, although most hospitals regularly audited adherence to protocols, a substantial proportion did not have standard protocols or did not regularly audit them (Figure 1A). Peer review or practice audit was the most frequently used remedy in the event of a provider having poor compliance with written protocols (reported by 86.5% of the hospitals; data not shown).

Most hospitals regularly tracked common quality indicators (Table 2), ranging from 70.9% for rate of vaginal birth after cesarean to 99.5% for overall and primary cesarean rates and 100% for patient satisfaction. Yet fewer hospitals tracked indications for cesarean delivery (69.0%) and induction of labor (62.0%) or rate of episiotomy (60.3%). When asked about engagement in other quality improvement efforts, 77.4% and 92.3% of the hospitals reported engaging in initiatives of primary cesarean rate reduction and restraining elective labor induction before 39 weeks, respectively; while 91.8%, 74.6% and 71.8% of the hospitals reported adoption of CMQCC toolkits for obstetric hemorrhage, pre-eclampsia, and early

elective deliveries,²² respectively. However, fewer hospitals reported enhanced patient education regarding cesarean delivery without medical indications (58.8%).

Formal credentialing or certification in fetal monitoring was required for nurses at most (79.3%) responding hospitals, while only 28.8% of hospitals required attending physicians or midwives to be formally credentialed or certified and 20.1% reported formal credentialing or certification was not required of providers (Table 3). Likewise, regular training in patient communication and team communication skills was conducted primarily among nurses (60.9% and 61.4%, respectively), rather than attending physicians or midwives (19.0% and 29.9%, respectively). Importantly, one in ten hospitals (9.7%) reported not regularly reviewing cases with significant morbidity or mortality, and 14.6% regularly reviewed these cases but did not regularly implement remedies.

Most hospitals conducted interprofessional simulations at least annually for eclampsia (53.1%), emergency cesarean section (64.6%), shoulder dystocia (68.7%), neonatal resuscitation (74.3%) and postpartum hemorrhage (77.7%) (Figure 1B and Appendix 6). Nevertheless, only 34.4% performed such simulations for anesthesia-related obstetric emergencies at least annually. Moreover, 26.3%, 14.3% and 8.7% of the hospitals reported never performing interprofessional simulations for eclampsia, shoulder dystocia, and postpartum hemorrhage, respectively.

Teaching status was significantly associated with more frequent conduct of interprofessional simulations for eclampsia ($p=0.003$), shoulder dystocia ($p=0.02$), and postpartum hemorrhage ($p=0.04$) (Table 4); while larger volume was associated with more frequent simulations for eclampsia (correlation coefficient=0.16, $p=0.04$). Overall, hospital type of ownership was significantly associated with their likelihood of having written protocols for abnormal fetal heart rate tracings ($p=0.01$). Closer examination of different types of ownership showed that hospitals with private non-profit ownership were more likely to have written protocol for abnormal fetal heart rate tracings than other hospitals (89.4% versus 71.7%, $p=0.002$). There was no other statistically significant difference in practices by hospital characteristics.

DISCUSSION

Obstetric units at 185 hospitals in California engaged in a broad range of quality assurance activities. However, they varied in practices. Teaching hospitals and hospitals that were of larger volume or private non-profit ownership had greater use of evidence-supported practices.

This study extends the scant but emerging literature regarding hospital obstetric quality assurance practices and patient safety initiatives. Despite growing interest in understanding hospital activities in improving quality of care,^{23,24} prior studies rarely focused on obstetrics even though childbirth remains the leading reason for hospitalizations in the U.S.²⁵ The few studies that assessed obstetric practices were limited to procedures or guidelines in selected areas of care.^{7-9,26} In contrast, our analysis provides a comprehensive description of a broad

spectrum of obstetric quality assurance activities, enabling improved understanding of overall practice patterns among hospitals.

We found important gaps in use of evidence-supported practices that are known as beneficial for improving patient outcome and safety. For instance, a concerning proportion of hospitals reported never or infrequent conduct of interprofessional simulations for obstetric emergencies and one-tenth of obstetric units did not regularly review cases with significant morbidity or mortality, highlighting opportunities for improvement. Additionally, lack of protocols or regular audit of protocols for diagnosis of labor arrest and management of abnormal fetal status was notable; and the majority of hospitals only mandated nurses but not physicians or midwives to be formally credentialed or certified in fetal monitoring. The low proportion of hospitals that required formal credentialing in fetal monitoring for residents may be due to our survey inquiring about “formal” credentialing, whereas some hospitals might use educational or more informal approaches to ensure that residents were practicing within standards. Likewise, some hospitals might not require “formal” credentialing for residents because they were considered as still in a training position and did not have hospital privileges. As labor dystocia or arrest and abnormal fetal heart rate status are the leading indications contributing to increased primary cesarean rate,^{16,27} enhancing protocols for management of these conditions may be particularly useful in safely reducing primary cesareans and associated morbidities. Further research is needed to validate our findings and assess the exact nature of protocols for management of abnormal fetal heart rate at hospitals that reported having such protocols.

We also identified significant proportions of hospitals lagging in other quality management activities (e.g., tracking quality indicators, regular team communication training). The utility and cost-effectiveness of these practices in promoting better outcomes or quality of care require further investigation. Our exploratory analysis found no significant difference in publicly reported rate of cesarean delivery among nulliparous term singleton vertex births and rate of vaginal birth after cesarean²⁸ between hospitals that regularly tracked these rates versus those that did not. However, such cross-sectional assessments are confounded by potential reverse causality and do not measure ultimate health outcomes. Further research prospectively monitoring maternal and neonatal outcomes and assessing cost implications²⁹ of these initiatives will help identify beneficial practices. Additionally, some hospital practices (e.g., tracking quality indicators or gathering feedback from patients but not using them to stimulate changes or remedies) may suggest missed opportunities and the need for a more proactive approach to quality assurance and more attention to the “quality” or “adequacy” of these efforts.

Moreover, there is important variation in quality assurance practices across hospitals. Hospitals that were smaller volume, non-teaching, and of private for-profit ownership may particularly benefit from enhanced efforts. Active involvement of these hospitals in future perinatal collaborative models may allow them to benefit from pooled resources available. Nevertheless, some important differences in quality management practices among hospitals (e.g., severe morbidity and mortality review) could not be explained by conventional institutional characteristics assessed in our analysis. Additional research is needed to

understand the role of other factors (e.g., insurer mandate of quality metrics) in explaining such variability in practice.

Findings of this study should be interpreted with several limitations in mind. First, our data came from California where there are robust quality efforts led by the CMQCC and CPQCC.

³⁰ Hence our findings may not be generalizable to practices elsewhere in the country.

Second, like all survey research, there is a potential for non-response bias. Nevertheless, with an overall response rate of 78.0% (75.5% for this analysis) and largely similar characteristics between responding and non-responding hospitals, impact of non-response bias should be minimal. Third, hospital data were collected from a single informant and hence may be subjective to report or interpretation bias. However, survey respondents demonstrated extensive familiarity with their institution's obstetric practice (long tenure in current position and obstetric unit and most identified as directors or managers of perinatal services) and 37.4% of them reported input from other colleagues when completing the survey. These should help reduce bias. Finally, the modest sample size and low proportion of hospitals with certain characteristics or practices limited our statistical power for discerning differences between hospitals. While additional research is warranted to validate our findings, these data help facilitate hypothesis generation and inform future studies.

Overall, hospitals in California actively engaged in efforts to ensure quality of obstetric care. However, there was large variation in their practices. Further research is needed to elucidate causes of such variation and its effect on patient safety and maternal and neonatal outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.

Hospital practices regarding protocol auditing and interprofessional simulations. **A.** Hospital audit of adherence to written clinical protocols. **B.** Hospital conduct of interprofessional simulation for clinical scenarios. Percentages may not add to 100 due to rounding.

Table 1.

Characteristics of survey respondents and responding hospitals

Characteristic		N (%) or Median (IQR)
Respondent	Position: Director (maternity, perinatal, or women's services)	78/184 (42.4)
	Labor & delivery or perinatal nurse manager	54/184 (29.4)
	Labor and delivery or postpartum charge nurse	10/184 (5.4)
	Other [*]	42/184 (22.8)
	Years in current position [†]	4.0 (1.5–10)
	Years in the obstetric unit at current hospital [‡]	12.5 (5–22)
	Degree or credential: Nursing	177/185 (95.7)
	MD or DO	3/185 (1.6)
	Other [§]	5/185 (2.7)
Hospital	Annual delivery volume ^{//}	1600 (700–2885)
	Type of ownership: Government, non-Federal	36/185 (19.5)
	Private non-profit	124/185 (67.0)
	Private for-profit	25/185 (13.5)
	Teaching status: Yes	88/185 (47.6)
	No	97/185 (52.4)
	Urban/rural location: Urban	166/185 (89.7)
	Rural	19/185 (10.3)

IQR=interquartile range; MD=doctor of Medicine Degree; DO=doctor of Osteopathic Medicine.

^{*} Includes medical director for obstetrics, clinical nurse specialist, educator, clinical mentor, clinical practice consultant, perinatal safety or quality position, and labor & delivery data manager.

[†] N=2 hospitals missing information on years in current position.

[‡] N=1 hospital missing information on years in current obstetric unit.

[§] Includes Certified Nurse midwife (CNM), M.Ed. and degree or credential unspecified.

^{//} N=2 hospitals missing information on delivery volume.

Table 2.**Hospital tracking of quality indicators and engagement in quality improvement efforts**

Hospital practice	N (%)	95% CI
Does obstetric unit regularly track the following quality indicators: *		
Overall cesarean rate	183/184 (99.5)	98.9–99.99
Primary cesarean rate	183/184 (99.5)	98.9–99.99
Cesarean rate for nulliparous term singleton vertex pregnancies	164/183 (89.6)	87.4–91.8
Indications for cesarean delivery	127/184 (69.0)	65.7–72.4
Vaginal birth after cesarean rate for women with prior cesarean	129/182 (70.9)	67.6–74.2
Obstetric trauma (3rd or 4th degree laceration) rate	146/183 (79.8)	76.9–82.7
Elective induction rate <39 weeks	166/181 (91.7)	89.7–93.7
Medical induction rate <39 weeks	149/180 (82.8)	80.0–85.5
Indications for induction of labor	111/179 (62.0)	58.5–65.6
Elective delivery (elective cesarean or induction) rate <39 weeks	168/183 (91.8)	89.8–93.8
Episiotomy rate	108/179 (60.3)	56.8–63.9
Newborn birth trauma rate	142/179 (79.3)	76.4–82.3
Apgar score <7 at 5 minutes	157/182 (86.3)	83.8–88.8
Patient satisfaction with obstetric care (e.g., Press Ganey, HCAHPS)	183/183 (100)	NA
Postpartum hemorrhage rate	144/182 (79.1)	76.2–82.1
Surgical site infection rate	162/183 (88.5)	86.2–90.8
How obstetric unit quality indicator data compared with other benchmarking data: *		
Compare with regional or national benchmarking data	149/183 (81.4)	78.6–84.2
Compare with other hospitals	124/183 (67.8)	64.4–71.1
Do not compare with other benchmarking data	12/183 (6.6)	4.8–8.3
Are data on these quality indicators used to implement or stimulate changes in your obstetric unit		
Yes	169/183 (92.3)	90.4–94.3
No	14/183 (7.7)	5.7–9.6
Engagement of hospital obstetric unit in the following quality improvement efforts: *		
Adopted CMQCC OB Hemorrhage toolkit	168/183 (91.8)	89.8–93.8
Adopted CMQCC Preeclampsia toolkit	132/177 (74.6)	71.4–77.8
Adopted CMQCC Early Elective Deliveries toolkit	127/177 (71.8)	68.4–75.1
Engaged in primary cesarean rate reduction	137/177 (77.4)	74.3–80.5
Promoted trial of labor after cesarean	88/178 (49.4)	45.8–53.1
Banned elective induction of labor prior to 39 weeks	169/183 (92.3)	90.4–94.3
Enhanced patient education on induction of labor without medical indications	118/181 (65.2)	61.7–68.7
Enhanced patient education on cesarean delivery without medical indications	107/182 (58.8)	55.2–62.4

Percentages may not add to 100 due to rounding. CI=confidence interval; CMQCC=California Maternal Quality Care Collaborative; HCAHPS=Hospital Consumer Assessment of Healthcare Providers and Systems; NA=not applicable; OB=obstetrics.

* Answer options not mutually exclusive

Table 3.**Hospital organization of quality assurance activities**

Hospital practice	N (%)	95% CI
Does hospital require formal credentialing in fetal monitoring for the following providers: *		
Nurses	146/184 (79.3)	76.4–82.3
Attending physicians or midwives	53/184 (28.8)	25.5–32.1
Residents [†]	10/59 (17.0)	11.7–22.2
Not required	37/184 (20.1)	17.2–23.0
Does hospital regularly provide training on patient communication skills for the following provider types: *		
Nurses	112/184 (60.9)	57.3–64.4
Attending physicians or midwives	35/184 (19.0)	16.2–21.9
Residents [†]	9/59 (15.5)	10.4–20.6
No	71/184 (38.6)	35.1–42.1
Does hospital regularly provide training on team communication skills for the following providers: *		
Nurses	113/184 (61.4)	57.9–64.9
Attending physicians or midwives	55/184 (29.9)	26.6–33.2
Residents [†]	13/59 (22.4)	16.6–28.3
No	70/184 (38.0)	34.5–41.5
Does your obstetric unit have a system in place to:		
Regularly gather feedback from patients regarding their experience with care and regularly implement remedies	150/183 (82.0)	79.2–84.7
Regularly gather feedback from patients regarding their experience with care but do not regularly implement remedies	28/183 (15.3)	12.7–17.9
No system in place to regularly gather feedback from patients	5/183 (2.7)	1.6–3.9
Does your obstetric unit regularly review cases with significant morbidity or mortality and implement remedies:		
Regularly review cases with significant morbidity and regularly implement remedies	140/185 (75.7)	72.6–78.8
Regularly review cases with significant morbidity or mortality but do not regularly implement remedies	27/185 (14.6)	12.1–17.1
No regular review of cases with significant morbidity or mortality	18/185 (9.7)	7.6–11.9
Presence of a formal system for providers and staff to file safety concerns in obstetric unit		
Yes	177/184 (96.2)	94.8–97.6
No	7/184 (3.8)	2.4–5.2
Presence of the following positions or committees in obstetric unit: *		
Patient safety or quality assurance committee	120/181 (66.3)	62.9–69.7
Safety or quality officer (physician, certified nurse midwife or nurse)	92/185 (49.7)	46.1–53.3
Patient or family experience committee	55/181 (30.4)	27.0–33.7
Perinatal practice or protocol committee	99/181 (54.7)	51.1–58.3

Percentages may not add to 100 due to rounding. CI=confidence interval; ACOG=American College of Obstetricians and Gynecologists; OB=obstetric.

* Answer options not mutually exclusive

[†] Statistic reflects proportion among hospitals with residents only (n=59)

Table 4.

Association between institutional characteristics and evidence-supported obstetric quality assurance practices

Quality assurance practice	Teaching Status			Location			Delivery Volume		Type of Ownership			
	Yes (N=88)	No (N=97)	P value	Urban (N=166)	Rural (N=19)	P value	Median (IQR)	P value	Government non-federal (N=36)	Private non-profit (N=124)	Private for-profit (N=25)	P value
Interprofessional simulation - eclampsia												
At least every 6 months	18.8%	9.6%		15.0%	5.3%		1900 (966–2842.5)		11.4%	16.5%	4.4%	
At least annually	44.7%	34.0%		38.1%	47.4%		1800 (800–2800)		45.7%	39.7%	26.1%	
Less than annually	18.8%	22.2%	0.003	18.8%	36.8%	0.77	1400 (600–2800)	0.04	22.9%	19.8%	21.7%	0.25
Never	17.7%	34.0%		28.1%	10.5%		1100 (480–2600)		20.0%	24.0%	47.8%	
Interprofessional simulation - shoulder dystocia												
At least every 6 months	23.3%	16.7%		20.3%	15.8%		1400 (825–2885)		17.1%	21.3%	16.0%	
At least annually	51.2%	46.9%		46.6%	68.4%		1800 (700–2730)		42.9%	50.0%	52.0%	
Less than annually	19.8%	14.6%	0.02	17.2%	15.8%	0.20	1800 (750–3324)	0.71	17.1%	17.2%	16.0%	0.78
Never	5.8%	21.9%		15.9%	0.0%		1050 (500–2600)		22.9%	11.5%	16.0%	
Interprofessional simulation - postpartum hemorrhage												
At least every 6 months	27.3%	24.0%		25.5%	26.3%		1450 (900–2800)		19.4%	26.8%	28.0%	
At least annually	56.8%	47.9%		51.5%	57.9%		1937.5 (725–2780)		58.3%	52.0%	44.0%	
Less than annually	12.5%	14.6%	0.04	13.3%	15.8%	0.39	1250 (600–3412)	0.47	13.9%	13.8%	12.0%	0.79
Never	3.4%	13.5%		9.7%	0.0%		787.5 (475–2325)		8.3%	7.3%	16.0%	
Perform regular review of cases of significant morbidity or mortality												
Yes	89.8%	90.7%		89.8%	94.7%		1600 (700–2800)		91.7%	91.9%	80.0%	
No	10.2%	9.3%	0.83	10.2%	5.3%	0.70	2050 (750–3000)	0.39	8.3%	8.1%	20.0%	0.19

Quality assurance practice	Teaching Status			Location			Delivery Volume		Type of Ownership			
	Yes (N=88)	No (N=97)	P value	Urban (N=166)	Rural (N=19)	P value	Median (IQR)	P value	Government non-federal (N=36)	Private non-profit (N=124)	Private for-profit (N=25)	P value
Track indications for cesarean delivery												
Yes	67.1%	70.8%	0.58	68.5%	73.7%	0.64	1700 (700–2900)	0.71	63.9%	72.4%	60.0%	0.36
No	32.9%	29.2%		31.5%	26.3%		1500 (700–2700)		36.1%	27.6%	40.0%	
Have written protocol for diagnosis of labor arrest												
Yes	27.3%	17.7%	0.12	23.6%	10.5%	0.25	1837.5 (750–2600)	0.99	36.1%	18.7%	20.0%	0.08
No	72.7%	82.3%		76.4%	89.5%		1450 (700–3000)		63.9%	81.3%	80.0%	
Have written protocol for management of abnormal (non-reassuring) fetal heart rate												
Yes	80.5%	86.5%	0.27	82.9%	89.5%	0.74	1600 (621–2800)	0.57	75.0%	89.4%	66.7%	0.01
No	19.5%	13.5%		17.1%	10.5%		1500 (900–3200)		25.0%	10.6%	33.3%	

Less than 3.2% of hospitals had missing values on any of the practices assessed in this table.