Original Research

Association Between Senior Obstetrician Supervision of Resident Deliveries and Mode of Delivery

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OBJECTIVE: In December 2012, the Mount Sinai Hospital implemented a program to have senior obstetricians (more than 20 years of experience) supervise residents on labor and delivery during the daytime. The objective of this study was to estimate the association of resident supervision by senior obstetricians with mode of delivery.

METHODS: This was a retrospective cohort study of all resident deliveries at Mount Sinai from July 2011 to June 2015. We included all patients with live, term, singleton, vertex fetuses. We compared delivery outcomes between patients delivered before December 2012 and patients delivered December 2012 and later using logistic regression analysis to control for age, body mass index, parity, induction, and prior cesarean delivery. During the study period there were no other specific departmental initiatives to increase forceps deliveries aside from having six obstetricians with significant experience in operative deliveries supervise and teach residents on labor and delivery.

RESULTS: There were 5,201 live, term, singleton, vertex deliveries under the care of residents, 1,919 (36.9%) before December 2012 and 3,282 (63.1%) December 2012 or later. The rate of forceps deliveries significantly increased from 0.6% to 2.6% (adjusted odds ratio [OR] 8.44, 95% confidence interval [CI] 3.1–23.1), and the rate of cesarean deliveries significantly decreased from 27.3% to 24.5% (adjusted OR 0.68, 95% CI 0.55–0.83). There were no statistically significant differences in the rates of third- or fourth-degree lacerations or 5-minute Apgar scores less than 7. Among nulliparous women, the forceps rate increased from 1.0% to 3.4% (adjusted OR 4.87, 95% CI 1.74–13.63) and the cesarean delivery rate decreased from 25.6% to 22.7% (adjusted OR 0.69, 95% CI 0.53–0.89). The increase in forceps deliveries and the decrease in cesarean deliveries were seen only in daytime hours (7 AM to 7 PM), that is, the shift that was covered by senior obstetricians.

CONCLUSION: Having senior obstetricians supervise resident deliveries is significantly associated with an increased rate of forceps deliveries and a decreased rate of cesarean deliveries.

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Over the past 20 years the rate of cesarean deliveries within the United States has increased from 22% in 1990 to 32% in 2014.[1,2] Healthy People 2020 is a current, national agenda to improve overall health care, which includes reducing the nulliparous, term, singleton, vertex cesarean delivery rate from 27.4% to 23.9%.[3] There are various possible reasons for the current cesarean delivery rate including fetal heart rate monitoring, increase in risk factors such as advanced maternal age and obesity, malpractice concerns, decreased vaginal birth after cesarean delivery, and a decrease in operative vaginal deliveries.[4]

Given the increase in morbidity with primary cesarean deliveries,[5] the American College of Obstetricians and Gynecologists and the Society for Maternal-Fetal Medicine recently published a consensus statement

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to try to reduce the incidence of primary cesarean delivery.[6] The consensus statement lists "training in, and ongoing maintenance of, practical skills related to operative vaginal delivery" as a strong recommendation with moderate-quality evidence. However, over the past 25 years, there has been a significant decrease in operative vaginal deliveries in the United States from 5.11% of deliveries in 1990 to 0.57% in 2014.[2] This decline may be attributable in part to decreasing skill, comfort, or both among graduating residents and junior attendings in performing operative deliveries.[7,8]

To combat this trend, in December 2012, our institution implemented a program to have senior obstetrician–gynecologist coverage on the labor floor during the daytime to supervise resident deliveries and help teach operative, specifically forceps, deliveries. From December 2012 and on, one to two senior attendings covered labor and delivery at least 5 days a week. The attendings selected to cover the floor had extensive experience (more than 20 years) with forceps deliveries. They were informed of the department's goal to reduce avoidable cesarean deliveries by teaching and performing forceps deliveries with the residents. Our hypothesis was that the involvement of experienced and skilled obstetricians would result in an increase in operative deliveries and a decrease in cesarean deliveries with no increase in maternal morbidity. Therefore, the objective of this study was to estimate the association of resident supervision by senior obstetricians with mode of delivery.

MATERIALS AND METHODS

This was a retrospective cohort study. After Mount Sinai institutional review board approval was obtained, we reviewed the electronic charts of all patients who delivered at our institution between July 2011 (when our computerized database was created) and July 2015. For this study, we included term (37 weeks of gestation or greater), live, singleton, vertex births under the care of residents. In our institution, patients are either on the private service, where the primary provider is an obstetrician in private practice, or the resident service, where the primary providers are the obstetric residents under the supervision of a covering attending. All patients on the resident service have Medicaid-based insurance.

Over the entire course of the study period, two obstetric attendings supervised resident deliveries during daytime (7 AM to 7 PM) hours and one attending supervised resident deliveries during nights and weekends (with a second attending available as backup in the event of an emergency or increased volume). Before December 2012, the experience of the attendings was variable. Starting in December 2012, during daytime hours from Monday to Friday, at least one of the two supervising attendings was senior (greater than 20 years' experience, including residency training, because all performed operative deliveries in residency) who was specifically charged by the department to try to improve resident training of forceps deliveries. There were six senior obstetricians chosen to take part in this program. Each was a board-certified specialist in obstetrics and gynecology, and none had subspecialty fellowship training. Over the course of the study period, there were no other departmental initiatives to teach operative vaginal deliveries aside from the usual teaching and training of residents on a rotating 2-year didactic schedule.

The patients were divided into two cohorts based on delivery before December 2012 and delivery December 2012 and later. The delivery mode was then compared between the two groups using χ^2 testing. The primary outcome was the rate of forceps deliveries, because this was the specific goal of the intervention. Secondary outcomes included the rate of cesarean deliveries, vacuum deliveries, third- and fourth-degree lacerations, and 5-minute Apgar scores less than 7. We looked at all deliveries as well as a subgroup of nulliparous deliveries. Because the senior obstetrician coverage program instituted in December 2012 was specifically during the daytime hours, we also analyzed day (7 AM to 7 PM) and night (7 PM to 7 AM) deliveries separately.

A multivariable logistic regression model was used to control for confounding variables to identify the independent relationship of senior obstetrician coverage and the rate of forceps deliveries and secondary outcomes (IBM SPSS for Windows 22.0). The regression model took into account variables that were considered a priori as potentially having an effect on the mode of delivery including advanced maternal age (age 35 years or older), maternal obesity (body mass index [calculated as weight (kg)/[height (m)]^2] 35 or greater at delivery), induction of labor, parity, and prior cesarean delivery. The final two variables were not included in the analysis of nulliparous patients only.

RESULTS

Over the course of the study period (July 2011–July 2015), there were a total of 22,440 term, singleton, vertex deliveries at our institution, of which 5,201 (23.2%) were under the care of residents. Of the 5,201 deliveries, 1,919 (36.9%) occurred before December 2012 and 3,282 (63.1%) occurred December 2012 or later (Table 1). There were no

Table 1. Baseline Characteristics of the Population

Characteristic	July 2011–November 2012 (n=1,919)	December 2012–June 2015 (n=3,282)	*P*
Age 35 y or older	242 (12.6)	427 (13.0)	.655
BMI 35 kg/m^2 or greater	476 (24.8)	843 (25.7)	.533
Nulliparous	1,044 (54.4)	1,799 (54.8)	.679
Induction of labor	537 (28.0)	1,142 (34.8)	<.001
Prior cesarean delivery	330 (17.2)	591 (18.0)	.472

Data are n (%) unless otherwise specified.
BMI, body mass index.

significant differences at baseline in maternal age, obesity, nulliparity, and prior cesarean delivery. There were significantly more patients who underwent induction of labor in the more recent cohort.

In the cohort of patients delivered after institution of senior attending coverage, the rate of forceps deliveries was significantly higher than before the change to senior attending coverage, 2.6% compared with 0.6% (Table 2), a fourfold increase with an adjusted odds ratio (OR) of 8.44 (95% confidence interval [CI] 3.1–23.1). The rate of cesarean deliveries was significantly lower, 27.3% compared with 24.5% (adjusted OR 0.68, 95% CI 0.55–0.83). There was no significant change in vacuum delivery rates or in 5-minute Apgar scores less than 7. The episiotomy rate increased from 3.6% to 7.4% ($P<.001$), but the rate of third- or fourth-degree lacerations did not increase significantly (1.4% compared with 2.0%, adjusted OR 1.30, 95% CI 0.74–2.27).

There were 2,280 nulliparous term singleton vertex deliveries, with 841 (36.9%) before December 2012 and 1,439 (63.1%) December 2012 and later (Table 3). After institution of the senior attending coverage, the forceps delivery rate increased from 1.0% to 3.4% (adjusted OR 4.87, 95% CI 1.74–13.63) (Table 4) and the primary cesarean delivery rate decreased from 25.6% to 22.7% (adjusted OR 0.69, 95% CI 0.53–0.89). The episiotomy rate increased from 6.7% to 12.8% ($P<.001$), but, like in the overall cohort, the rate of third- or fourth-degree lacerations did not increase significantly (2.5% compared with 3.3%, adjusted OR 1.18, 95% CI 0.64–2.17).

We further divided the patients into those delivered during the day (7 AM to 7 PM) and night (7 PM to 7 AM) shifts and the results are shown in Appendix 1, available online at http://links.lww.com/AOG/A928 (all patients), and Appendix 2, available online at http://links.lww.com/AOG/A928 (nulliparous patients). The increase in forceps deliveries and decrease in cesarean deliveries beginning December 2012 was most pronounced during the daytime deliveries. The rates of nighttime forceps and cesarean deliveries did not change significantly.

DISCUSSION

In this study we found that having senior obstetricians with experience in forceps deliveries supervising residents was significantly associated with mode of delivery. Implementation of this program was associated with significantly higher forceps rates and significantly lower cesarean delivery rates even after controlling for several potential confounding variables. This effect was seen only during the daytime hours when the senior obstetricians were overseeing the resident deliveries and not during nighttime deliveries, indicating that the increased forceps and decreased cesarean delivery rates were likely not the result of general trends over time at our institution. Importantly, in all the analyses, the rate of vacuum delivery did not change, indicating the increase in forceps deliveries was not simply the result of changing from vacuum to forceps. Additionally, the increased rate of forceps deliveries was not significantly associated with our measured adverse

Table 2. Delivery Outcomes

Outcome	July 2011–November 2012 (n=1,919)	December 2012–June 2015 (n=3,282)	OR (95% CI)	Adjusted OR (95% CI)*
Forceps	12 (0.6)	85 (2.6)	4.80 (2.48–9.28)	8.44 (3.1–23.1)
Vacuum	63 (3.3)	108 (3.3)	1.01 (0.73–1.39)	1.08 (0.72–1.63)
Cesarean	524 (27.3)	804 (24.5)	0.86 (0.76–0.98)	0.68 (0.55–0.83)
3rd- or 4th-degree laceration	27 (1.4)	66 (2.0)	1.36 (0.85–2.19)	1.30 (0.74–2.27)
5-min Apgar score less than 7	6 (0.3)	16 (0.5)	1.76 (0.64–4.83)	1.14 (0.30–4.32)

Data are n (%) unless otherwise specified.
OR, odds ratio; CI, confidence interval.
* Adjusted for advanced maternal age, obesity, parity, induction of labor, prior cesarean delivery.

Table 3. Baseline Characteristics of Nulliparous Patients

Characteristic	July 2011–November 2012 (n=841)	December 2012–June 2015 (n=1,439)	*P*
Age 35 y or older	48 (5.7)	78 (5.4)	.772
BMI 35 kg/m^2 or greater	170 (20.2)	315 (21.9)	.348
Induction of labor	289 (34.4)	567 (39.4)	.035

Data are n (%) unless otherwise specified.
BMI, body mass index.

outcomes, third- and fourth-degree laceration and 5-minute Apgar scores less than 7. This is important because one might expect an increase in these outcomes with more forceps deliveries.

Perhaps the most telling result of this study was the analysis of nulliparous patients. Although the analysis of all patients controlled for parity and prior cesarean delivery, there were enough nulliparous patients to perform a separate analysis. In this subgroup, there was a significant reduction in the primary cesarean delivery rate, from 25.6% to 22.7%, which exceeds the Healthy People 2020 goal of 23.9%.[3] Furthermore, nulliparous women are precisely the group that is being targeted by the American College of Obstetricians and Gynecologists and the Society for Maternal-Fetal Medicine to lower the cesarean delivery rate.[6] Our study showed that having senior obstetricians with experience in forceps deliveries, and a goal to teach residents how to perform them, might be one way to achieve the goal of decreasing the primary cesarean delivery rate.

A recent study showed that simulation and structured teaching of forceps deliveries to residents are associated with a decrease in the rate of severe perineal lacerations by 22%.[9] This type of curriculum was also recommended in a recent review of the declining rates of forceps deliveries, because the other alternative is to essentially abandon forceps deliveries entirely.[7] Our study adds to the growing literature regarding resident education of forceps deliveries. Many obstetric departments have obstetricians (senior or junior) with significant forceps training. Our study indicates that a concerted effort to have these obstetricians cover labor and delivery and teach forceps deliveries to residents could be one way to significantly improve training of this procedure. In turn, this could produce more residency graduates with the requisite skill to not only perform forceps deliveries, but also to teach them to the next group of residents, hopefully reversing the trend of decreased forceps deliveries. In our own department, many of the senior obstetricians approached to supervise the residents were obstetricians in private practice for their entire careers, and several agreed to participate. We believe many other departments either have similar skilled obstetricians or can effectively recruit them to increase forceps deliveries. It is likely that the same increase in forceps deliveries could be seen with less senior obstetricians supervising residents provided they had extensive experience and comfort in performing forceps deliveries themselves.

Strengths of this study include the large sample size. We were able to control for several potential confounding variables. We found that induction of labor was higher in the more recent cohort (likely as a result of the increasing practice of induction of labor for gestational hypertension and advanced maternal age at our institution) and this variable was included in the regression model. However, it should be noted that despite our large sample size, the rates of certain outcomes, including forceps deliveries, were low so the regression model could have been overfitted. Another strength of the study is that we were able to separately analyze day and night deliveries so we were able to demonstrate that the differences seen were not

Table 4. Delivery Outcomes of Nulliparous Patients

	July 2011–November 2012 (n=841)	December 2012–June 2015 (n=1,439)	OR (95% CI)	Adjusted OR (95% CI)*
Forceps	8 (1.0)	49 (3.4)	3.43 (1.61–7.31)	4.87 (1.74–13.63)
Vacuum	44 (5.2)	75 (5.2)	1.02 (0.69–1.52)	1.15 (0.71–1.86)
Cesarean	215 (25.6)	327 (22.7)	0.85 (0.70–1.04)	0.69 (0.53–0.89)
3rd- or 4th-degree laceration	21 (2.5)	47 (3.3)	1.35 (0.78–2.34)	1.18 (0.64–2.17)
5-min Apgar score less than 7	4 (0.5)	10 (0.7)	1.46 (0.46–4.68)	1.28 (0.26–6.39)

Data are n (%) unless otherwise specified.
OR, odds ratio; CI, confidence interval.
* Adjusted for advanced maternal age, obesity, induction of labor.

likely the result of general trends in mode of delivery in our institution.

There are several limitations to this study related to its retrospective design. There could have been unmeasured confounding variables and there is always the possibility of inaccurate data, although mode of delivery is unlikely to be incorrectly documented. This type of study does not lend itself to randomization, aside from randomizing two separate residency programs, which would be challenging. Therefore, multiple different analyses were performed to ensure as best as possible that the differences seen were in fact associated with the variable of senior obstetrician coverage. Another limitation is that our results may be limited only to the studied attendings and residents because maybe these attendings are uniquely adept at performing and teaching forceps deliveries, and perhaps these residents are better learners than others. However, there is no reason to assume that these assumptions are true and that this forceps training program could not be reproduced elsewhere. It is also possible that among our six senior attending obstetricians, some could have been more successful than others in teaching residents. However, the purpose of this study was to estimate the effect of a departmental initiative to improve resident training and not the effect of a single obstetrician on outcomes. Another limitation is that our sample size(s) lacked statistical power to detect potentially clinically meaningful differences in outcomes that occurred at low rates such as severe perineal lacerations and low Apgar scores.

In conclusion, our study indicates that resident supervision by senior obstetricians is significantly associated with mode of delivery. There was a significant increase in the rate of forceps delivery with a concomitant decrease in the overall cesarean delivery rate. Adding senior obstetrician coverage might be a method for hospitals to decrease the primary cesarean delivery rate, which is now monitored by various agencies and will be published publically. Therefore, hospitals with obstetric residency programs should consider adding senior skilled obstetricians to supervise resident deliveries.

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