

Obstetric Anesthesia Workforce Survey

Twenty-year Update

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“THE position of woman in any civilization is an index of the advancement of that civilization; the position of woman is gauged by the care given her at the birth of her child.”¹ Although many developments have occurred in obstetric anesthesia since this quote’s first publication in 1929, advances in the subspecialty have been complicated by medicolegal, financial, maternal, and fetal considerations. In addition to these concerns, recent economic pressures, variations in payment, patient expectations, and the technical aspects of providing these services have challenged obstetric anesthesia practice.

Surveys are frequently used to define and detect changes in practice. Since data were collected more than 20 yr ago for the first obstetric anesthesia workforce survey,² there have been improvements in delivery of obstetric analgesia and anesthesia. Many factors affect the number and type of available anesthesia care providers and the services they provide. The most recent obstetric anesthesia survey reported that although the availability of both regional analgesia and anesthesia for labor and delivery had improved in the previous decade, improvement was still needed in staffing patterns and availability of personnel.³ Organizations outside the practice of anesthesiology (e.g. American College of Obstetricians and Gynecologists [ACOG], Association of Women’s Health Obstetric and Neonatal Nurses [AWHONN]) have published their own guidelines,⁴⁻⁶ which impact the management of pain relief. Newer approaches to regional analgesia for labor (e.g., patient-controlled epi-

dural analgesia, combined spinal-epidural [CSE] analgesia) may aid practitioners in meeting the increased demands of obstetric anesthesia practice, but whether these newer approaches are used substantially is unknown.

The 2001 obstetric anesthesia workforce survey was performed in conjunction with the Society for Obstetric Anesthesia and Perinatology to estimate and assess current trends in obstetric anesthesia practice as well as to identify potential areas needing improvement.

Materials and Methods

In 1981 and 1992,^{2,3} workforce surveys were conducted to assess trends in obstetric anesthesia practice. The survey was repeated in 2001, modifying the 1992 instrument to include newer questions to define contemporary practice patterns. The 2001 survey instrument differed from previous surveys by separating the questionnaire into three parts to direct questions to the three key labor and delivery personnel (Chief of Anesthesiology, Chief of Obstetrics, Labor and Delivery Manager) that were most likely to provide the most accurate information. Questionnaires were developed using TELEform[®] technology (Verity, Inc., Sunnyvale, CA), which simplified the process of data entry and quality control by converting information written on paper documents directly into an electronic database. Each draft survey was distributed to a four- or five-participant focus group to obtain feedback about the survey (e.g., validity of questions, ease of use) before distribution.

The primary focus of the survey was to obtain data on obstetric anesthesia practice from obstetrics and anesthesia providers as well as labor and delivery managers in groups of hospitals defined by the annual number of births and to compare these data across these hospital strata. Using the response rates known from previous surveys, the number of individuals contacted within each stratum was determined with the expectation that approximately 170 respondents would complete and return the survey.

A stratified random sample frame of 1,300 hospitals was selected from the American Hospital Association’s 2001 *Guide to the Health Care Field*. Hospitals were stratified based on geographic region (Northeast, Mid-Atlantic, South Atlantic, East North Central, East South Central, West North Central, West South Central, Mountain, and Pacific) and number of births for that year:

◆ This article is featured in “This Month in Anesthesiology.” Please see this issue of Anesthesiology, page 5A.

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|| Association of Women’s Health, Obstetric and Neonatal Nurses: The role of the registered nurse (RN) in the care of pregnant women receiving analgesia/anesthesia by catheter techniques (epidural, intrathecal, spinal, patient-controlled epidural analgesia catheters). Association of Women’s Health, Obstetric and Neonatal Nurses, 2001. Available at: www.awhonn.org/awhonn/?pg=873-6230-7000-4730-4760. Accessed July 24, 2004.

Table 1. Number of Hospitals Providing Obstetric Care by Number of Births

	Stratum I (≥ 1,500 Births)	Stratum II (500–1,499 Births)	Stratum III (100–500 Births)	Total Hospitals	Total Births
1981	573 (14)	1,249 (30)	2,341 (56)	4,163	3,667,316
1992	824 (23)	1,118 (32)	1,603 (45)	3,545	3,669,112
2001*	889 (28)*	1,189 (38)*	1,081 (34)*	3,160*	3,973,925
Total births for 2001 by strata	2,594,036 (65)	1,075,755 (27)	304,134 (8)	3,973,925	

Data are presented as n (%).

* Data aggregated from the American Hospital Association's Annual Survey Database for the fiscal year 2001.

stratum I (> 1,500 births), stratum II (500–1,499 births), and stratum III (100–500 births).

During the presurvey time period, letters were sent to each hospital administrator in the sample (stratum I: n = 336; stratum II: n = 492; stratum III: n = 473) asking them to identify and provide contact information for the three key labor and delivery personnel at their institution: Chief of Anesthesiology, Chief of Obstetrics, and Labor and Delivery Manager. Administrators who did not respond received a second mailing. Following the methods outlined by Dillman,⁷ a survey introductory letter was mailed to the three key personnel at each responding institution, followed by the survey instrument 1 week later. Each of the personnel was contacted periodically up to five times during the survey. Incentives or inducements for completion of the survey were not offered. The identity of all survey respondents remained confidential. Returned questionnaires were scanned using TELEform[®] software. Response tabulation and statistical analysis (by strata) were completed using SAS[®] software (SAS Institute, Inc., Cary, NC). Responses were analyzed by strata.

A brief follow-up telephone survey of nonresponding hospitals was conducted to identify potential differences between responders and nonresponders. This brief survey focused on several key characteristics, including anesthesia procedures and personnel.

Results

Data on Survey Respondents

Number of Hospitals Providing Obstetric Care by Number of Births. Table 1 contains data aggregated

from the American Hospital Association's Annual Survey Database for the fiscal year 2001. Compared with their 1981 and 1992 data, the number of hospitals providing obstetric care decreased from 4,163 in 1981 and 3,545 in 1992 to 3,160 in 2001. A substantial decrease was observed in the number of stratum III hospitals (100–500 births) providing obstetric care compared with 1992 data (1,603–1,081), and there was a considerable increase in the number of the largest stratum I facilities (824–889).

Description of Respondents and Profile of Responding Hospitals. Table 2 describes survey respondents, profiles of responding hospitals, and total number of births at responding hospitals for 2001. A total of 378 of the 1,300 initially sampled hospitals responded to the request for contact information on their key labor and delivery personnel (29% overall response). In the Anesthesiology survey, responses were received from 57% of the contacted anesthesiologists and certified registered nurse anesthetists. In the Obstetrics survey, responses were received from 45% of the contacted obstetricians, nurse midwives, and family practitioners. In the Labor and Delivery Manager survey, responses were received from 75% of the registered nurses and other labor and delivery management personnel.

Stratum I hospitals (> 1,500 births) were more likely to be regional referral centers for high-risk obstetrics and to have anesthesiology residency and Clinical Anesthesiology year 4 programs. Nevertheless, 20% of hospitals with 500–1,500 deliveries per year consider themselves regional referral centers for high-risk obstetrics (*i.e.*, high-risk referral center).

Table 2. Description of Respondents and Profile of Responding Hospitals, 2001

	Stratum I (≥ 1,500 Births)	Stratum II (500–1,499 Births)	Stratum III (100–500 Births)
Hospitals surveyed, n (%)	107 (32)	145 (29)	126 (27)
Anesthesiology returned	63 (59)	72 (50)	80 (63)
Obstetrics returned	70 (65)	113 (78)	103 (82)
Labor and delivery returned	50 (47)	63 (43)	59 (47)
Anesthesiology residency, %	33	4	5
Clinical Anesthesiology year 4 program, %	14	0	0
Military hospital, %	2	0	0
Regional referral center for high-risk obstetrics, %	59	20	2
Total No. of births	152,868	59,515	18,817

Table 3. Types of Anesthesia Provided during Labor and Cesarean Delivery

	Stratum I			Stratum II			Stratum III		
	1981	1992	2001	1981	1992	2001	1981	1992	2001
Labor									
None	27	11	6	33	14	10	45	33	12
Parenteral	52	48	34	53	60	42	37	48	37
Paracervical	5	2	2	5	4	3	6	7	3
Epidural	22	51	61	13	33	42	9	17	35
Unspecified spinal	0	4		0	4		0	4	
Spinal without local			3			4			8
Spinal with local			5			5			9
Combined spinal-epidural			8			8			5
Use patient-controlled epidural analgesia			35			32			18
If yes, % of patients			60			48			42
Cesarean delivery									
General anesthesia	35	12		45	15		46	22	
Elective			3			5			3
Emergent			15			30			25
Epidural	29	54		16	45		12	29	
Elective			22			17			14
Emergent			36			21			14
Spinal	33	35		35	40		37	49	
Elective			67			75			80
Emergent			45			48			59
Combined spinal-epidural									
Elective			8			2			3
Emergent			4			2			3

Data are presented as percentages.

Procedures and Personnel

Types of Analgesia Provided for Labor. Compared with previous surveys, there was an overall increase in the percent of maternity cases using regional analgesia for labor across all strata (table 3). There were decreases in the percent of parturients receiving either parenteral analgesia or no analgesia at all compared with 1981 and 1992 survey data. In all hospitals, the use of epidural analgesia increased compared with previous surveys, with the sharpest increase occurring in stratum III hospitals. Spinal analgesia (either with or without local anesthetics) was used in less than 10% of cases. Similarly, CSE was administered in a small number of maternity cases across all strata. Patient-controlled epidural analgesia was used in nearly one-third of stratum I and II hospitals, but only 18% of stratum III hospitals reported its use.

Types of Anesthesia Provided for Cesarean Delivery. The use of spinal anesthesia for cesarean delivery increased across all strata, whereas the use of epidural anesthesia decreased across all strata compared with 1992 survey data (table 3). General anesthesia was used in 5% or less of elective cesarean deliveries. However, general anesthesia was used in 15% of urgent-emergent cases in stratum I hospitals (> 1,500 births), 30% in stratum II hospitals (500-1,499 births), and 25% in stratum III hospitals (100-500 births). CSE anesthesia was used in less than 10% of cesarean deliveries across all strata.

Availability of Regional Anesthesia for Obstetrics.

Eighty percent of stratum I hospitals reported in-house availability of regional analgesia during labor (table 4). In the smallest hospitals, only 3% reported in-house coverage for regional analgesia for labor. Compared with 1992, stratum II hospitals reported a decrease in in-house coverage from 27% to 20% in 2001. Seventy-seven percent of stratum II hospitals reported on-call coverage for regional analgesia. Compared with 20% provider unavailability in 1992, only 3% of stratum III hospitals reported that regional analgesia for labor was not available. In all hospital categories, the provider availability of regional anesthesia for cesarean delivery was similar to that available during labor.

Personnel Providing Regional Analgesia for Labor. In 2001, across all strata, an anesthesiologist was slightly more often directly involved in the care of patients receiving regional analgesia for labor compared with 1981 and 1992 survey data (table 5). Less than 6% of regional analgesics were administered by obstetricians for labor across all strata, compared with 30% in 1981. In stratum III hospitals, 34% of regional analgesics for labor were administered by independently practicing certified registered nurse anesthetists, and 14% of these anesthetics were administered by certified registered nurse anesthetists under the medical direction of nonanesthesiologist physicians.

Personnel Performing Newborn Resuscitation. Respondents were asked for the percentage of various personnel performing newborn resuscitation in their

Table 4. Availability of Regional Anesthesia for Obstetrics

	Stratum I			Stratum II			Stratum III		
	1981	1992	2001	1981	1992	2001	1981	1992	2001
Labor									
In-house	43	75	80	12	27	20	3	3	3
On-call	36	24	20	57	67	77	57	77	95
Unavailable	15	1	0	22	7	3	33	20	3
Cesarean delivery									
In-house	46	77	79	13	26	20	5	3	4
On-call	46	23	21	78	74	78	81	95	96
Unavailable	1	1	0	3	0	2	9	2	0

Data are presented as percentages.

hospitals. In stratum I and II hospitals, pediatricians performed an average of 42% and 48% of neonatal resuscitations during cesarean deliveries, respectively. This was offset by a large increase in the average percentage of resuscitations performed by nursing personnel (*e.g.*, nurse specialist trained in neonatal resuscitation, labor nurse).

Labor and Delivery Policies

Vaginal Birth after Cesarean Delivery. Respondents were asked whether their hospitals allowed vaginal birth after cesarean delivery (VBAC) (table 6). Vaginal birth after cesarean delivery was allowed in 98% of stratum I and 92% of stratum II hospitals but was allowed in only 68% of stratum III hospitals. Regardless, only 25–30% of all patients attempted it across all strata. Forty percent of the stratum III hospitals reported that since the introduction of the July 1999 American College of Obstetrics and Gynecology Practice Bulletin on Vaginal Birth after Cesarean Delivery,⁵ VBAC was no longer performed. Both stratum I and II hospitals also indicated a decrease in VBAC attempts since introduction of the practice bulletin. Across all strata, at least 60% of attempted VBACs were successful.

Required In-house Anesthesia Provider. Respondents were asked about in-house anesthesia provider coverage during epidural infusions, and VBAC with and without regional analgesia (table 6). During epidural infusions, the majority of institutions in all three strata

required anesthesia providers to be in-house. Across all strata, between 63% (stratum III) and 94% (stratum I) of institutions required providers to be in-house when parturients were attempting VBAC with regional analgesia. Eighty-six percent of stratum I hospitals required anesthesia providers to be in-house during attempted VBAC even if regional analgesia was not used. In the smallest hospitals, 33% of respondents stated that in-house anesthesia providers were required during VBAC attempts without regional analgesia.

Ambulation Allowed during Labor. Almost all hospitals allowed ambulation during spinal opioid administration (table 6). Although approximately 50% of hospitals allowed ambulation during epidural or CSE analgesia, a much smaller percentage of patients actually ambulated.

Labor and Delivery Nurse Authorization. Less than 10% of institutions allowed nurses to reinstitute (*i.e.*, restart) epidural infusions across all strata (table 6). Twenty-eight percent of stratum II hospitals reported that nurses were allowed to adjust infusion rates, but only 7% of stratum I hospitals permitted nursing staff to adjust epidural infusion rates. Nurses were allowed to administer epidural boluses in 13% of stratum II hospitals, but only 3% of stratum I hospitals allowed nurses to administer boluses.

Collections and Payment

Collection Rates. The collection rates for professional fees for anesthesia for labor and vaginal delivery as

Table 5. Personnel Providing Regional Analgesia for Labor

	Stratum I			Stratum II			Stratum III		
	1981	1992	2001	1981	1992	2001	1981	1992	2001
Anesthesiologist*	70	95	98	61	79	81	35	42	45
Obstetrician†	26	0	1	31	5	2	46	3	6
CRNA‡			0			15			34
CRNA§			2			2			14
CRNA‡§	4	4		8	16		10	55	

Data are presented as percentages.

* Personally performed, anesthesiologist-directed resident, or anesthesiologist-directed certified registered nurse anesthetist (CRNA). † 2001 survey asked "obstetrician or family practitioner." ‡ Independent CRNA. § CRNA under medical direction of nonanesthesiologist M.D. ‡ and § combined in 1981 and 1992.

Table 6. Labor and Delivery Policies, 2001

	Stratum I ($\geq 1,500$ Births)	Stratum II (500–1,499 Births)	Stratum III (100–500 Births)
Hospitals allowing VBAC	98	92	68
VBAC attempts*	30	29	25
Successful VBAC attempts*	66	64	60
Change in hospital policy regarding VBAC			
Remained the same	13	14	7
Decreased	79	80	47
No longer performed	4	7	40
In-house anesthesia provider required during:			
VBAC with regional analgesia	94	81	63
VBAC without regional analgesia	86	45	33
Epidural infusion	81	42	53
Ambulation allowed during labor	11	19	49
During spinal opioids	86	86	97
During epidural analgesia	50	36	65
During combined spinal–epidural analgesia	63	58	64
Average % of patients who ambulate†	3	11	26
Labor and delivery nurses authorized to:			
Adjust epidural infusion rate	7	28	20
Administer epidural bolus	3	13	7
Reinstitute epidural infusion	9	7	7

Data are presented as percentages.

* In hospitals allowing vaginal birth after cesarean delivery (VBAC). † In hospitals allowing ambulation during epidural–spinal labor analgesia.

well as cesarean delivery and for other surgical procedures steadily decreased from 1981 to 2001 (table 7).

Patient Payer Categories and Payment of Actual Charges. Stratum I hospitals had the largest percentage of health maintenance organization payers, and stratum II and III hospitals had the largest percentage of Medicaid payers. Stratum III hospitals had the highest percentage of Medicaid and private insurer categories but had the smallest percentage of health maintenance organization payers. Percentage payment of actual charges was similar among all groups of payers across all sizes of hospitals.

Data on Follow-up Survey Nonrespondents

Responses were obtained from 43 hospital administrators (16 stratum I, 13 stratum II, and 14 stratum III) of institutions that did not respond to the initial survey. Collectively, there were no significant differences ($P = 0.05$) in responses obtained from initial survey respondents compared with nonrespondents.

Discussion

More than 4 million deliveries occur in the United States each year. During the past 20 yr, there has been an

Table 7. Collection Rates for Anesthesia Providers*

	1981	1992	2001
Cesarean delivery	76	70	66
Other surgical procedures	82	74	68
Labor and vaginal delivery	67	68	60

Data are presented as percentages.

* All responses weighted for stratum-specific response rates.

increasing trend toward the use of regional analgesia/anesthesia for labor and delivery. Current survey results suggest that there has been improvement in availability as well as staffing of regional analgesia/anesthesia for labor and delivery. These results are particularly notable because the number of anesthesia providers has not kept pace with increasing demand for services.^{8–10} In a report published in 2003, the number of American anesthesia residency graduates decreased by 75% from a high of 1,511 in 1994 to only 400 in 2000.¹¹ Although the number increased to 783 in 2003, several factors will continue to intensify and prolong the shortage of anesthesiologists. The number of nurse anesthetists is also expected to decrease because the average age of nurses is increasing and nonhospital jobs are multiplying.¹² While the availability of trained anesthesiologists has declined,^{10,13} surgical volumes have increased and the scope of practice has extended to outpatient surgical centers, intensive care units, pain clinics, and preoperative testing centers. Increased demand for anesthesia services and availability of skilled anesthesia providers will influence the provision of obstetric anesthesia services.

The 2001 survey estimated that in the United States, the total number of hospitals as well as the number of stratum III hospitals (100–500 births) providing obstetric care decreased by 12% and 33%, respectively, compared with the previous decade (table 1). In contrast, both the number of stratum I (> 1,500 deliveries) and II (500–1,499 births) hospitals providing obstetric care increased. The increased number of stratum I and decreased number of stratum III hospitals providing obstetric care is consistent with observations in the 1992

survey and represents redistribution of obstetric services to larger obstetric units or closure of smaller labor and delivery units. Both the American Society of Anesthesiologists and ACOG support regionalization of obstetric care as stated in the "Optimal Goals for Anesthesia Care in Obstetrics." Although only 8% of deliveries occurred in hospitals with obstetric services between 100 and 500 deliveries per year, these hospitals constituted 36% of the hospitals providing obstetric care. Sixty-six percent of all deliveries now occur in hospitals with more than 1,500 deliveries per year, allowing for enough volume to support comprehensive anesthesia services. Many of these hospitals are also affiliated with medical schools and residency programs. Still, 20% of stratum II and 2% of stratum III hospitals are regional referral centers for high-risk obstetrics (table 2), likely reflecting that some moderate-size facilities are referral sites in sparsely populated areas. According to a joint statement issued by the American Society of Anesthesiologists and ACOG ("Optimal Goals for Anesthesia Care in Obstetrics"), 24-h in-house anesthesia, obstetric, and neonatal specialists are usually necessary in large maternity units and those functioning as high-risk centers.[#] Such subspecialty care centers should have a board-certified anesthesiologist with special training or experience in maternal-fetal anesthesia in charge of obstetric anesthesia and personnel privileged in administration of obstetric anesthesia should be available in the hospital 24 h a day.¹⁴

Current survey results suggest that use of regional analgesia for labor increased across all strata, especially in stratum III hospitals (table 3). In addition, fewer parturients received parenteral or no analgesia compared with 1981 and 1992 data.^{2,3} Many factors influence labor analgesia preferences: family and friends, past experience and expectations, cultural background, knowledge of the lay or scientific literature, and the media and medical professionals providing care.¹⁵ Although few sources address how labor pain management preferences affect provision of pain management, Goldberg *et al.*¹⁶ reported a strong association between a birth plan incorporating epidural analgesics and the likelihood of a parturient receiving one. The study also reported that 40% of women who plan to avoid a labor epidural receive one. More recently, a systematic review of pain during childbirth revealed that behaviors and attitudes of the caregivers are more important for women's satisfaction than the magnitude of pain, pain relief, and intrapartum medical interventions.¹⁷ Although the long-standing controversy about effects of epidural analgesia

on the likelihood of cesarean delivery has been resolved,¹⁸ some childbirth educators advocate avoidance of regional analgesia in the absence of maternal complications.^{**} In contrast, a joint American Society of Anesthesiologists-ACOG statement makes the point that for many women, regional anesthesia (epidural, spinal, or CSE) will be the most appropriate anesthetic. Although the overall availability of anesthesia providers has decreased,⁸⁻¹⁰ use and availability of regional analgesia for labor in all hospitals has increased, especially in stratum III hospitals. Despite this increase, not all hospitals require anesthesia groups to provide this service, and some hospitals only provide services for cesarean delivery.¹⁹

Although continuous epidural infusions were improvements in the administration of regional analgesia for labor compared with intermittent bolus techniques,²⁰ newer techniques (*i.e.*, patient-controlled epidural analgesia) have allowed for self-administration of local anesthetics and for reduction or elimination of background infusions. Although patient-controlled epidural analgesia reduces total epidural medication requirements, anesthesiologist-delivered supplemental "top-ups," and decreases anesthesia personnel workload,²¹ only 18-35% of hospitals used patient-controlled epidural analgesia (table 3). Reasons for a low rate of use are unclear, but one possible explanation may be unfamiliarity or cost of the devices themselves.

Since publication of the last obstetric anesthesia workforce survey, CSE is one other technique that is new to obstetric anesthesia practice. Before its development, single-injection spinal analgesia offered the advantage of administration of low doses of spinal anesthetics without the complications associated with epidural catheter insertion. The single injection spinal technique has been used in smaller hospitals because it can be administered by obstetric care providers with little additional training or by anesthesia personnel who do not remain in the hospital.^{22,23} Our survey results suggest that single-injection spinal techniques were used in a small number of hospitals across all the strata. In contrast to the limited duration of single-injection techniques, CSE labor analgesia provides the best of both single-injection spinal and epidural techniques. Despite these advantages, our data suggest that CSE was used in less than 10% of all hospitals in 2001. Although CSE seems to be a straightforward technique, it is more complicated than either spinal or epidural alone. Besides the complexity of the technique, the epidural catheter has not been shown to function until after the interval of spinal analgesia, if an urgent procedure is necessary. Despite these potential reasons for low use, CSE catheters have been shown to fail at the same rate as epidural catheters.²⁴ Although actual complications do not seem to be different between the two techniques,²⁵ provider use could also be influenced by concern about potential complications.

[#] American Society of Anesthesiologists and American College of Obstetricians and Gynecologists: Optimal Goals for Anesthesia Care in Obstetrics. American Society of Anesthesiologists, 2000. Available at: www.asahq.org/publications/AndServices/standards/24.html. Accessed July 24, 2004.

^{**} American College of Nurse-Midwives: Core competencies for basic midwifery practice. May 2002. Available at: www.acnm.org. Accessed July 24, 2004.

The use of regional anesthesia and especially spinal anesthesia for cesarean delivery has increased since publication of the 1992 survey results (table 3). Either epidural or spinal anesthetics allow the mother to be awake, minimizing or completely avoiding problems with airway management. The current survey results also suggest that spinal anesthesia was used in approximately 50% of urgent-emergent cesarean deliveries. These results are not surprising, because spinal anesthesia offers many advantages over epidural anesthesia, and the rapid onset allows for its use in many urgent-emergent cesarean deliveries. Despite concerns about the decreased use of general anesthesia for cesarean delivery and trainees no longer obtaining experience in providing general anesthesia for obstetric patients,^{26,27} survey results suggest that general anesthesia was still used in 15–30% of urgent-emergent cesarean deliveries in 2001. However, in elective cesarean deliveries, general anesthesia was used in less than 5% of cases in all sizes of hospitals.

Although previous workforce surveys stated that availability of regional analgesia could be improved,^{2,3} several changes were observed in the 2001 survey regarding provider availability and personnel providing regional anesthesia for obstetrics. In stratum III hospitals (100–500 births), providers were available on-call for labor and cesarean deliveries in more than 95% of services. In contrast, 20% of these small services had no regional analgesia for labor in 1992. Although epidural analgesia is often recognized as costly,²⁸ labor intensive,²⁹ and poorly rewarded, several factors may have contributed to its increased use. First, restricted use of epidural analgesia can lead to overall patient dissatisfaction with the labor and delivery experience. In addition, an epidural catheter placed during labor can potentially reduce the morbidity associated with general anesthesia and emergent cesarean delivery. However, with current payment levels and an imbalance between supply and demand for anesthesia providers, staffing of obstetric anesthesia services will continue to be a challenge.

Pronounced changes in personnel performing newborn resuscitation at the time of cesarean delivery were observed in stratum I and II hospitals where in 2001, approximately 45% of resuscitations were performed by pediatricians compared with 72% in 1992. In stratum III hospitals, the percentage of resuscitations performed by family practitioners decreased from 31% in 1992 to 13% in 2001. Resuscitations performed by advanced practice or labor nursing personnel increased in all sizes of hospitals. Anesthesia providers (M.D. or certified registered nurse anesthetist) are rarely involved in newborn resuscitation (< 5%). This is consistent with previous surveys.

Since publication of the most recent obstetric anesthesia workforce survey in 1997, VBAC has become a more controversial area of obstetric practice. Although enthusiasm for VBAC attempts increased from 1989 to 1996,³⁰ reports of uterine rupture and complications associated

with trial of labor in patients with previous cesarean delivery³¹ have decreased the number of VBAC attempts by 55% to 12.6% in 2002.³² In 1999, ACOG issued a practice bulletin for VBAC mandating the “immediate” availability of anesthesia and operative personnel for emergency cesarean delivery.⁵ Much controversy followed this publication, and many anesthesiologists objected to the VBAC recommendations because they changed requirements for in-house coverage of labor and delivery suites, especially in community hospitals. More recently, ACOG issued a revised VBAC practice bulletin reemphasizing the need for immediate availability of anesthesia and operating room personnel during attempted VBAC.⁶ Although the term *immediate* has not been specifically defined in VBAC practice bulletins, VBAC should be attempted primarily in institutions equipped to respond to emergencies with physicians immediately available to provide emergency care.⁶ Survey results demonstrate decreased numbers of VBAC attempts in all sizes of maternity services (table 6). These results are consistent with the 2002 National Vital Statistics Report on Births.³² In addition, our results suggest that fewer small hospitals attempted VBAC, and some anesthesia providers remained out-of-house during attempted VBAC. Although VBAC attempts can be performed safely in smaller community hospitals if they have the personnel and resources necessary to respond to obstetric emergencies (e.g., uterine rupture), the safety of VBAC is less well documented in these hospitals.⁶ Joint Commission on Accreditation of Healthcare Organizations Standards have also reaffirmed ACOG’s position that the definition of immediate availability of personnel and facilities remains a local decision based on each institution’s availability of resources and geographic location.³³

Although much interest was generated after publication of a large study evaluating the “walking” epidural,³⁴ our survey results demonstrate that in hospitals that allow ambulation during spinal or epidural labor analgesia, the average percentage of patients using ambulation ranged from only 3% in the largest hospitals to 26% in stratum III hospitals (table 6). Stratum III hospitals were far more likely to allow ambulation and for patients to exercise the option. Despite apparent maternal and fetal safety of supervised ambulation after regional analgesic administration during labor, it is difficult to predict which patients are able to ambulate,³⁵ and the benefits of ambulation during labor remain unclear.^{36,37}

Outside the practice of anesthesiology, a policy has been instituted regarding the delivery of obstetric anesthesia care that likely affects regional analgesia delivery. In 2001, AWHONN published an updated position stating that nonanesthetist registered nurses should not adjust epidural infusion rates, start or reinstitute epidural infusions, administer epidural catheter boluses, or manipulate patient-controlled epidural analgesia doses. Be-

cause some nurses have stopped adjusting epidurals infusions despite physician orders, it was important to determine the extent to which labor and delivery nurses adhered to AWHONN's position statement. Study results revealed that nurses in stratum II (500–1,499 births) and III (100–500 births) hospitals were more likely to adjust epidural infusion rates (table 6). However, less than 10% of stratum I hospitals (> 1,500 births) allowed nurses to adjust epidural infusion rates, administer epidural boluses, or reinstitute epidural infusions. Although the Society for Obstetric Anesthesia and Perinatology and the American Society of Anesthesiologists have encouraged AWHONN to revise their statement and have encouraged labor nurses to take an active role in managing pain relief during labor,³⁸ AWHONN has been steadfast in their position. However, ACOG's most recent Committee Opinion on Pain Relief during Labor states that "under appropriate physician supervision, labor and delivery nursing personnel who have been properly educated and have demonstrated current competence should be able to participate in the management of epidural infusions, including adjustment of dosage and discontinuation of infusions."⁴ How or whether this statement will affect AWHONN's position is unknown.

Survey respondents were asked "What is the collection rate of professional fees for anesthesia?" and the results are shown in table 7. Although we do not know whether responders referred to gross or contractual charges, clearly, collection rates are similar between surgical and obstetric cases. We also determined patient payer categories and percentage of actual charges paid for uncomplicated cesarean delivery and labor epidural analgesia in all sizes of hospitals. Stratum I hospitals had the largest percentage of health maintenance organization payers, and stratum II and III hospitals had the largest percentage of Medicaid payers. Stratum III hospitals had the highest percentage of Medicaid and private insurer categories but had the smallest percentage of health maintenance organization payers. The number of practitioners indicating that they had been denied payment increased from 25% in 1992 to 39% in 2001. Thirty-five percent of respondents reported that some carriers had occasionally denied payment, but only 3.5% responded that payment was completely denied by some carriers.

Similar to previous obstetric anesthesia workforce surveys, there are several limitations to the current study. A number of things are required for the conduct of a successful sample survey.⁷ One of the most important requirements for a valid survey is a complete sampling frame that reduces response bias by ensuring that the randomly drawn sample accurately reflects the population of interest. Certainly one of the biggest limitations of this study was our difficulty in establishing contact with key personnel in institutions in the sample. Multiple contacts of institutions were made, but our initial queries were met with a high nonresponse rate. Further,

although we used the most recent 2001 American Hospital Association's Annual Survey Database to ensure a reasonably current and accurate list of participating hospitals, publication of such guides lags behind the ongoing process of opening, consolidation, and attrition of hospitals in the United States.

Adequate sample sizes are also required for successful surveys. Although sample sizes were based on response rates known from previous surveys,^{2,3} one of the limitations of such surveys is nonresponse bias. Despite efforts to minimize the number of nonresponders, including endorsement by hospital administrators and multiple contacts, responses did not approach desired rates. The survey instrument was modified to obtain single answers from the most informed source in another effort to increase survey participation. This reduced the length of the survey for each participant. To evaluate the potential effects of nonresponse bias, we performed a follow-up telephone survey of nonresponders. Overall, these results were not significantly different from initial survey results, providing some evidence that our results are unbiased. Despite aggressive efforts, national medical surveys are often compromised by low response rates.

Another important component to a successful survey is the survey instrument itself. In addition to questions from the previous survey, newer questions were added to develop the 2001 survey to ensure addition of the most recent developments in obstetric anesthesia practice. Before survey distribution, we tested the reliability and validity of the instrument by distributing draft instruments to four or five participants in each focus group (*i.e.*, anesthesia provider, obstetrics provider, labor and delivery management personnel) to obtain feedback about survey questions and its ease of use. These participants acted as survey consultants to the group.

In summary, a number of substantial changes have occurred in the practice of obstetric anesthesia since publication of the 1992 survey results. Overall, the number of hospitals providing obstetric care decreased, but the number of stratum I hospitals increased. Despite the potential shortfall in anesthesia provider workforce, there was an overall increase in the use of regional analgesia for labor across all strata, and more parturients used some type of analgesia for labor. In addition, regional anesthesia for cesarean delivery increased across all sizes of delivery services, but general anesthesia is still used in many urgent-emergent cesarean deliveries. Collectively, the 2001 survey results suggest that despite staffing and payment challenges, availability of services and anesthesia personnel have improved.

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