Anesthesiology
2000; 92:851–8

How Much Labor Is in a Labor Epidural?

Manpower Cost and Reimbursement for an Obstetric Analgesia Service in a Teaching Institution

Elizabeth D. Bell, M.D., M.P.H., Donald H. Penning, M.D.,† Edward F. Cousineau, M.A., M.B.A.,‡ William D. White, M.P.H.,§ Andrew J. Hartle, M.B. Ch.B., F.R.C.A.,‖ William C. Gilbert, B.S.,# David A. Lubarsky, M.D., M.B.A.***

Background: **Some anesthesiologists avoid provision of obstetric analgesia services (OAS) because of low reimbursement rates for the work involved. This study defines the manpower costs of operating an OAS in a tertiary referral center and examines reimbursement for this cost.**

Methods: **The time spent providing OAS in a total of 55 parturients was studied prospectively using a modification of classic time and motion studies.**

Results: **Mean duration of OAS in our population was 412 ± 313 min. Mean bedside anesthesia staff time was 90 ± 40 min, and mean number of visits to each patient's bedside was 6.3 ± 2.0 visits. Assuming staffing on demand for service (intermittent staffing), a minimum of 2.5 full-time equivalent (FTE) attending anesthesiologists was required to meet demand. With intermittent staffing, labor cost was $325 per patient. Actual practice at Duke University Medical Center is around-the-clock (dedicated) staffing, which requires 4.4 FTEs at a cost of $728 per patient. Neither average indemnity reimbursement ($299) nor Medicaid reimbursement ($204) covered the cost per OAS patient. Breaking even is possible under indemnity reimbursement because operating room reimbursement subsidizes OAS costs. Breaking even cannot occur with Medicaid reimbursement under any circumstances.**

Conclusions: **Obstetric analgesia services requires a minimum of 2.5 FTE attending anesthesiologists at Duke University Medical Center. With the current payer mix, positive-margin operating room activities associated with the obstetric service are not sufficient to compensate for the losses incurred by an OAS. Around-the-clock dedicated obstetric staffing (4.4 FTEs) cannot operate profitably under any reasonable circumstances at our institution. (Key words: Delivery; economics; pain; payers; parturient; pregnancy; workload.)**

This article is accompanied by an Editorial View. Please see: Chestnut DH: How do we measure (the cost of) pain relief? ANESTHESIOLOGY 2000; 92:643–5.

PROVISION of an obstetric analgesia service (OAS) is sometimes perceived as a costly, labor-intensive, and poorly rewarded task.[1,2] The greatest direct expense in providing the service is anesthesia staff. Obstetric anesthesia workload is unpredictable, which makes forecasting staff needs difficult. We undertook this pilot study to identify the manpower costs to the anesthesia providers of operating OAS. A method to define the labor costs of operating OAS would aid in predicting required staffing *versus* reimbursement to anesthesia providers. This would be useful both for bidding on OAS and negotiating with hospitals to provide this service. Furthermore, analysis of the third-party payer mix, volume of service, and relative Medicaid reimbursement would demonstrate whether this service can break even in a given hospital setting. At Duke University Medical Center (DUMC), both resident anesthesiologists and certified registered nurse anesthetists (CRNAs) are employed by the hospital, not the attending anesthesiologist's group practice. The hospital's revenues from Medicaid cannot be specifically related to its technical and hospital personnel costs associated with the OAS. This study examines the costs associated with providing attending anesthesiologist coverage for on-demand (intermittent) obstetric services and also for around-the-clock (dedicated) service to obstetrics. Both OAS and operating room (OR) activities in

* Assistant Professor.

† Associate Professor.

‡ Business Manager.

§ Senior Statistician.

‖ Visiting Associate.

Database Administrator.

** Associate Professor and Vice Chairman.

Received from the Department of Anesthesiology, Duke University Medical Center, Durham, North Carolina. Submitted for publication January 5, 1999. Accepted for publication November 23, 1999. Supported by Division of Women's Anesthesia Research Fund, Duke University Medical Center, Durham, North Carolina.

Address reprint requests to Dr. Bell: Department of Anesthesiology, Box 3094, Duke University Medical Center, Durham, North Carolina 27710. Address electronic mail to: bell0027@mc.duke.edu

the obstetric suite were included in the analysis to determine whether positive-margin OR cases could subsidize OAS.

Methods

OAS Time Study

Institutional Review Board approval was obtained at DUMC. The time spent managing labor epidural catheters in a total of 55 parturients was studied prospectively. We used a modification of classic time and motion studies developed by Frank Gilbreth for industry[3] and later adapted to hospital work by Lillian Gilbreth and Ruth Kuehn.[4] This technique develops labor standards using a series of timed observations. The modified version of this technique requires that the staff performing the task record their own times for activities. This modification has been widely used to develop standards in the hospital industry for nursing care and can be applied to physician services.[5] Feldman *et al.*[6] showed that physician estimates of time spent performing patient care responsibilities were reliable. Franzini and Berry[7] used self-reported times to determine costs of an anesthesiology residency program. All time spent at the patient's bedside was recorded by the individual anesthesia staff, including: (1) preoperative evaluation of the chart; (2) directed physical examination and discussion for informed consent with the patient and any family members present; (3) positioning for the block, ascertainment of satisfactory analgesia, and documentation of the procedure; (4) reevaluation of analgesia, top-up doses, or refilling of syringes during the block; (5) discontinuing the catheter and postprocedure instructions after delivery; and (6) postprocedure visit the following day to assess the site and evaluate for possible anesthesia complications.

Times recorded reflect all nonoverlap times spent at the patient's bedside by an anesthesia care provider in the Labor and Delivery Unit. Nonoverlap times meant that if two providers were present at the same time, only one provider's time was counted. A second- or third-year resident, an attending anesthesiologist, and a CRNA were dedicated to obstetrics each weekday and weeknight. Weekends were staffed with a resident and an attending anesthesiologist. Staff recorded all time spent in attendance at the bedside of all patients who requested labor analgesia during the fiscal period from August 15–31, 1995. During this period, a total of 74 epidural catheters were placed for 114 deliveries in our facility. Data on 17 patients eligible for inclusion in the study were either incomplete or not collected (23%), primarily during high workload periods when paperwork was deferred for hands-on patient care. Review of age, weight, height, parity, and duration of labor in these patients found no significant differences between excluded patients and the study group.

Operative Procedures

In our institution, there are three ORs in the Labor and Delivery Unit for obstetric procedures, including cesarean section (CS), postpartum bilateral tubal ligations (BTLs), cervical cerclage placements, and dilation and curretage (D&C) procedures. Time measurement for management of OAS stopped at the point that the decision to perform CS was made in patients delivered surgically. Time in attendance for OAS included time spent at the bedside of patients delivered with vacuum assistance or outlet forceps (operative vaginal delivery). Once a decision to perform CS was made, time spent with the patient was counted as OR time instead of OAS time. OR time included patient preoperative preparation, transport by anesthesia staff, surgical time, attendance in the recovery area, and subsequent postoperative visit.

Staff Mix

For clarity, this article examines only the attending physician costs of OAS and obstetric OR activities, without including dependent providers, supplies, or equipment. To determine labor costs, the mix of patient care provided by attending physicians, residents, and CRNAs was determined. During the study period, 42 of 55 labor epidural catheters were placed by the resident on duty supervised by the on-site attending anesthesiologist (76%), 7 were placed by the CRNA supervised by the on-site attending anesthesiologist (13%), and 6 were placed by the attending anesthesiologist without assistance (11%). Of these 55 labor epidural catheters, 13 (24%) were subsequently used to provide anesthesia for CS.

Workload Mix

In addition to 13 CSs after labor, there were 10 scheduled CSs during the study period, for a total of 23 CSs. Other OR procedures included 10 BTLs and one postpartum D&C, for a total of 34 OR cases. Total OR time was 45 h and 17 min during the study period. Anesthesia for OR procedures was provided by the attending anes-

Table 1. Patient Variables

Variable	Mean ± SD
Maternal age (yr)	25.4 ± 6.2
Maternal weight (kg)	78.5 ± 16.5
Maternal height (cm)	164 ± 7
Estimated gestational age (weeks)	38.6 ± 2.4
Cervical dilation at placement of block (cm)	4.3 ± 1.8
Labor duration (min)	536 ± 390
Continuous lumbar epidural analgesia (min)	412 ± 313

thesiologist supervising the resident in 32 cases (94%) and supervising the CRNA in 2 cases (6%).

Statistical Analysis

Data were entered into a computer spreadsheet (Microsoft Excel; Microsoft Corporation, Redmond, WA) for analysis. Statistics were derived using a package developed by SAS Institute (Cary, NC) for microcomputers.

Results

Demographics

Patient variables are presented in table 1, and bedside time by procedure type is presented in table 2. Of the 55 parturients studied, 25 were nulliparous (46%), and 30 were parous (54%). During the study period, 60% of deliveries occurred to parous women at DUMC. Labor was induced in 22 of the 55 patients (40%). During the study period, 22% of deliveries were induced for maternal or fetal indications. Methods of delivery included 34 spontaneous vaginal deliveries (63%), 5 vacuum-assisted deliveries (9%), 4 low or outlet forceps deliveries (7%), and 11 CSs (20%).

Measured Time and Motion Data

The mean ± SD bedside time for performing and managing a labor epidural was 90 ± 40 min. Mean time for positioning for the block, ascertainment of satisfactory analgesia, and documentation of the procedure was 43 ± 22 min. There was a mean of 6.3 ± 2.0 visits to patients' bedside during continuous lumbar epidural analgesia preoperative and postoperative assessment. There was no association between the number of visits and total bedside time spent by the anesthesia staff. There was a significant difference in the time staff spent at the bedside of nulliparous as compared with parous patients (104 ± 9 *vs.* 79 ± 5 min; $P = 0.025$). However, there was no significant difference in the number of visits to the bedside, implying that visits were longer for nulliparous patients. There was no significant relationship between maternal weight and bedside time or number of visits. In addition, there was no significant difference in bedside time or number of visits spent on patients with epidural catheters placed at night compared with those placed during daylight hours.

Staffing Required for Direct Patient Care

It is our practice for the attending anesthesiologist to be present for the placement of all regional anesthetics and continuously present during CS at least until delivery of the infant. Average duration of CS during the study period was 93 ± 31 min. Average duration of BTL during the study period was 66 ± 15 min. Total time spent in direct clinical activities was 156.3 h during the study period (111 h OAS time and 45.3 h OR time). This represents an average of 9.2 h/day of direct patient care to meet the level of demand present during the study period. This would equal 64.4 h in one 7-day period. The average DUMC clinical assignment was 56 h per anesthesiologist per week, requiring 1.15 full-time equivalent (FTE) attending anesthesiologists present to meet the level of demand during the study. Unfortunately, this demand occurs randomly throughout the 24-h day, requiring staff to be available around the clock to provide services when needed. This randomness must be accounted for in staffing for unscheduled cases by setting a productivity target allowance. In addition, paid time off such as vacation, holidays, and sick leave must be accounted for to determine appropriate staffing levels.

Productivity Target Allowance

To determine the lowest labor cost per patient possible, one must look at the scenario of optimal productivity. Because only 0.5% of OAS cases were scheduled in 1998, we chose a target productivity level of 70% for this analysis of OAS staffing. Adjusting for a target productiv-

Table 2. Bedside Time and Visits by Procedure Type

Variable	Time (min)	Visits
Induction of labor (min)	88 ± 39	6.3 ± 2.1
Spontaneous labor (min)	91 ± 40	6.3 ± 2.1
Cervical dilation ≤ 4 cm (min)*	92 ± 35	6.4 ± 1.9
Cervical dilation > 4 cm (min)*	84 ± 40	6.2 ± 2.0
Spontaneous delivery (min)	89 ± 38	6.1 ± 1.8
Cesarean section after labor (min)	91 ± 52	6.6 ± 2.9
Forceps delivery (min)	91 ± 43	6.3 ± 1.5
Vacuum-assisted delivery	79 ± 15	6.4 ± 2.7

* Cervical dilation at time of epidural placement.

Table 3. Salary and Fringe Benefits

Staff	Salary	Fringe Benefits/Insurance	Total per FTE	FTE per Year	Total per Year
Attending anesthesiologist	$160,778	$45,627	$206,405	2.5	$516,012

FTE = full-time equivalent.

ity of 70% requires staffing 1.5 FTE to meet the demand for OAS.

Paid Time Off Allowance

To staff the 1.5 FTE to provide OAS, allowance for paid time off must be made. A factor of 16.7% (0.5 FTE) was used to account for DUMC vacation, sick, and meeting time off, increasing the 1.5 FTE to 2.0 FTE anesthesiologists required to meet demand for OAS. In addition, DUMC allocated 1 nonclinical day within the 5-day work week to be used for research, teaching, lecture preparation, writing, and other academic pursuits. This resulted in a minimum staff requirement of 2.5 FTE attending anesthesiologists to meet the workload demand for OAS when using the intermittent staffing model (2.0 FTE $\times$ 1.25).

Actual Staffing

The actual practice at DUMC is to staff OAS with one FTE attending anesthesiologist, requiring a minimum of 3.0 FTE to fill the position around the clock. A paid-time-off factor of 16.7% (0.5 FTE) was used to account for DUMC vacation, sick, and meeting time off. In addition, DUMC allowed 1 nonclinical day within the 5-day work week to be used for research, teaching, lecture preparation, writing, and other academic pursuits. This resulted in a minimum staff requirement of 4.4 FTE attending anesthesiologists to fill the one position (3.5 FTE $\times$ 1.25).

Labor Costs

Average compensation for attending anesthesiologists at DUMC, including benefits and malpractice insurance coverage, was $206,405 (table 3). This is direct physician compensation and benefits and does not include other practice costs and university teaching and research costs ("Dean's tax"). The annual cost of 2.5 FTE attending anesthesiologists to meet OAS demand was $516,012 per year, or $1,413 per day ($516,012/365.25 days per year). Total cost for attending anesthesiologists during the study period was $24,021 ($1,413 per day $\times$ 17 days). The cost per OAS patient during the study period was $325 ($24,021/74), assuming OAS is staffed on an intermittent basis. This model assumes that an anesthesiologist will be available to meet all demands for OAS to receive maximal reimbursement. Staffing OAS with one attending anesthesiologist around the clock, as DUMC does, would yield an actual cost per patient of $728.

Reimbursement for OAS

Directly related to staffing OAS is the issue of reimbursement for services rendered. There are two major payers for obstetric health care at DUMC: (1) indemnity or insurance payers, and (2) the Medicaid program. To determine the labor cost for OAS, one must allocate the total labor costs over the volume of procedures performed. Clearly, a change in the volume of work performed with a given level of staffing will affect the cost per patient. If the service is staffed around the clock, as at DUMC, the labor costs are fixed such that underutilization will result in a higher per-patient cost.

Indemnity Reimbursement

For fiscal year 1998, the average DUMC indemnity reimbursement for OAS was $299 (table 4) compared with the cost of $325 per patient, assuming OAS is staffed on an intermittent basis. Total reimbursement for the study period would be $35,615 if all patients were covered by indemnity policies, compared with staff costs of $24,021. The indemnity reimbursement for obstetric OR cases can subsidize the inadequate indemnity reimbursement for OAS when using the intermittent staffing model.

Medicaid Reimbursement

Medicaid within North Carolina currently reimburses $204 for continuous epidural analgesia during labor and delivery, whether vaginal or CS. If all patients during the study period had been covered by Medicaid, the reimbursement for all 74 epidural catheters for delivery placed during the 3-week period would be $204 $\times$ 74 = $15,096. There is no further reimbursement for CS after labor epidural analgesia (*i.e.*, one price for delivery, whether vaginal or CS). Reimbursement for scheduled CS would be $204 for each of 10 cases, or $2,040. Reimbursement for 10 BTLs would be $1,850. During

Table 4. Average Duke University Medical Center Indemnity Reimbursement

Procedure	CPT Code	Average Reimbursement per Case*	Study Volume	Total Reimbursement
Labor epidural/vaginal delivery	00955	$298.96	74	$22,123
Labor epidural/CS	00857	$429.02	13	$5,577
Scheduled CS	00850	$296.41	10	$2,964
BTL	00840	$443.66	10	$4,437
Dilation and curretage	00940	$385.07	1	$385
Total				$35,101

CPT = current procedural terminology; CS = cesarean section; BTL = bilateral tubal ligation.

* Includes denials of payment.

the study period, no BTLs were performed on the day of delivery using a preexisting epidural catheter, which would have led to a reduced reimbursement of $97 per case. Medicaid payment for CS or BTL under general anesthesia and for D&C and cerclage placement is $0.90/min. One D&C was performed, and reimbursement would have been $70 (table 5). Total reimbursement for the study period if all patients were Medicaid recipients would therefore be $19,153, compared with minimum staff costs of $24,021. Breaking even cannot occur with Medicaid reimbursement under any circumstances (table 6).

Applied to annual procedure volumes, reimbursement for fiscal year 1998 would have been $461,543, compared with staffing costs of $516,012. This assumes all patients were covered at Medicaid rates and staffing was perfectly accomplished using an intermittent staffing model (*i.e.*, no missed cases or lost reimbursement opportunities).

The additional reimbursement from OR procedures during the study period would be $3,960 (10 CSs at $204 plus one D&C at $70 plus 10 BTLs at $185). Subtracting this reimbursement from the labor cost leaves a net labor cost per epidural of $271 ($20,061/74) at the volume of labor patients and OR cases performed during the study period. The OR cases reimbursed at Medicaid rates do not generate a positive margin to cover the overall cost of providing OAS.

Discussion

Representative Nature of the Data

Methods of delivery during the study period were similar to DUMC annual rates, with a spontaneous deliv-

Table 5. North Carolina Medicaid Reimbursement

Procedure	CPT Code	Reimbursement per Case	DUMC Volume	Total 1997–1998 Reimbursement
Labor epidural/vaginal delivery or CS	00955 00857	$204	1979	$403,716
Scheduled CS regional anesthesia	00955 00850	$204	123	$25,092
CS general anesthesia*	00850	$152	72	$10,944
BTL regional anesthesia: no prior labor epidural	W8208 X0840	$185	68	$12,580
BTL general anesthesia†	W8208	$113	3	$339
BTL after labor epidural same day	W8208	$97	46	$4,462
Cerclage‡	X0948	$80	21	$1,680
Dilation and curretage§	X0948	$70	39	$2,730
Total			2,351	$461,543

CPT = current procedural terminology; DUMC = Duke University Medical Center; BTL = bilateral tubal ligation.

* 75 time units @ $0.90/unit plus $0.90/min (93 min) = $68 + $84 = $152.

† 60 time units @ $0.90/unit plus $0.90/min (66 min) = $54 + $59 = $113.

‡ 45 time units @ $0.90/unit plus $0.90/min (45 min) = $40 + $40 = $80.

§ 45 time units @ $0.90/unit plus $0.90/min (33 min) = $40 + $30 = $70.

Table 6. Medicaid Reimbursement: Staffing Required and Breakeven Analysis

Staffing Parameters	Projected Variables				
Demand for OAS (patients)	8	9	10	11	12
Direct care hours/day (h)	12	13.5	15	16.5	18
Direct care FTEs	1.5	1.7	1.9	2.1	2.3
70% productivity target (FTE)	1.9	2.2	2.5	2.7	3.0
Paid time off allowance (FTE)	2.4	2.7	3.0	3.3	3.6
Nonclinical time allowance factor	1.25	1.25	1.25	1.25	1.25
Total FTE required	3.0	3.4	3.8	4.1	4.5
Labor cost/FTE ($)	$206,405	$206,405	$206,405	$206,405	$206,405
Annual labor cost ($)	$619,215	$701,777	$784,339	$846,261	$928,822
Cost/day ($)	$1,695	$1,921	$2,147	$2,317	$2,543
North Carolina medicaid revenue ($)	$1,632	$1,836	$2,040	$2,242	$2,448

OAS = obstetric analgesia services; FTE = full-time equivalent.

ery rate of 60%, CS rate of 22%, and 18% assisted deliveries (forceps or vacuum). The national rate of CS was 20.6% of deliveries in 1996.[8] Operative deliveries (forceps and vacuum-assisted) are not tracked nationally because of lack of specific coding, but a survey of United States university programs in 1994 showed rates between 5.5 and 20.7%.[9] The overall labor induction rate of 22% can be compared to a rate of 22.3% reported by Queen Elizabeth Hospital, South Australia,[10] an elective induction rate of 12.3% reported in a U.S. community teaching hospital,[11] and a rate of 14% of low-risk deliveries in Toronto.[12] The induction rate in England ranged from 17 to 20% of all deliveries from 1989 to 1995, reported to the Maternity Hospital Episode Statistics system.[13]

Mean time for positioning for the block, ascertainment of satisfactory analgesia, and documentation of the procedure was 43 ± 22 min. This compares with a previous study of epidural *versus* spinal anesthesia for CS in which the time from entering the OR to incision was 46 ± 11 min.[14] Our average clinical assignment was 56 h per anesthesiologist per week. This is similar to the national average derived in a survey by Abt Associates for the American Society of Anesthesiologists in 1994.††

Average labor costs per attending anesthesiologist at DUMC was $206,405, including compensation, benefits, and malpractice insurance coverage. Compensation alone was $160,778. Franzini and Berry[7] found average total costs per attending anesthesiologist of $336,313 at the University of Texas–Houston. Compensation alone was $134,525. The average costs are not directly comparable because Franzini and Berry included the cost per faculty member of all supporting resources and University "Dean's tax." Our study examines the labor costs to the anesthesiologist rather than the total costs to the University. Labor costs may be more easily compared because supporting resources are highly variable from practice to practice.

Reimbursement Analysis

The cost per patient during the study period was $325, assuming OAS is staffed on an intermittent basis. Dedicated staffing yields a cost per patient of $728. Total reimbursement to the attending anesthesiologist's practice for the study period if all patients were Medicaid recipients would have been $19,153, compared with attending staff costs of $24,021. Medicaid reimbursement for all obstetric procedures during fiscal year 1998 would be $461,543, compared with attending staff costs of $516,012. If all patients were covered by indemnity reimbursement, there would have been an adequate positive margin to defray the salary and benefits for attending anesthesiologist coverage on an intermittent basis. However, covering the service intermittently increases the probability that the attending anesthesiologist will not be available when demand for OAS arises, thus losing the opportunity for maximal reimbursement.

It is unlikely that any anesthesiologist's OAS practice is comprised of Medicaid patients exclusively. However, making this assumption allows an examination of whether the Medicaid reimbursement for OAS is sufficient to meet costs rather than requiring indemnity payers to subsidize Medicaid patients. The argument that anesthesiologists will benefit from increased volume of services by performing more obstetric anesthesia ser-

†† Abt Associates Inc: Forecasting anesthesia manpower needs for the year 2010. Park Ridge, American Society of Anesthesiologists, 1994. Available from the American Society of Anesthesiologists: 520 North Northwest Highway, Park Ridge, Illinois 60068.

vices for Medicaid patients does not hold because there is a negative contribution margin for each procedure performed.

Productivity and Breaking Even

In emergency service areas such as the OR or the emergency department, departmental productivity levels of 70–80% are considered optimal because excess capacity must be built in to handle unanticipated cases and emergencies.[4] There is an exponential decay in the ability to accommodate new service requests once this threshold is exceeded. The wait for delivery of pain relief can become unreasonably long. Even in ambulatory surgery centers in which few unplanned procedures are performed, a departmental productivity level of 85% is considered optimal.[15,16] Assuming 90 min of contact time per labor epidural placement, OAS at DUMC cannot break even (table 6). Very few studies have addressed the issue of productivity of anesthesiologists specifically. Posner and Freund[17] recently suggested using billed hours of anesthesia care per clinical day as a measure of productivity for attending anesthesiologists. Productivity rates in this study ranged from 10 to 17 h of billed anesthesia care per attending anesthesiologist per clinical day, with concurrency rates of 1.6 to 2.2 cases per attending anesthesiologist. Concurrency rates may be much higher with the longer duration of labor analgesia, but these cases are not billed by hourly rates. An important note is that the American Society of Anesthesiologists Practice Guidelines suggest that an anesthesia care provider must be in-house during the conduct of a labor epidural. No allowance for this availability was factored into the intermittent staffing analysis. DUMC, like many busy practices, chooses to have dedicated attending presence in obstetrics to meet this need for availability. Productivity as defined by Posner and Freund was not measured in this study.

A recent survey by the American Society of Anesthesiologists revealed Medicaid reimbursement rates from $55 to $169.55 in eight other states.[18] Although the $204 reimbursement provided by the state of North Carolina is inadequate to cover the cost of an anesthesiologist's services in providing OAS, it is nearly twice the average from the other eight states surveyed. These results suggest that anesthesia groups are correct in the perception that OAS is not adequately reimbursed and that anesthesiologists are providing the service to Medicaid recipients at a true loss. The argument that obstetric anesthesiologists should provide services for a lower average salary is unrealistic. The opportunity exists for an obstetric anesthesiologist to move practice to the OR, where reimbursements are higher, and current job market opportunities exist. We now know our true variable cost for providing this service, and this information should be used wisely to price services to third-party payers. Optimization models using directed dependent providers may influence the conclusions presented here. Analyses such as we present are the building blocks of economic survival in today's medical marketplace. At the time of this pilot study, only continuous lumbar epidural analgesia was offered at our institution. A follow-up study to evaluate the economic effect and manpower requirements attending changes in practice, such as the use of the combined spinal–epidural technique and patient-controlled epidural analgesia, is planned.

We conclude that, even with intermittent staffing, there is a negative contribution margin for anesthesiologists to provide OAS at DUMC. With the current payer mix, positive-margin OR activities associated with the obstetric service are not sufficient to compensate for the losses incurred by OAS. Around-the-clock dedicated obstetric staffing (4.4 FTEs) cannot operate profitably under any reasonable circumstances at our institution.

References

1. Chestnut DH: Preface, Obstetric Anesthesia: Principles and Practice, 2nd Ed. Edited by Chestnut DH. St. Louis, Mosby, 1999, xiii–iv

2. Owens W: Members say low reimbursement for epidurals root of problem. Am Soc Anesth President's Update 1998; 2:1–2

3. Gilbreth FB: Motion study in surgery. Can J Med Surg 1916; 40:22–31

4. Gilbreth L, Kuehn R: Management engineering and nursing. Am J Nurs 1950; 50:780–1

5. Deschambeau GL: Industrial engineering. Hospitals 1968; 42: 89–92

6. Feldman R, Hillson S, Wingert T: Measuring the dimensions of physician work. Med Care 1994; 32:943–57

7. Franzini L, Berry JM: A cost-construction model to assess the total cost of an anesthesiology residency program. ANESTHESIOLOGY 1999; 90:257–68

8. Ventura SJ, Peters KD, Martin JA, Maurer JD: Births and deaths: United States 1996. Monthly Vital Stat Report 1997; 46(Suppl 2):5

9. Hankins GD, Rowe TF: Operative vaginal delivery: Year 2000. Am J Obstet Gyn 1996; 175:275–82

10. Robson S, Pridmore B, Dodd J: Outcomes of induced labor. Austr NZ J Obstet Gynecol 1997; 37:16–9

11. Prysak M, Castronova FC: Elective induction versus spontaneous labor: A case-control analysis of safety and efficacy. Obstet Gynecol 1998; 92:47–52

12. Ruderman J, Carroll JC, Reid AJ, Murray MA: Are physicians changing the way they practice obstetrics? Can Med Assoc J 1993; 148: 409–15

13. Macfarlane A: At last—Maternity statistics for England: Some

trends are apparent but the data still have too many gaps. Br Med J 1998; 316:566–7

14. Riley E, Cohen S, Macario A, Desai J, Ratner E: Spinal versus epidural anesthesia for cesarean section: A comparison of time efficiency, costs, charges, and complications. Anesth Analg 1995; 80:709–12

15. Templin JL: Setting ambulatory surgery staffing standards and measuring productivity. Proceedings of the 11th Annual Quest for Quality and Productivity in Health Services Conference, Washington, DC, August 29–September 1, 1999, pp 82–91

16. McKee TC, Ward TJ, Iksen MW: From theory to practice: Developing decision support tools to manage cost and quality of obstetrical care. Proceedings of the 11th Annual Quest for Quality and Productivity in Health Services Conference, Washington, DC, August 29–September 1, 1999, pp 1–6

17. Posner KL, Freund PR: Trends in quality of anesthesia care associated with changing staffing patterns, productivity, and concurrency of case supervision in a teaching hospital. ANESTHESIOLOGY 1999; 91:839–47

18. Labor epidural survey shows wide variation in reimbursement. Am Soc Anesth News 1998; 62:28–9