PATIENT SAFETY SERIES

Effect of a comprehensive obstetric patient safety program on compensation payments and sentinel events

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Our objective was to describe a comprehensive obstetric patient safety program and its effect on reducing compensation payments and sentinel adverse events. From 2003 to 2009, we implemented a comprehensive obstetric patient safety program at our institution with multiple integrated components. To evaluate its effect on compensation payments and sentinel events, we gathered data on compensation payments and sentinel events retrospectively from 2003, when the program was initiated, through 2009. Average yearly compensation payments decreased from $27,591,610 between 2003-2006 to $2,550,136 between 2007-2009, sentinel events decreased from 5 in 2000 to none in 2008 and 2009. Instituting a comprehensive obstetric patient safety program decreased compensation payments and sentinel events resulting in immediate and significant savings.

Key words: compensation payments, medical liability, obstetric adverse outcomes, patient safety, sentinel events

Improving patient safety has become an important goal for hospitals, physicians, patients, and insurers.[1] Implementing patient safety measures and promoting an organized culture of safety, including the use of highly specialized protocols, has been shown to decrease adverse outcomes;[2-5] however, it is less clear whether decreasing adverse outcomes also reduces compensation payments and sentinel events.

Our objective is to describe comprehensive changes to our obstetric patient safety program and to report their impact on actual spent compensation payments (sum of indemnity and expenses paid) and sentinel events.

Materials and Methods

New York Presbyterian Hospital-Weill Cornell Medical Center is a tertiary academic referral center with a level 3 neonatal intensive care unit and serves as a New York State regional perinatal center. The labor and delivery unit performs about 5200 deliveries per year of which voluntary attending physicians manage approximately 25%, and 75% are managed by full-time faculty.

The New York Weill Cornell Investigation Research Board approved this report as exempt research.

Patient safety program

In 2002, we began to implement in a step-wise fashion a comprehensive and ongoing patient safety program. The date of implementation is included for each step.

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Consultant Review (2002)

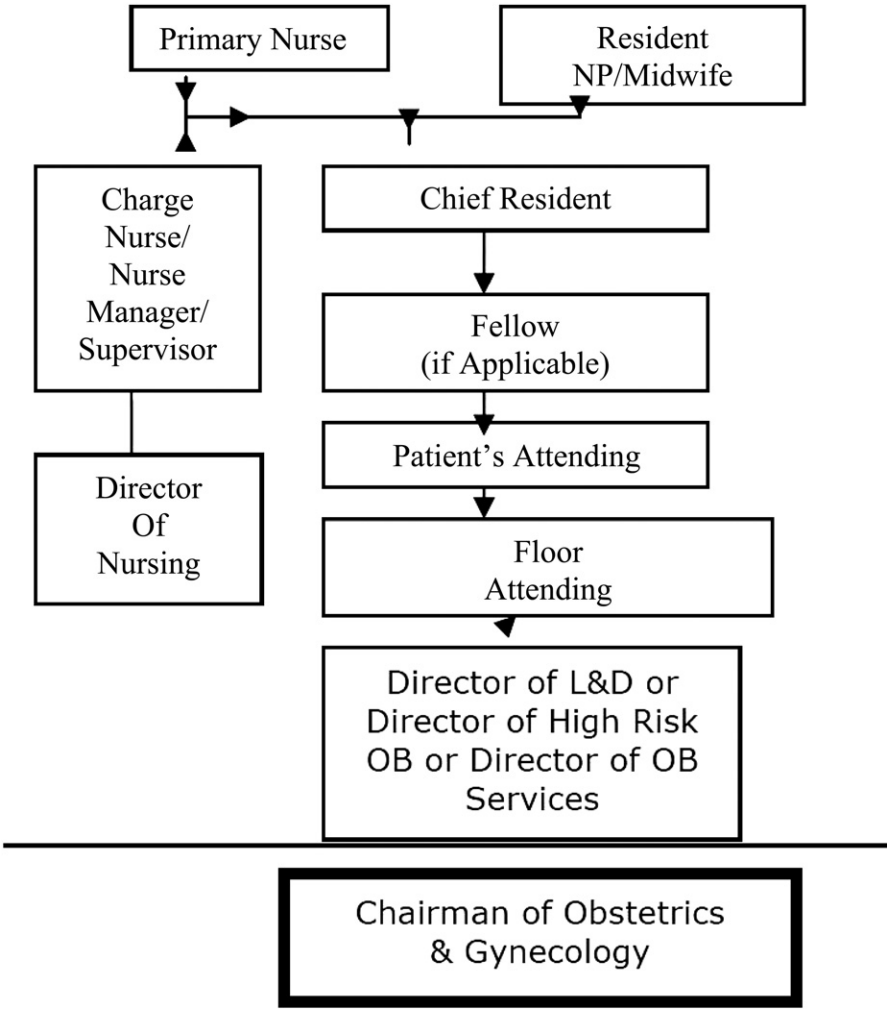
In 2002, as part of an obstetric initiative by our insurance carrier (MCIC Vermont, Inc, Burlington, VT), 2 independent consultants reviewed our department and assessed our institution's obstetric service. This review resulted in specific recommendations and provided a general outline for making changes and improvements in patient safety. Building on these findings, we implemented a comprehensive obstetric patient safety program.

Labor and delivery team training (2003)

Poor communication is among the most cited reasons for malpractice suits,[6] whereas improved nurse-physician communication can make labor and delivery safer.[7] Consequently, the Institute of Medicine recommended interdisciplinary team training programs for providers to incorporate proven methods of team training as a way to improve efforts and to empower every team member to speak up and intervene if an unsafe situation may be occurring.[8] Crew Resource Management (CRM) can potentially decrease medical malpractice litigation, mostly by improving communication,[9] but studies have been less clear about its effect on adverse outcomes.[10]

In 2003, several of our labor and delivery staff members including nurses, obstetricians, and anesthesiologists attended a "train the trainer" team-training course. Subsequently, all staff working on labor and delivery including clerical staff, nurses, attending obstetricians, neonatologists, anesthesiologists, and residents successfully attended a 4-hour team training session and team principles were introduced on labor and delivery. Since then, all new staff has been required to attend labor and delivery team training sessions. The CRM program is performed regularly every 2-3 months. New staff, including nurses, attending, residents, and clerical staff, are scheduled to undertake CRM at the next available time. Attending physicians are instructed that credentialing/privileges will not be

FIGURE 1
Chain of communication



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granted or renewed if CRM is not completed and nursing staff and residents are informed that they must take the CRM program within a year after employment begins.

Electronic medical record charting (2003)

Good medical record charting can help defend professional liability cases and may persuade potential plaintiffs to forego filing a suit[11] and electronic health records on labor and delivery are less likely to miss key clinical information.[12] To facilitate communication and to improve patient safety, we were among the first departments in our institution to require electronic medical record charting with Eclipsys XA (Eclipsys Corporation, Boca Raton, FL) for all patients on labor and delivery. OB Tracevue (Phillips, Andover, MA) is used for electronic fetal monitoring (EFM). All documentation occurs in these electronic formats. Paper documentation is not allowed, except when the electronic format is temporarily incapacitated.

Chain of communication for labor and delivery (2003)

Communication on labor and delivery is crucial to ensure patient safety and to provide the best care for patients and prevent errors,[13] but there are times when physician's orders and actions need to be questioned. We believed that the most effective way for staff on the labor and delivery unit to voice their concerns is to establish and promote chain-of-communication policies. In 2004, a new chief of labor and delivery was appointed and a clear chain of communication was established and supported by the departmental chairman (Figure 1). The chain of communication includes involvement of all staff beginning at the nurse and junior resident level, then up to the chief resident, the inhouse attending, the maternal-fetal medicine specialist on call, and finally the director of labor and delivery and the chairman of the department. All staff are being empowered to use the chain of communication frequently and around the clock to ensure a quick resolution to unresolved and urgent issues.

Dedicated gynecology attending on call (2004)

A gynecology attending on call schedule was established separately from the obstetric coverage. Before this change, the labor and delivery attending covered both the obstetric and gynecology services and there had been occasions when there were concurrent emergency gynecologic and obstetric cases. This situation prevented the attending from sufficiently covering both services. The added gynecology coverage allowed the labor and delivery attending to cover the labor floor exclusively.

Limitation of misoprostol to induction of labor or cervical ripening for a nonviable fetus (2004)

Misoprostol is not US Federal Drug Administration (FDA) approved for use during labor. There is evidence that misoprostol is not effective,[14] and its use is associated with an increase in hyperstimulation/tachysystole.[15]

Misoprostol has never been used at the medical center for a live fetus. After the warning from the Searle company discouraging its use in the year 2000, there was no incentive to begin using this medication at our institution, and our concern about potential adverse outcomes led us to conclude that misoprostol use

TABLE 1
Standardized protocol for induction or augmentation with oxytocin

Item	Protocol
a.	Only a premixed oxytocin solution is used
b.	The oxytocin infusion is limited to intravenous route via an infusion pump
c.	A buretrol infusion is used with a "smart pump" (a pump that comes with error reduction system and drug library capabilities)
d.	The infusion is piggybacked into the port most proximal to patient
e.	A written attending order (electronic template) is required before the start of oxytocin
f.	Before the start of oxytocin an attending must document the plan of care including indication, fetal presentation and station, cervical status, estimated fetal weight, pelvic adequacy, and fetal heart rate assessment.
g.	An attending must be available on the same floor as labor and delivery floor at all times while the patient is on oxytocin
h.	Before initiation of oxytocin a reassuring fetal heart rate must be present for a minimum of 20 minutes
i.	The oxytocin concentration is a premixed solution of 30 U per 500 mL. No individual mixing of solutions is permitted onsite.
j.	The oxytocin infusion begins at 1 mU per minute.
k.	The infusion is increased by 1 mU per minute no more frequently than every 15 minutes
l.	An attending must evaluate, document, and determine the plan of care if the oxytocin dosage reaches 20 mU per minute
m.	The maximum oxytocin dosage cannot exceed 40 mU per minute
n.	If the oxytocin infusion was discontinued for 20 minutes or less, it may be restarted at a lower rate than before discontinuation. If it was stopped for greater than 20 minutes then it should be restarted at 1 mU per minute
o.	Only a nurse can titrate oxytocin. The nurse can stop or titrate the oxytocin infusion if indicated. The doctor must be notified of this.
p.	The oxytocin infusion must be stopped or titrated for any of the following: uterine hyperstimulation/tachysystole (contractions less than 2 minutes in frequency and/or lasting longer than 90 seconds and/or more than 5 contractions in any 10 minute period); elevated uterine resting tone; nonreassuring fetal heart rate tracing; presumed uterine rupture; water intoxication
q.	The attending physician must be notified of any hyperstimulation/tachystole, abnormal fetal heart rate changes and/or stoppage or down titration of oxytocin.
r.	Terbutaline may be given if stopping oxytocin does not lead to a normalization of fetal heart rate changes in the presence of hyperstimulation
s.	Oxytocin should be discontinued as soon as a cesarean delivery is planned

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should be limited to induction of labor and cervical ripening only in the nonviable fetus.

Standardized oxytocin labor induction and stimulation protocol (2005)

A standardized protocol enables the staff to become facile in handling the myriad of problems that occur on any busy unit, quickly and efficiently.[16] In 2005, we implemented a standardized low-dose oxytocin labor induction and stimulation policy (Table 1) and a standardized order template was designed in the hospital's electronic ordering system (Eclipsys, Atlanta, GA). No other method of using intrapartum oxytocin was permitted. Highlights of this protocol included a premixed oxytocin solution, a required written attending order and note before starting the oxytocin infusion, a standardized starting dosage and increases, and a "smart pump" (a pump that comes with an error reduction system and drug library capabilities). The protocol paid special attention to tachysystole and fetal heart rate concerns. If there was tachysytole, or there were concerns about the fetal heart rate, the oxytocin infusion had to be decreased or stopped.

Premixed and safety color-coded labeled magnesium sulfate and oxytocin solutions (2005)

Magnesium sulfate is among the most dangerous solutions used on labor and delivery.[17] More recently, in addition to seizure prophylaxis and tocolysis, prevention of cerebral palsy was added as a potential indication for giving magnesium sulfate on labor and delivery.[18,19] To improve the safe use of magnesium sulfate, we implemented several changes, including the use of premixed magnesium sulfate and oxytocin solutions, color coded magnesium sulfate and oxytocin containers and intravenous lines, as well as using both with "smart pumps."

Electronic medical record templates for shoulder dystocia and operative deliveries (2005)

Both shoulder dystocia and operative deliveries are associated with an increase in

TABLE 2
Shoulder dystocia documentation template

Shoulder dystocia note
Head delivery (Spont/Forc/Vac):
Time head delivered (min/sec):
Time body delivered (min/sec):
Second stage (min):
Anterior shoulder (right/left):
Initial traction: gentle attempt at traction, assisted by maternal expulsive forces
Oxytocin stopped: yes or no
Terbutaline given: yes or no
Any/all maneuvers that apply and the order in which they were utilized.
McRoberts maneuver and by whom:
Suprapubic pressure and by whom:
Episiotomy (and by whom):
Rubin's maneuver and by whom:
Woods maneuver and by whom:
Gaskin maneuver (all fours):
Posterior arm release and by whom:
Other (maneuvers list):
No Fundal pressure after the head delivered
The arm under the symphysis at the point the head was delivered was: right OR left
Primary Care Provider(s) present:
Registered Nurse(s) present:
Pediatrician(s) present:
Others present:
Full disclosure given to patient: Yes/No

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neonatal and maternal injury and consequently litigation.[20] Making the correct diagnosis, performing the correct maneuvers, time management, prevention of traction, and documenting management and maneuvers are therefore essential.[21] We designed and implemented required templates and electronic medical charting tools for several clinical situations, including shoulder dystocia and operative delivery (Table 2).

Early identification of potential obstetric professional liability cases (2005)

Our medicolegal department met with our department and decided that early identification of adverse obstetric outcomes and potential professional liability cases and expedited reviews would be implemented. If a clear medical error was identified, we planned to approach the patient with the goal of an early settlement. Since the implementation of this program, 1 adverse outcome (an early neonatal death) was identified and quickly settled.

Obstetric patient safety nurse (2005)

As part of our patient safety efforts, our insurance carrier (MCIC Vermont, Inc) funded an obstetric patient safety nurse. The patient safety nurse is employed full-time by the hospital and is involved in staff education, team training, implementation of protocol changes on labor and delivery, obstetric emergency drills, and collection of data.

Electronic online communication whiteboard (2006)

For decades, the labor whiteboard has been the center of communications on many labor and delivery units. It usually serves as a hub for situational awareness to make all staff aware of events on labor and delivery. However, the traditional dry erasable whiteboard has many disadvantages, including limited visibility, limited access, small size, no interactivity, and inflexibility. We programmed and implemented our own proprietary online electronic whiteboard (http://www.LDTrack.com), a secure password-protected and IP address-controlled site available through any internet browser that has many interactive features, including color-coded warning labels and automatic mathematically supported updates.[22]

Recruitment of physician's assistants for labor and delivery (2006)

Newly instituted resident work hours limit the extent of resident involvement and night calls in the hospital including the labor and delivery unit. Three new obstetric physician assistants were recruited to amplify the staff and help with the workload. The physicians' assistants are assigned to labor and delivery triage and as assistants for cesarean deliveries and provide continuity and stability on the labor and delivery floor.

Electronic fetal monitor interpretation certification (2006)

Effective communication is essential when discussing and interpreting fetal heart rate and uterine activity and it requires a mutual understanding of terminology. We required that all staff involved in interpreting electronic fetal monitoring, including attendings, residents, physician assistants, and nurses, become certified in electronic fetal monitoring by National Certification Corporation (NCC), a not-for-profit organization that provides a national credentialing program for nurses, physicians, and other licensed health care professionals. In addition, all staff are required to use the National Institute of Child and Human Development

(NICHD) standardized language for fetal heart rate interpretation[23] and templates for documenting fetal heart rates based on the NICHD language were added in the electronic charting tools.

Electronic antepartum medical records (2006)

We implemented uniform antepartum medical record charting (Epic Systems Corporation) for all full-time faculty and staff patients (about 75% of all deliveries). The availability of electronic antepartum charts on a 24-hour/7 day a week basis improves availability of data, such as laboratory results and helps in improving communication among the staff.

Routine thromboembolism prophylaxis for all cesarean deliveries (2006)

Pulmonary thromboembolism is among the leading causes of maternal deaths in the United States, and most events of venous thromboembolism can be reduced with either medical or mechanical thromboprophylaxis,[24,25] and it has been suggested that a systematic reduction in maternal death rate in the United States can be expected if all women undergoing cesarean delivery receive thromboembolism prophylaxis.[5] Therefore, in addition to using pharmacologic anticoagulation prophylaxis for high-risk patients, we also implemented the routine use of intermittent lower extremity pneumatic compression devices for all cesarean deliveries.

Obstetric emergency drills (2006)

The Joint Commission recommends that obstetric departments consider periodically conducting clinical drills to help staff prepare for shoulder dystocia, conduct debriefings to evaluate team performance, and identify areas for improvement.[13] Such drills appear to improve recognition and management of shoulder dystocia and can improve physician's communication skills as well as reduce traction forces.[26,27] Drills were instituted over time for maternal cardiac arrest, shoulder dystocia, emergency cesarean section, and maternal hemorrhage. Obstetricians, anesthesiologists, neonatologists, nurses, residents, fellows, and physician assistants participate in these drills. The shoulder dystocia and maternal hemorrhage drills are performed with a maternal and fetal manikin and in small groups of 6-8 individuals so each can obtain practice in performing the necessary fetal manipulations.

The main objectives of the shoulder dystocia drill are to diagnose shoulder dystocia, prevent injury by performing the correct maneuvers, time management, prevention of traction, and teach proper documentation.

Recruitment of a laborist (2007)

Inhouse oncall attending coverage is provided on a 24-hour basis by one of the full-time faculty attendings that have obstetric privileges. To address lifestyle and patient safety concerns, Weinstein recommended a practice of having hospitalists and laborists,[28] Clark recommended a reassessment of group obstetric practice to improve patient safety,[29] and a survey showed that laborists can have a high career satisfaction.[30] In 2006, we hired a laborist to provide inhouse coverage for the labor and delivery floor for nights and weekends and therefore reduce inhouse oncall responsibilities of other physicians.

Oxytocin initiation checklist (2009)

We implemented a checklist with the most important elements of the standardized oxytocin policy. Completion of the checklist is required by nurses before initiation of oxytocin for induction or stimulation of labor.

Postpartum hemorrhage kit (2009)

We made available a single hemorrhage kit that includes the 4 most important drugs used for postpartum hemorrhage (oxytocin [Pitocin; King Pharmaceuticals, Bristol, TN], misoprostol [Methergine; Novartis Pharmaceuticals, Basel, Switzerland, Cytotec; Bristol-Myers Squibb, Skillman, NJ], carboprost [Hemabate; Pfizer, New York, NY]).

Internet based required reading assignments and testing (2009)

We created an inhouse internet-based password protected reading and testing program (http://www.InPrep.com) for protocols and other publications related to labor and delivery safety. All attendings and residents have been required to regularly read assigned literature and pass a multiple choice test related to the reading material.

Compensation payments and sentinel events

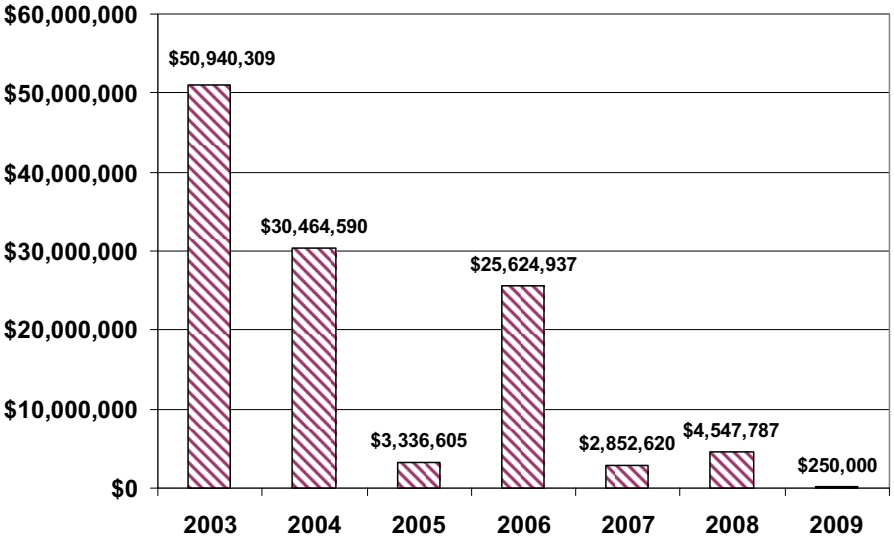
We performed a retrospective review of obstetric compensation payments from 2003 to 2009 collected by the MCIC. Obstetric compensation payments were defined as all actual payments made as a sum of indemnity paid plus medicolegal expenses paid for by the hospital for defending the case. In New York City, most professional liability suits are initiated within 2-3 years after delivery, and they are often not settled until many years later. Therefore, in addition to actual compensation payments, we also assessed new and ongoing significant professional liability suits (expected at $1,000,000 and above) and potential future professional liability suits. Data on sentinel events at our institution were evaluated from 2000 to 2009 by analyzing data obtained from a sentinel event adverse outcome database that is prospectively recorded by the hospital's quality assurance committee. Sentinel events are determined by the Medical Center according to Joint Commission standards. The Joint Commission defines a sentinel event as "... an unexpected occurrence involving death or serious physical or psychological injury, or the risk thereof ..." (http://www.jointcommission.org/SentinelEvents/). At our institution, sentinel events included maternal deaths, and serious newborn injuries, including birth asphyxia and hypoxic ischemic encephalopathy.

Results

Compensation payments

Figure 2 shows the yearly obstetric compensation payment totals paid out from 2003 to 2009. The 2009 compensation payment total constituted a 99.1% drop from the average 2003-2006 payments (from $27,591,610 to $ 250,000). The average yearly compensation payment in the 3 years from 2007 to 2009 was

FIGURE 2
Compensation payments by year



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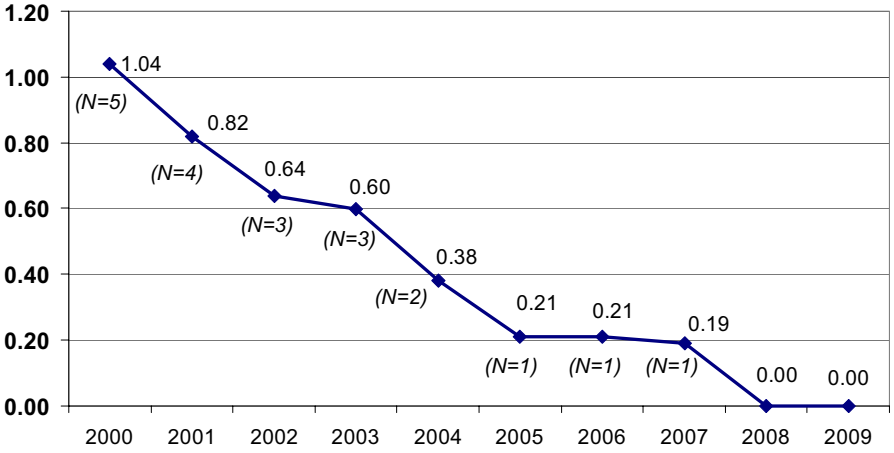
$2,550,136 as compared with an average of $27,591,610 in the previous 4 years (2003-2006), a yearly saving of $25,041,475 (total: $75,124,424) during the last 3 years.

The compensation payments between 2003 and 2008 included delivery dates before 2003. We also assessed potential future and pending professional liability suits through the early identification program. In 2006, we had 1 adverse outcome case that was identified through our program for the early identification of potential professional liability cases, and the case was settled expeditiously. In 2008 and 2009, for the first time in this decade, there was no professional liability suit initiated involving a possibly brain-damaged infant. In addition, there is currently only 1 active professional liability suit exceeding a $1 million estimated loss for an obstetric case from 2005 onward. One of the 2 other currently pending "baby damage" suits involves deliveries before 2003.

Table 3 shows the average time it takes from the event to payment. There is an average of 6.9 years (range, 0.6–17.1 years) between the event and the payment. On average, it takes 3.2 years (range, 0–10 years) between the event and the claim and another 3.7 years (range, 0.3–10.4 years) between the claim and the payment. Of all claims, 65% (26/40) were made within 3 years after the event and 49% of payments (20/41) were made within 6 years after the event.

FIGURE 3
Sentinel events by year (per 1000 deliveries)



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Sentinel events and adverse outcomes

Figure 3 shows the yearly rate of sentinel events per 1000 deliveries. There was a steady decline of sentinel events over the years of the study, from 1.04 sentinel events per 1000 deliveries in the year 2000, to no sentinel events in both 2008 and 2009. For the last 6 years, there has been no maternal death on labor and delivery (we had 1 postpartum maternal death 10 days after discharge from a cerebrovascular accident) and there has been no permanent Erb's palsy since we began shoulder dystocia drills in 2008. Since 2007 there was only 1 infant born of a total of 15,932 deliveries with the diagnosis of hypoxic ischemic encephalopathy (HIE) for an incidence of 0.6 HIE of 10,000 deliveries. Subsequently, that infant had no moderate or severe neurodevelopment impairments. In 2009 there was no infant born with HIE.

The definition of HIE included a severely depressed newborn with need for resuscitation in the delivery room, evidence of severe acidemia at birth based on cord blood gas values and early abnormal findings on neurologic examination and/or abnormal assessment of cerebral function.[32]

Comment

In 1999, the Institute of Medicine published a report challenging the prevailing wisdom that all was well with the American health care system.[8] This report called for a sweeping overhaul and stated that "higher level of care cannot be achieved by further stressing current systems of care. The current care systems

cannot do the job. Trying harder will not work. Changing systems of care will." There also have been increasing concerns about the rise in malpractice costs and its effect of availability of health care.[31]

After an external review of our obstetric service, we undertook comprehensive system changes beginning in 2003, to improve patient safety on our service. Among these patient safety changes were significant eliminations in practice variations as well as significant improvements in communication methods between staff. The main goal of these changes was to improve patient safety and decrease adverse outcomes. We did not expect a rapid and significant effect on compensation payments.

Our results show that implementing a comprehensive obstetric patient safety program not only decreases severe adverse outcomes but can also have an immediate impact on compensation payments. Beginning with the fourth year of the program, compensation payments began to drop significantly. Yearly payments for the most recent 3 years (2007-2009) averaged $2,550,136 as compared with average yearly payments of $27,591,610 for the preceding 4 years (2003-2006). The $25,041,475 yearly savings in compensation payments for the last 3 years alone dwarf the incremental cost of the patient safety program and are well above those reported by Simpson et al.[32] In our opinion the documented success of our patient safety improvement program in decreasing compensation payments for the past years understates the true long-term impact of the program on patient safety, as we expect significant savings to continue into the future.

Our neonatal intensive care unit is a center for "cool cap" treatments (treatment of infants with neonatal encephalopathy with hypothermia helmets), and it regularly treats infants with HIE.[33] Of the more than 50 infants with HIE who were treated in this program over the last 3 years, only 1 among our own 15,932 deliveries came from our institution (the only 2007 sentinel event). Our observed departmental incidence of 0.6 HIE of 10,000 deliveries in the last 3 years is well below the reported 25 of 10,000 deliveries.[34] On follow-up, this infant had no moderate or severe neurodevelopment impairments and hence for the last 3 years there are presently no known HIE brain damaged infants "in the pipeline." As the amount of compensation payments for an infant with neurodevelopment impairments can be well in excess of $10 million in New York City, the prevention of each and every 1 of these cases is crucial to minimize such payments.

TABLE 3
Yearly compensation payments and event-to-payment time

Year	Payments	Event-to-payment average (range), y
2003	$50,940,309	5.9 (1.1–10.3)
2004	$30,464,590	10.5 (3.9–17.1)
2005	$3,336,605	5.5 (1.2–9.5)
2006	$25,624,937	8.2 (4.1–13.2)
2007	$2,852,620	8.1 (5.0–12.0)
2008	$4,547,787	4.7 (0.6–14.4)
2009	$250,000	0.8
2003-2009	$117,991,848	6.9 (0.6–17.1)

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The Institute for Safe Medication Practices (ISMP) has added oxytocin to its list of high alert medications.[35] The use of oxytocin during labor has been found to be associated with malpractice claims.[36] Using oxytocin during labor may have a negative impact on the probability of successfully defending a professional liability case, and its misuse, especially its association with hyperstimulation, has been alleged to be responsible for many if not most of the adverse outcomes and professional liability litigation involving abnormal labor.[37-40]

The best defense against legal challenges involving the misuse of oxytocin is to use the drug judiciously and in accord with institutional policies.[41] However, despite reports that standardized and uniform practice patterns are known to have better outcomes than greater practice variations, medical practice continues to be characterized by wide variations that have little basis in clinical science.[16] This is especially true for oxytocin usage, which has many persistent variations even within the same institution.[42] Clark et al[41] concluded that a physiologically sound and evidence-based approach to oxytocin use is possible and explained that it may be difficult to effect change in practice when physicians so often see no untoward effects of excessive uterine activity.

It has been suggested that implementing a uniform oxytocin policy and using an oxytocin checklist may improve perinatal outcomes.[43-45] We also found that implementing a uniform oxytocin protocol and checklist helped our staff make better use of oxytocin and allowed nurses to focus on better patient care instead of following protocols that varied from physician to physician. Implementing a uniform oxytocin protocol likely contributed to our improved patient safety and prevention of adverse outcomes. Our experience supports the recommendation that: ". . . Malpractice loss is best avoided by reduction in adverse outcomes and the development of unambiguous practice guidelines."[5]

Many pregnant women are given misoprostol "off-label" for cervical ripening and labor induction even though this medication is not approved for use in labor and is associated with an increase in uterine hyperstimulation and resultant fetal asphyxia and uterine rupture, amniotic fluid embolism, perinatal mortality, and HIE in surviving infants.[46] Because of these concerns, we decided to limit the use of misoprostol in labor to inductions in a nonviable fetus.

Good teamwork promotes professional integrity and is essential in delivering optimal patient care,[47] and failure in communication and teamwork is often cited as a common cause of adverse events.[6,48,49,50] We found that teamwork can be further improved in labor and delivery by maintaining an electronic comprehensive communication board as the essential hub for communications among staff.

Sleep deprivation can impair safety, and establishing a laborist program has been recommended to improve safety.[28] The hiring of a laborist allowed our obstetricians to work reduced inhospital hours and likely contributed to the improved safety climate and improved outcomes at our institution.

The traditional erasable labor and delivery white board usually reflects situational awareness, the state of knowing what is going on with patients and in the unit. Unfortunately, most obstetric units still use a dry erasable white board that has severe limitations, including accessibility and space limitations. We believe that the implementation of a centralized, internet-based comprehensive electronic "white board" with automatic alarms and color-coding[18] significantly improved situational awareness and thus may have contributed in decreasing adverse outcomes and reducing compensation payments.

Historically, EFM tracings have been interpreted with wide variations among the labor and delivery staff, often leading to inconsistent decision making in response to tracing interpretation. MacEachin et al[51] showed improved communication as well as improved safety perception by the staff with the use of a common EFM language after a multidisciplinary EFM training program.

Our study is limited by its retrospective nature. There were numerous changes made over several years, so that the impact of any one change on a single outcome measure cannot be individually determined. It is possible, that because of the retrospective nature of this report, there may have been other unknown factors that contributed to the reduction of compensation payments and sentinel events.

To paraphrase Ralph Waldo Emerson (1803-1882) who said "Life is a journey not a destination," we believe that achieving patient safety on labor and delivery is a journey, not a destination.

Improving patient safety requires extensive and considerate changes, physician and staff cooperation, constant vigilance, flexibility, and rapid adaption based on new experiences and it may take considerable time to reap financial benefits in the future.

Making significant changes on a labor and delivery unit including such features as the implementation of a standardized oxytocin protocol, electronic charting, team training, and improving situational awareness through a central communication system, should be considered by all obstetric services. As we have shown, these changes can increase patient safety, decrease sentinel events, and, as a consequence, reduce compensation payments. ■

REFERENCES

1. Weinstein L. A multifaceted approach to improve patient safety, prevent medical errors and resolve the professional liability crisis. Am J Obstet Gynecol 2006;194:1160-5.

2. Wagner B, Meirowitz N, Cohen P, et al. Perinatal safety initiative to reduce adverse obstetric events. Am J Obstet Gynecol 2009;201:S45.

3. Pettker CM, Thung SF, Norwitz ER, et al. Impact of a comprehensive patient safety strategy on obstetric adverse events. Am J Obstet Gynecol 2009;200:492.e1-8.

4. Pettker C, Thung S, Raab C, Copel J, Funai J. A comprehensive OB patient safety program improves safety climate and culture. Am J Obstet Gynecol 2009;201:S202-3.

5. Clark SL, Belfort MA, Dildy GA, Herbst MA, Meyers JA, Hankins GD. Maternal death in the 21st century: causes, prevention, and relationship to cesarean delivery. Am J Obstet Gynecol 2008;199:36.e1-5.

6. Sutcliffe KM, Lewton E, Rosenthal MM. Communication failures: an insidious contributor to medical mishaps. Acad Med 2004;79:186-94.

7. Simpson KR, James DC, Knox GE. Nurse-physician communication during labor and birth: implications for patient safety. J Obstet Gynecol Neonatal Nurs 2006;35:547-56.

8. Kohn LT, Corrigan JM, Donaldson MS, eds. Committee on Quality of Health Care in America, Institute of Medicine. To err is human: building a safer health system. Washington, DC: National Academy Press; 1999:1-312.

9. Mann S, Pratt SD. Team approach to care in labor and delivery. Clin Obstet Gynecol 2008;51:666-79.

10. Nielsen PE, Goldman MB, Mann S, et al. Effects of teamwork training on adverse outcomes and process of care in labor and delivery: a randomized controlled trial. Obstet Gynecol 2007;109:48-55.

11. Williams DG. Practice patterns to decrease the risk of a malpractice suit. Obstet Gynecol 2008;51:680-7.

12. Eden KB, Messina R, Li H, Osterweil P, Henderson CR, Guise JM. Examining the value of electronic health records on labor and delivery. Am J Obstet Gynecol 2008;199:307.e1-9.

13. Joint Commission on Accreditation of Healthcare Organizations: Sentinel event alert. Issue 30, July 21, 2004. Available at: www.jointcommission.org/SentinelEvents/SentinelEventAlert/sea_30.html. Accessed July 1, 2010.

14. Fonseca L, Wood HC, Lucas MJ, et al. Randomized trial of preinduction cervical ripening: misoprostol vs oxytocin. Am J Obstet Gynecol 2008;199:305.e1-5.

15. Hofmeyr GJ, Gülmezoglu AM Vaginal misoprostol for cervical ripening and induction of labour. Cochrane Database Syst Rev 2003;CD000494.

16. Wennberg JE. Unwarranted variations in healthcare delivery: implications for academic medical centres. BMJ 2002;325:961-4.

17. Simpson KR, Knox GE. Obstetrical accidents involving intravenous magnesium sulfate: recommendations to promote patient safety. MCN Am J Matern Child Nurs 2004;29:161-9.

18. Conde-Agudelo A, Romero R. Antenatal magnesium sulfate for the prevention of cerebral palsy in preterm infants less than 34 weeks' gestation: a systematic review and metaanalysis. Am J Obstet Gynecol 2009;200:595-609.

19. Rouse DJ. Magnesium sulfate for the prevention of cerebral palsy. Am J Obstet Gynecol 2009;200:610-2.

20. Mavroforou A, Koumantakis E, Michalodimitrakis E. Physicians' liability in obstetric and gynecology practice. Med Law 2005;24:1-9.

21. Deering S, Poggi S, Macedonia C, et al. Improving resident competency in the management of shoulder dystocia with simulation training. Obstet Gynecol 2004;103:1224.

22. Grunebaum A, Langsenkamp C, Chervenak FA. An intelligent web-based board to improve patient safety and communication on labor and delivery. Am J Obstet Gynecol 2005:193:S97.

23. Macones GA, Hankins GD, Spong CY, Hauth J, Moore T. The 2008 National Institute of Child Health and Human Development workshop report on electronic fetal monitoring: update on definitions, interpretation, and research guidelines. Obstet Gynecol 2008;112:661-6.

24. Duhl AJ, Paidas MJ, Ural SH, et al. Antithrombotic therapy and pregnancy: consensus report and recommendations for prevention

and treatment of venous thromboembolism and adverse pregnancy outcomes. Am J Obstet Gynecol 2007:197:457.e1-21.

25. Quiñones J, James D, Cleary K, Stamilio D, Macones G. Thromboprophylaxis after cesarean section: a decision analysis. Am J Obstet Gynecol 2004;191:S93.

26. Goffman D, Heo H, Pardanani P, Merkatz IR, Bernstein PS. Improving shoulder dystocia management among resident and attending physicians using simulations. Am J Obstet Gynecol 2008;199:294.e1-5.

27. Gurewitsch E, Cha S, Johnson T, et al. Traction training for routine and shoulder dystocia deliveries: an experimental study. Am J Obstet Gynecol 2005;193:S41.

28. Weinstein L, Garite TJ. On call for obstetrics—time for a change. Am J Obstet Gynecol 2007;196:3.

29. Clark SL. Sleep deprivation: implications for obstetric practice in the United States. Am J Obstet Gynecol 2009;201:136.e1-4.

30. Funk C, Anderson BL, Schulkin J, Weinstein L. Survey of obstetric and gynecologic hospitalists and laborists. Am J Obstet Gynecol 2010;203:177.e1-4.

31. Laros RK, Presidential address: medical-legal issues in obstetrics and gynecology Am J Obstet Gynecol 2005;192:1883.

32. Simpson KR, Kortz CC, Knox E. A comprehensive perinatal patient safety program to reduce preventable adverse outcomes and costs of liability claims. Jt Comm J Qual Patient Saf 2009;35:565-74.

33. Perlman J. Induced hypothermia: a novel neuroprotective treatment of neonatal encephalopathy after intrapartum hypoxia-ischemia. Curr Treat Options Neurol 2005;7:451-8.

34. Graham EM, Ruis KA, Hartman AL, Northington FJ, Fox HE. A systematic review of the role of intrapartum hypoxia-ischemia in the causation of neonatal encephalopathy. Am J Obstet Gynecol 2008;199:587-95.

35. Institute for Safe Medical practices. ISMP's List of High-Alert Medications. Available at: http://www.ismp.org/Tools/highalertmedications.pdf. Accessed Jan. 24, 2010.

36. Jonsson M, Nordén SL, Hanson U. Analysis of malpractice claims with a focus on oxytocin use in labour. Acta Obstet Gynecol Scand 2007;86:315-9.

37. Simpson KR, James DC. Effects of oxytocin-induced uterine hyperstimulation during labor on fetal oxygen status and fetal heart rate patterns. Am J Obstet Gynecol 2008;199:34.e1-5.

38. Milsom I, Ladfors L, Thiringer K, Niklasson A, Odeback A, Thornberg E. Influence of maternal, obstetric and fetal risk factors on the prevalence of birth asphyxia at term in a Swedish urban population. Acta Obstet Gynecol Scand 2002;81:909-17.

39. Berglund S, Grunewald C, Pettersson H, Cnattingius S. Severe asphyxia due to delivery-related malpractice in Sweden 1990-2005. BJOG 2008;115:316-23.

40. Cohen WR, Schifrin BS. Medical negligence lawsuits relating to labor and delivery. Clin Perinatol 2007;34:345-60, vii-viii.

41. Clark SL, Simpson KR, Knox GE, Garite TJ. Oxytocin: new perspectives on an old drug. Am J Obstet Gynecol 2009;200:35.e1-6.

42. American College of Obstetrics and Gynecology Committee on Practice Bulletins-Obstetrics. ACOG practice bulletin no. 49, December 2003: dystocia and augmentation of labor. Obstet Gynecol 2003;102:1445-54.

43. Clark S, Belfort M, Saade G, et al. Implementation of a conservative checklist-based protocol for oxytocin administration: maternal and newborn outcomes. Am J Obstet Gynecol 2007;197:480.e1-5.

44. Freeman RK, Nageotte M. A protocol for use of oxytocin. Am J Obstet Gynecol 2007;197:445-6.

45. Hayes EJ, Weinstein L. Improving patient safety and uniformity of care by a standardized regimen for the use of oxytocin. Am J Obstet Gynecol 2008;198:622.e1-7

46. Wagner M. Off-label use of misoprostol in obstetrics: a cautionary tale. BJOG 2005;112:266-8.

47. Chervenak FA, McCullough LB. Neglected ethical dimensions of the professional liability crisis. Am J Obstet Gynecol 2004;190:1198-200.

48. Arora V, Johnson J, Lovinger D, Humphrey HJ, Meltzer DO. Communication failures in patient sign-out and suggestions for improvement: a critical incident analysis. Qual Saf Health Care 2005;14:401-7.

49. Gawande AA, Zinner MJ, Studdert DM, Brennan TA. Analysis of errors reported by surgeons at three teaching hospitals. Surgery 2003;133:614-21.

50. Clark SL, Belfort MA, Byrum SL, Meyers JA, Perlin JB. Improved outcomes, fewer cesarean deliveries, and reduced litigation: results of a new paradigm in patient safety. Am J Obstet Gynecol 2008;199:105.e1-7.

51. MacEachin SR, Lopez CM, Powell KJ, Corbett NL. The fetal heart rate collaborative practice project: situational awareness in electronic fetal monitoring-a Kaiser Permanente Perinatal Patient Safety Program Initiative. J Perinat Neonatal Nurs 2009;23:314-23; quiz 324-5.