Abstract
Patient injury from drug therapy is the single most common type of adverse event that occurs in the in-patient setting. When medication errors result in patient injury, there are significant costs to the patient, healthcare providers, and institution. Some medications that have a heightened risk of causing significant patient harm when they are used in error are called “high-alert medications.” In 2007, the Institute for Safe Medication Practices added intravenous (IV) oxytocin to their list of high-alert medications. This is significant for perinatal care providers because oxytocin is a drug that they use quite frequently. Errors that involve IV oxytocin administration for labor induction or augmentation are most commonly dose related and often involve lack of timely recognition and appropriate treatment of excessive uterine activity (tachysystole). Other types of oxytocin errors involve mistaken administration of IV fluids with oxytocin for IV fluid resuscitation during nonreassuring (abnormal or indeterminate) fetal heart rate patterns and/or maternal hypotension and inappropriate elective administration of oxytocin to women who are less than 39 completed weeks’ gestation. Oxytocin medication errors and subsequent patient harm are generally preventable. The perinatal team can develop strategies to minimize risk of maternal-fetal injuries related to oxytocin administration consistent with safe care practices used with other high-alert medications.

Key Words: Oxytocin; Uterine hyperstimulation/tachysystole; Medication error; Adverse drug event; Patient safety.

Oxytocin as a High-Alert Medication: Implications for Perinatal Patient Safety

Patient injury from drug therapy is the single most common type of adverse event that occurs in the inpatient setting. When medication errors result in patient injury, there are significant costs to the patient, healthcare providers, and institution. Some medications that have a heightened risk of causing significant patient harm when they are used in error are called “high-alert medications.” In 2007, the Institute for Safe Medication Practices added intravenous (IV) oxytocin to their list of high-alert medications. This is significant for perinatal care providers because oxytocin is a drug that they use quite frequently. Errors that involve IV oxytocin administration for labor induction or augmentation are most commonly dose related and often involve lack of timely recognition and appropriate treatment of excessive uterine activity (tachysystole). Other types of oxytocin errors involve mistaken administration of IV fluids with oxytocin for IV fluid resuscitation during nonreassuring (abnormal or indeterminate) fetal heart rate patterns and/or maternal hypotension and inappropriate elective administration of oxytocin to women who are less than 39 completed weeks’ gestation. Oxytocin medication errors and subsequent patient harm are generally preventable. The perinatal team can develop strategies to minimize risk of maternal-fetal injuries related to oxytocin administration consistent with safe care practices used with other high-alert medications.

Key Words: Oxytocin; Uterine hyperstimulation/tachysystole; Medication error; Adverse drug event; Patient safety.
and appropriate treatment of tachysystole (see Figure 1). Other types of oxytocin errors involve mistaken administration of IV fluids with oxytocin for IV fluid resuscitation during nonreassuring (abnormal or indeterminate) fetal heart rate (FHR) patterns and/or maternal hypotension and inappropriate elective administration of oxytocin to women who are less than 39 completed weeks’ gestation (See Table 1 for case reports). Oxytocin medication errors and subsequent patient harm are generally preventable (Clark et al., 2008). Although oxytocin administered using pharmacologic principles can be therapeutic during labor, inappropriate timing or excessive doses can have a potentially negative effect on the mother and baby.

Physiologic implications of contractions include an intermittent decrease or interruption in blood flow to the intervillous space (American College of Obstetricians and Gynecologists [ACOG] & American Academy of Pediatrics [AAP], 2003). As a contraction begins, the fetus uses the reservoir of oxygen in the intervillous space; limited blood flow prevents complete recovery until some time after the contraction, when full oxygenation has been restored (Bakker & van Geijn, 2008). Normal labor contractions are
Table 1. ADVERSE DRUG EVENTS INVOLVING INTRAVENOUS OXYTOCIN (CASE REPORTS)

Case 1.
A nulliparous woman was receiving oxytocin for labor induction based on a protocol starting at 2 mU/min and increasing by 2 mU/min every 20 min. Within 6 hr, the rate was 38 mU/min. Uterine activity was irregular, with coupling and tripling of contractions. After 20 hr of labor, the oxytocin rate was 44 mU/min, having been increased, decreased, discontinued, and reinitiated several times over the course of labor as a result of hyperstimulation and/or a nonreassuring FHR pattern. A series of recurrent variable decelerations was noted for 25 min. A sudden bradycardia occurred that was unresolved by repositioning and discontinuing oxytocin. A vaginal exam ruled out umbilical cord prolapse. An emergent cesarean birth performed within 23 min of the beginning of the bradycardia revealed uterine rupture. Uterine atony and a significant postpartum hemorrhage occurred (estimated blood loss = 3,000 mL). A hysterectomy was required. Twenty-two units of blood products were administered during the intraoperative and immediate postpartum period. The woman was admitted to the ICU and developed disseminated intravascular coagulation and pulmonary edema. She required kidney dialysis for several days. The baby’s Apgar scores were 1, 3, and 4 at 1, 5, and 10 min, respectively, with umbilical cord blood gas results indicating metabolic acidemia (pH 6.84, pCO2 59, base excess -18). At 20 hr of life, the baby developed seizures. The baby was discharged from the neonatal ICU (NICU) after 30 days with a presumptive diagnosis of hypoxic ischemic encephalopathy.

Case 2.
A nulliparous woman undergoing elective induction was receiving oxytocin at 11 mU/min. She developed a pattern of frequent contractions lasting 30 to 40 seconds. Labor progress was stalled, with cervical dilation remaining at 6 cm for 2 hr and 40 min. The nurse reported this contraction pattern to the physician, who ordered oxytocin increased to “pit through” the frequent contractions to achieve a more functional labor. Although the nurse was uncomfortable with this order, oxytocin was increased to 13 mU/min, then 15 mU/min without resolution of abnormal uterine activity. The FHR baseline increased from 130 bpm to 160 bpm with moderate variability evolving to minimal variability and recurrent late decelerations. Oxytocin was discontinued when the woman complained of intense abdominal pain. During an emergent cesarean birth, a 50% placental abruption was noted. Apgar scores were 4, 5, and 7 at 1, 5, and 10 min, respectively. The baby was admitted to the NICU. Maternal estimated blood loss = 2,500 mL. Mother and baby eventually did well and were discharged home on the 5th postoperative day.

Case 3.
A 38-year-old woman, gravida 2, para 1 with secondary infertility, was admitted in spontaneous early labor with intact membranes (cervical status = 1-2 cm; 50%-2 station). Her last labor was 16 years ago. After 2 hr without cervical change, elective amniotomy was performed and oxytocin augmentation was started based on a protocol starting at 2 mU/min and doubled every 15 min until 16 mU/min, then increased by 4 mU/min every 15 min. Labor progressed at 1 to 1.5 cm/hr. Contractions were every 1.5 to 2 min for the last 5 hr of labor, including the second stage. The FHR pattern had intermittent periods of minimal variability with recurrent variable decelerations. Oxygen was administered to the mother on and off during that period, and her position was changed. When complete cervical dilation occurred, the woman was coached to begin pushing by the nurse and physician who maintained continuous bedside attention. Some deviation occurred, the FHR became increasingly nonreassuring, pushing efforts intensified, as guided by the nurse and physician, and oxytocin was increased. An acute bradycardia occurred that progressed from 60 bpm to 30 bpm over an 11-min period. Pushing efforts continued while the surgical team was called for an emergent cesarean birth. The FHR was unable to be detected in the surgical suite before the cesarean birth. A stillborn baby boy was born 6 min after arrival in the surgical suite. Efforts to resuscitate the baby were unsuccessful. Umbilical cord gases were pH 6.67, pCO2 80, base excess -22.

Case 4.
A nulliparous woman undergoing an elective induction received epidural anesthesia for labor pain relief. After the initial bolus of epidural medication, the FHR pattern developed recurrent, late decelerations followed by a prolonged deceleration. Maternal blood pressure was 72/40 mm Hg. The anesthesia provider administered a bolus of 300 mL of IV fluid to treat the hypotension. Within 90 seconds, uterine hyperstimulation and hyper-tonus were noted and the FHR became bradycardic. Terbutaline, 0.25 mg, was given subcutaneously without immediate recovery of the FHR pattern. An emergent cesarean birth was performed. In the surgical suite, the anesthesia provider realized that the bolus of IV fluid given in the labor room to treat the hypotension was from the IV bag that contained oxytocin for labor induction rather than plain lactated Ringer’s solution. The inadvertent bolus of IV solution containing oxytocin was likely the cause of abnormal uterine activity and nonreassuring FHR that led to emergent cesarean birth. Apgar scores were 4, 7, and 9 at 1, 5, and 10 min, respectively. The baby was admitted to the well-baby nursery and discharged in healthy condition with the mother.

Case 5.
A multiparous woman underwent an elective labor induction at 39 2/7 weeks’ gestation. Her previous baby was 9 lb, 2 oz. Her physician was worried that this baby might be even bigger, so the patient was encouraged to have the induction early to avoid complications of a macrosomic baby. Labor progressed normally, and a 7 lb, 1 oz baby boy was born with Apgar scores of 8 and 9 at 1 and 5 min, respectively. At 12 min of life, the baby appeared to have respiratory difficulty, with grunting and sternal retractions. The NICU team indicated gestational age was likely 36 weeks. Review of prenatal records revealed several different estimated due dates based on last menstrual period and two ultrasounds. The baby responded well to oxygen therapy in the NICU, was transferred to the well-baby nursery in 36 hr, and eventually was discharged in healthy condition with the mother.
well tolerated by most healthy fetuses; however, there is risk of fetal hypoxemia and acidemia if contractions are too frequent and/or prolonged (ACOG & AAP, 2003; Bakker, Kurver, Kuik, & van Geijn, 2007; Bakker & van Geijn, 2008; Simpson & James, 2008). Within 5 min of excessive uterine activity, fetal oxygen desaturation begins, progressively decreasing 20% to 29% over a 30-min period until normal uterine activity is restored (Simpson & James, 2008) (see Figure 2). One hour of excessive uterine activity during first stage labor or over the course of second stage labor is associated with a significant risk of neonatal acidemia (Bakker et al., 2007). When fetal oxygenation is sufficiently impaired to produce metabolic acidosis from anaerobic glycolysis, direct myocardial depression occurs (ACOG & AAP, 2003). As fetal deterioration progresses, the fetus will likely respond with late decelerations and the FHR will lose variability and reactivity (ACOG & AAP, 2003). Adequate time between contractions is required to maximally perfuse the placenta and transport oxygen to the fetus (Bakker & van Geijn, 2008; Caldeyro-Barcia, 1992).

Goals of IV oxytocin are to affect labor progress by stimulating contractions of normal intensity, duration, and frequency and to avoid tachysystole and its potential harmful sequelae. As with other high-alert medications, the lowest dose possible to achieve the desired clinical effect should be used. Complications related to excessive oxytocin and/or uterine tachysystole are not limited to the fetus. Associated adverse maternal events include pain, placental abruption, uterine rupture, unnecessary cesarean birth for nonreassuring (indeterminate or abnormal) FHR patterns, postpartum hemorrhage, and infection (ACOG, 1999; Crane & Young, 1998).

Oxytocin should not be administered electively to induce labor for women who are less than 39 completed weeks’ gestation (ACOG, 1999) because it can result in the birth of a baby at risk for developing respiratory problems, transient tachypnea, hypoglycemia, or other neonatal morbidities and admission to the special care nursery or neonatal ICU (Tita, 2007). Although considered “term,” babies born electively at 37 weeks or 38 weeks have 2 to 4 times and 1.5 to 2 times greater risk, respectively, of neonatal complications than babies born at ≥ 39 weeks (Tita, 2007). If there is miscalcu-
tion in estimated date of birth, elective labor induction can lead to birth of a late preterm baby (34 0/7 weeks’ to 36 6/7 weeks’ gestation).

Oxytocin administration errors are a significant source of professional liability. According to the 2004 ACOG professional liability survey, 21.9% of claims involving neurologically impaired babies and 14.7% of claims involving stillbirth or neonatal death included management of oxytocin. Approximately one half of paid claims involve allegations of oxytocin misuse (Clark, Belfort, & Dildy, 2006). Usually the claim is related to prolonged periods of oxytocin-induced uterine tachysystole presumed to have resulted in fetal hypoxemia, acidemia, asphyxia, and subsequent brain damage. In 2004, a jury awarded $22 million after a baby allegedly suffered brain damage as a result of oxytocin-induced tachysystole during labor (Riley, 2004). Plaintiff’s experts alleged that the mother was given an overdose of oxytocin that caused prolonged tachysystole and temporarily cut off the baby’s oxygen, which led to brain damage and cerebral palsy (Riley, 2004). This medication overdose was attributed to nurses’ administration of oxytocin. Although lay jury members may not always fully appreciate testimony in malpractice cases involving physiology and pharmacology, most understand that patients should not be given a medication overdose, and some are willing to award significant financial damages if that overdose is thought to have caused the patient’s injury or death.

Labor Nurses and Oxytocin

Because labor nurses are primarily responsible for oxytocin administration, they are at risk for professional liability when their titration of the drug results in uterine tachysystole that is not recognized and treated in a timely manner. Clinical disagreements between nurses and physicians regarding the definition of tachysystole and how and when to treat this oxytocin-related complication cause much frustration for clinicians of both disciplines (Simpson, James, & Knox, 2006). Physician orders to “push the pit” and “pit to distress” with comments such as “that’s not really hyperstimulation,” “the baby will let us know if contractions are too close,” or “we need to get her delivered one way or another” in the context of what the nurse feels is not the in the best interest of the mother and baby may be carried out at times because some nurses feel intimidated by physician colleagues and fear retaliation if they refuse (Simpson & Lyndon, 2009). In a recent study of labor nurses’ responses to clinical disagreements with physicians regarding how to manage uterine hyperstimulation, only 22.5% of nurses indicated that they would follow their own clinical judgment when physician orders to increase oxytocin rates during hyperstimulation and/or a nonreassuring FHR pattern were in conflict (Simpson & Lyndon, 2009).

Given the new status of oxytocin as a high-alert medication, clinicians can expect more scrutiny when using this drug during labor. It is likely that a prolonged period of oxytocin-induced tachysystole will be considered a medication error (inappropriate use of a drug that may or may not cause patient harm) and/or a potential ADE (circumstances that could result in patient harm by the use of the drug but did not cause harm). Resultant complications may be considered an ADE. This consideration may not be unreasonable based on commonly used definitions of these terms.

Strategies for Minimizing Risk of Patient Harm During Oxytocin Administration

When using high-alert medications, clinicians and hospitals should follow principles of safe care:

- Designing processes to prevent errors and harm
- Designing methods to identify error and harm when they occur
- Designing methods to mitigate the harm that may result from the error (IHI, 2007; ISMP, 2007).

With oxytocin, the key issue is prevention. Based on current evidence and published professional standards and guidelines, clinicians should have enough information to develop strategies for minimizing risk of harm to mothers and babies during oxytocin administration. A summary of current strategies is provided.

Processes to Prevent Errors and Harm

- Requirement that women having elective labor induction be at least 39 completed weeks’ gestation (with documentation of gestational age and how it was determined by the provider in the medical record, including discussion with the woman that includes risks and benefits of elective labor induction and alternatives such as waiting for spontaneous labor) (ACOG, 1999)
- Standard order sets and protocols that reflect a standardized clinical approach to labor induction and augmentation based on current pharmacologic and physiologic evidence (start at 1 mU/min and increase by 1-2 mU/min no more frequently than every 30 to 60 min based on the maternal-fetal response) (Arias, 2000; Crane & Young, 1998; Simpson, 2008a, 2008b)
- Standard concentration of oxytocin prepared by the pharmacy (e.g., 30 U in 500 mL of lactated Ringer’s solution; 1 mL/hr = 1 mU/min) (Simpson, 2008b)
- Standard definition of uterine tachysystole that does not include a nonreassuring (abnormal or indeterminate) FHR pattern or the woman’s perception of pain (a contraction frequency of more than five in 10 min, a series of single contractions lasting 2 min or more, contractions...
of normal duration occurring within 1 min of each other) (ACOG, 1999; 2003; 2005; Macones, Hankins, Spong, Hauth, & Moore, 2008; Simpson, 2008a, 2008b).

- **Standard treatment of oxytocin-induced uterine tachysystole guided by fetal status** (algorithm for treatment based on whether the FHR pattern is reassuring [normal] or nonreassuring [indeterminate or abnormal]) (Simpson, 2008a, 2008b) (see Table 2)

  Standardization and simplification are the hallmarks of safe patient care processes (Kohn, Corrigan, & Donaldson, 1999). Substantial evidence supports a standard physiologic oxytocin dosing regimen. Labor progresses at approximately the same rate as with more aggressive dosing regimens and with fewer complications, such as tachysystole, nonreassuring (indeterminate or abnormal) FHR patterns, cesarean birth, postpartum infection, and postpartum hemorrhage (Arias, 2000; Crane & Young, 1998). A standard concentration of oxytocin prepared by the pharmacy decreases risk of errors associated with individual clinicians admixing IV medications (American Hospital Association & ISMP, 2002). A standard definition of tachysystole is critical; all clinicians should know to identify this complication so that appropriate timely treatment can be initiated.

### Methods to Identify Errors

- **Careful and timely assessment** (assessment of FHR pattern and uterine activity every 15 min in the active phase of first stage labor and every 5 min in the active pushing phase of second stage labor) (AAP & ACOG, 2007)
- **Assessment performed by a registered nurse providing care to no more than two patients undergoing labor induction** (AAP & ACOG, 2007)

  In the context of adequate staffing, based on an assessment frequency of every 15 min, it is reasonable to expect that excessive uterine activity will be identified within 20 min and timely initiation of appropriate treatment will occur. However, although AAP & ACOG (2007) recommend a minimum of one nurse to two patients receiving oxytocin, complete assessment and documentation every 15 min in addition to other supportive clinical care can be challenging in this staffing scheme. One-to-one nurse-to-patient staffing during labor induction is more appropriate if recommended assessments are to be realistically accomplished and documented.

### Table 2. Suggested Clinical Protocol for Oxytocin-Induced Uterine Tachysystole

#### Oxytocin-Induced Tachysystole (Reassuring [Normal] FHR)

- Maternal repositioning (left or right lateral)
- IV fluid bolus of approximately 500 mL of lactated Ringer’s solution
- If uterine activity has not returned to normal after 10 min, decrease oxytocin rate by at least half; if uterine activity has not returned to normal after 10 more min, discontinue oxytocin until uterine activity is less than 5 contractions in 10 min

#### Oxytocin-Induced Tachysystole (Nonreassuring [Indeterminate or Abnormal] FHR)

- Discontinue oxytocin
- Maternal repositioning (left or right lateral)
- IV fluid bolus of approximately 500 mL of lactated Ringer’s solution
- Consider oxygen at 10 L/min via nonrebreather facemask if the first interventions mentioned previously do not resolve the nonreassuring (indeterminate or abnormal) FHR pattern; discontinue as soon as possible
- If no response, consider 0.25 mg terbutaline subcutaneously
- Notify primary provider of actions taken and maternal-fetal response

#### Resumption of Oxytocin After Resolution of Hyperstimulation

- If oxytocin has been discontinued for less than 20–30 min, the FHR is reassuring, and contraction frequency, intensity, and duration are normal, resume oxytocin at no more than half the rate that caused the tachysystole and gradually increase the rate if needed as appropriate based on unit protocol and maternal–fetal status
- If oxytocin is discontinued for more than 30–40 min, resume oxytocin at the initial dose ordered

#### Physician/Certified Nurse Midwife Notification

- If uterine activity and/or the FHR pattern has not returned to normal after initiating the interventions, notify physician or midwife

### Methods to Mitigate Harm

- **Protocols that allow discontinuing or decreasing the dose without having to contact the physician** (a clinical algorithm linked to physician orders, based on current evidence, agreed upon by the perinatal team to be used when oxytocin-induced uterine tachysystole occurs that is initiated without having to call the physician for additional orders; the physician is contacted when tachysystole and/or a nonreassuring (indeterminate or abnormal) FHR pattern has not resolved after the interventions have been implemented) (see Table 2)
- **Rescue protocols available and agreed upon by the perinatal team** (see Table 2)
- **Periodic case review** (random review of cases involving maternal exposure to oxytocin during labor using an audit tool based on explicit expectations that oxytocin-induced uterine tachysystole be identified within 20 min
followed by timely appropriate interventions guided by fetal status) (see Table 3).

A standard clinical algorithm linked to a standard physician order set allowing for immediate treatment for tachysystole is a prudent approach to patient safety. Requiring permission or an additional physician order to treat tachysystole can create situations in which clinical disagreement may ensue. Time spent attempting to resolve these types of clinical disagreements may significantly delay treatment and potentially jeopardize maternal-fetal safety. Physician notification is recommended when uterine activity and FHR pattern do not return to normal after the clinical algorithm has been implemented.

Summary

Complications of oxytocin administration during labor may occur even with excellent clinical care and careful vigilance. A standard approach based on current pharmacologic and physiologic evidence and guidelines from professional associations such as ACOG (1999; 2003) and the Association of Women’s Health, Obstetric and Neonatal Nurses (AWHONN) (Simpson, 2008a) will decrease risk of patient harm and professional liability. The perinatal team can develop strategies to minimize risk related to oxytocin administration consistent with safe care practices used with other high-alert medications.

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| Table 3. Tachysystole Audit Tool |

| Tachysystole/Hyperstimulation is defined as more than five contractions in 10 min averaged over a 30 min window, contractions lasting 2 min or more, or contractions of normal duration occurring within 1 min of each other. |

**Expected Care Process:** Excessive uterine activity is identified and interventions initiated within 20 min of its development; interventions are based on whether the FHR pattern is reassuring (normal) or nonreassuring (indeterminate or abnormal).

<table>
<thead>
<tr>
<th>Care Data</th>
<th>Times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginning</td>
<td></td>
</tr>
<tr>
<td>Identification</td>
<td></td>
</tr>
<tr>
<td>How many minutes before identification?</td>
<td></td>
</tr>
<tr>
<td>Interventions initiated</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Repositioning</td>
<td>Yes/No</td>
</tr>
<tr>
<td>IV fluid bolus of lactated Ringer’s solution</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Decrease in oxytocin by half of current rate (reassuring [normal] FHR pattern)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Discontinuation of oxytocin (nonreassuring [indeterminate or abnormal] FHR pattern or if half dosage decrease does not correct excessive uterine activity)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Terbutaline 0.25 mg subcutaneously</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>

Resolution time

Total length of tachysystole period in minutes

<table>
<thead>
<tr>
<th>Nonreassuring (indeterminate or abnormal) FHR characteristics (if applicable)</th>
<th>Absent or Present</th>
<th>Accurately Interpreted</th>
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</thead>
<tbody>
<tr>
<td>FHR (bradycardia or tachycardia)</td>
<td>Rate</td>
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</tr>
<tr>
<td>Variability (absent or minimal)</td>
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<td>Yes/No</td>
</tr>
<tr>
<td>Decelerations (late, variable, prolonged, recurrent, intermittent)</td>
<td>Yes/No</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>

Overall Evaluation of Care

Expected care process met | Yes/No

*Note: Data from ACOG, 2003, 2005; Simpson, 2008a; Macones et al., 2008*
might have an interest in the publication of this educational activity.

References


2008 MCN Paper of the Year Awards

MCN is delighted to announce the winners of the 2008 MCN Research Paper of the Year and the 2008 MCN Practice Paper of the Year awards. These articles were chosen from all articles published in 2008 (except those written by Editorial Board members, which are not eligible for these awards) by a vote of the MCN Editorial Board. These winners represent excellence in content, and help to continue MCN’s commitment to improve nursing knowledge and evidence-based practice.

2008 MCN Practice Paper of the Year

AUTHORS: Marirose Bernard, MN, APRN, CNA-BC, and Pamela R. Mathews, BSN, RNC.

Ms. Bernard is currently an Instructor at Louisiana State University Health Sciences Center School of Nursing, New Orleans, LA, having lost her position as Director of Nursing for Womens and Infants Services at Memorial Medical Center when the hospital was destroyed in the hurricane. Ms. Mathews is currently a student nurse recruiter at Louisiana State University Health Sciences Center School of Nursing, New Orleans, LA. Before the hurricane, she was the NICU nurse manager at Memorial Medical Center.

These nurses will receive a cash award and a certificate of achievement. Congratulations!

2008 MCN Research Paper of the Year

AUTHORS: Gloria Giarratano, PhD, APRN, CNS, Susan Orlando, DNS, APRN, NNP-BC, CNS, and Jane Savage, PhD, RN, LCCE, FACCE. Dr. Giarratano is a Professor of Nursing, Louisiana State University Health Sciences Center School of Nursing, New Orleans, LA, where Dr. Susan Orlando is an Assistant Professor. Dr. Jane Savage is an Associate Professor of Nursing at Our Lady of the Lake College, New Orleans, LA.