PENNSYLVANIA PATIENT SAFETY ADVISORY

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OBJECTIVE

The *Pennsylvania Patient Safety Advisory* provides timely original scientific evidence and reviews of scientific evidence that can be used by healthcare systems and providers to improve healthcare delivery systems and educate providers about safe healthcare practices. The emphasis is on problems reported to the Pennsylvania Patient Safety Authority, especially those associated with a high combination of frequency, severity, and possibility of solution; novel problems and solutions; and problems in which urgent communication of information could have a significant impact on patient outcomes.

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Addressing the Rise in Neonatal Abstinence Syndrome: A Multifaceted Approach

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ABSTRACT

With the rising incidence of neonatal abstinence syndrome (NAS) over the last decade, healthcare professionals are recognizing that close collaboration and standardized protocols aid in effectively diagnosing and treating newborns with drug withdrawal symptoms. Maternal use of prescription or illicit drugs during pregnancy can result in the newborn experiencing NAS, with symptoms of excessive or high-pitched crying, irritability, poor feeding, sleep problems, slow weight gain, and seizures. Pennsylvania Patient Safety Authority analysts identified 797 events involving newborns diagnosed with NAS that occurred from January 2005 through December 2014, with an increasing number of events reported each year. Healthcare professionals use a standardized scoring process, combinations of pharmacologic and nonpharmacologic interventions, and close care team collaboration to aid in the diagnosis and treatment of newborns with NAS. With the help of healthcare professionals, mothers and families can provide the supportive love and care needed to help their newborn through the withdrawal process. (Pa Patient Saf Advis 2015 Dec;12[4]:125-31.)

INTRODUCTION

The number of neonatal abstinence syndrome (NAS) cases involving newborns who experience withdrawal symptoms after birth from prenatal exposure to drugs such as opioids is dramatically increasing, causing hospitals to rethink their approaches to diagnosis and treatment.[1-3]

Opioid prescribing increased in the United States from around 76 million in 1991 to nearly 207 million in 2013, crossing all populations, including pregnant women.[4-6] Addiction may occur after opioids are prescribed for chronic pain caused by an accident, fibromyalgia, or other causes.[2]

Maternal use of prescription or illicit drugs during pregnancy can result in the newborn experiencing NAS.[4,7] Tolia et al. reported that the frequency of neonatal intensive care unit (NICU) admissions for newborns with NAS increased from 7 to 27 cases per 1,000 admissions in the United States from 2004 through 2013.[8] Patrick et al. calculated an increase in the rate of NAS from 3.4 to 5.8 per 1,000 hospital births per year in the United States from 2009 to 2012.[9]

Newborn symptoms of withdrawal measured using a scoring system such as the Modified Finnegan Neonatal Abstinence Scoring tool include neurologic signs such as irritability; inconsolable crying and seizures; gastrointestinal disturbances of vomiting, diarrhea, and poor feeding; and autonomic concerns of fever and mottling.[10]

Treatment for the infant depends on the type of drugs taken by the mother, the newborn's overall health, and whether the newborn was born at full term or prematurely. Depending on the type of opioid exposure, withdrawal can occur during the first day to three days after birth, and sometimes even up to five to seven days after birth, with an average onset of 48 hours.[10]

Pennsylvania Patient Safety Authority analysts performed a query of the Pennsylvania Patient Safety Reporting System (PA-PSRS) to identify event reports involving NAS and found an increasing number of events from January 2005 through December 2014. Healthcare professionals report using a standardized scoring process, combinations of pharmacologic and nonpharmacologic interventions, and close care team collaboration to aid in the diagnosis and treatment of newborns with NAS.

METHODS

Analysts queried the PA-PSRS database for reports of events that occurred from January 2005 through December 2014 using keywords including but not limited to "neonatal abstinence," "NAS," "Finnegan," "drug dependent," "withdrawal," "opioid," and "oxycodone." Analysts manually reviewed the resulting set of event reports to identify those reports with event narratives that described NAS events.

Additionally, during review of event narratives, analysts determined whether licit or illicit drug use was reported by the mother. Analysts then sorted the resulting data set into the categories of (1) methadone, (2) buprenorphine, (3) other prescription opioids, (4) benzodiazepines, and (5) illicit substances.

RESULTS

Analysts identified 797 NAS events (Figure 1). All of the identified events were submitted in the event type category of "complication of procedure/treatment/test" and the subcategory of "neonatal complication." The majority of the NAS events (n = 602, 75.5%)

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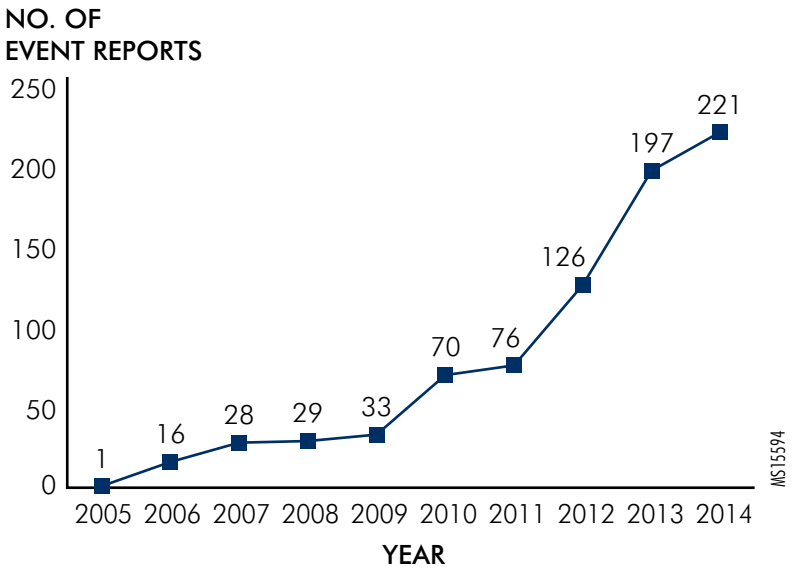
Figure 1. Number of Neonatal Abstinence Syndrome Events Reported to the Pennsylvania Patient Safety Authority, 2005 through 2014



involved newborns who had an unplanned transfer to the NICU. The remainder of the events (n = 195, 24.5%) were listed under "other."

Types of Drugs

Specific drugs were mentioned in 289 reports, with 68% describing drugs used to treat opioid dependence (i.e., methadone and buprenorphine) (Figure 2).

Types of NAS Events

The following are examples of events reported to the Authority involving NAS:*

> *Infant delivered by C-section. Infant showed signs of possible drug withdrawal. Finnegan score observed over initial period and was noted to be increasing. Infant was observed by physician and was transferred to NICU. Mother denied any drug use.*

> *Mother positive for oxycodone and other drugs. Infant showed signs of withdrawal with Finnegan scores of 10 and 14. Transferred to NICU for further evaluation and possible treatment.*

> *Baby girl was being scored for withdrawal from methadone and benzodiazepines. She had increased Finnegan scores multiple times in a row. Physician from the NICU was called and came to evaluate her. Infant was transferred to NICU to be started on morphine. Physician spoke with parents, and infant was taken to NICU.*

> *Infant delivered by a mother with a history of marijuana, cocaine, and Percocet use during the pregnancy. Initial NAS score was low; however, as time progressed, NAS score increased to 16. The infant was very fussy and jittery. Decision was made to transfer to a higher level of care.*

> *Change in infant status. High-pitched cry and severe tremors. Providers assessed infant. Infant NAS scored at 16. Parents deny all drug use. Infant transferred to NICU.*

> *NAS scoring was done on the night shift with [resulting scores of] 9 and 12; in the morning also 12. Symptoms included excoriation, excessive yawning, sneezing, and sucking with increased tone. A neonatologist was notified, and the patient was transferred to NICU.*

* The details of the PA-PSRS event narratives in this article have been modified to preserve confidentiality.

DISCUSSION

Helping newborns through the difficult time of withdrawal requires a series of observations over a period of time for correct diagnosis and collaboration of all healthcare professionals who contribute to treatment, including pharmacologic and nonpharmacologic interventions.[1-3] Families also play a key role in learning how to interact with their newborn, whose symptoms may include irritability, inconsolable crying, vomiting, and poor feeding.[2,3,10,11]

Dramatic increases in US addiction rates spurred the recent passage of a bill calling for information about NAS and opioid dependency in women. See "Addiction Surges in the United States" and "Protecting Our Infants Act" for more information.

Multidisciplinary Approach

The healthcare team. Treating the newborn with NAS requires a team approach using family-centered care, according to John Chuo, MD, MS, neonatal quality officer and medical director of telemedicine at the Children's Hospital of Philadelphia.[3] "The care team has the opportunity to set the attitude and tone towards the mom, being empathetic and non-accusatory," he said.[3] Management can include pharmacologic treatments, such as using a morphine wean, and nonpharmacologic treatments, such as encouraging breastfeeding, swaddling, and skin-to-skin contact, Chuo said.[3]

The neonatologist relies on information assessed by the nursing staff to determine the type and dose of pharmacologic

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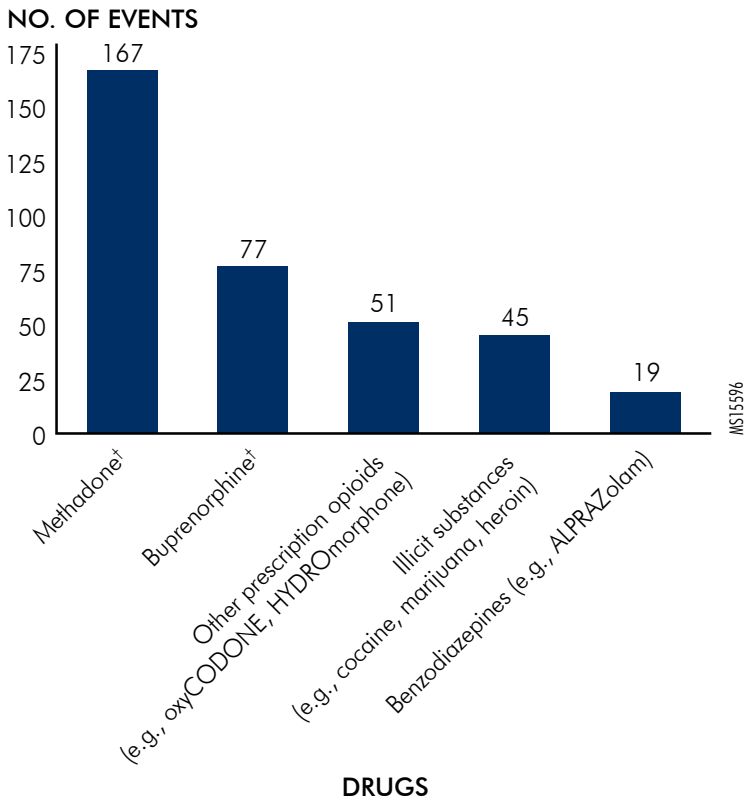
Figure 2. Maternal Use of Prescription and Illicit Drugs* as Described in Neonatal Abstinence Syndrome Events Reported to the Pennsylvania Patient Safety Authority, 2005 through 2014



*** Two hundred and eighty-nine events described specific drugs. More than one drug was identified in 50 events.**
† Used in the treatment of opioid dependence.

intervention. "Adjusting medication dosages often requires a discussion amongst the care providers, including physicians, nurses, and pharmacologists, especially when the baby's Finnegan scores are borderline," he said.[3]

Assessing and treating newborns with NAS is "definitely a multidisciplinary approach," according to Scott Wexelblatt, MD, regional medical director for newborn services, Cincinnati Children's Hospital Medical Center, who has conducted studies on NAS.[2]

"Nurses are key in this process," Wexelblatt said. "These babies are at higher risk for weight loss, so we also work with the nutrition department. We often need to involve social services because the moms have extra needs. We also use volunteers who swaddle and hold the babies. And then we need to have follow-up with these babies. We send them to the high-risk [follow-up] clinic, and we need to hand them off to their pediatrician for monitoring."[2]

Nursing's role. The healthcare team of physicians, nurses, social workers, and dietitians coordinate the care of the newborn with NAS. Nursing's role is particularly vital in helping to send home a healthy and strong family unit, according to Bawn Maguire, MSN, RN, outreach coordinator and programmatic nurse specialist, Magee-Womens Hospital of the University of Pittsburgh Medical Center. "Nursing's role is more than taking a vital sign and changing a diaper," she said.[11] "They are helping these families to become stronger, and become a family. The nurse holds the power in her hands to help these families care for the baby, see the baby, and understand the baby. The true treatment is the time the mom starts to care for her baby. The stronger nursing can make the unit, the healthier the family. That's what this is all about."[11]

Finnegan Scoring System

Tools available for quantifying the severity of neonatal withdrawal include the Lipsitz tool, the Neonatal Withdrawal Inventory, the Neonatal Narcotic Withdrawal Index, and the Finnegan Neonatal Abstinence Scoring System.[10] The Finnegan scoring system is the most commonly used NAS assessment tool in the United States.[1,10] A version of the Modified Finnegan Neonatal Abstinence Scoring tool can be accessed at http://www.lkpz.nl/docs/lkpz_pdf_1310485469.pdf.

The Finnegan scoring system is used to score symptoms over time and can be used to initiate, wean, or escalate pharmacologic treatment. The nurse scores the newborn throughout the course of the hospital stay, assigning a predetermined number of points for specific symptoms of gastrointestinal, metabolic, vasomotor, respiratory, and central nervous system disturbances.[10]

The first abstinence score is recorded approximately two hours after birth or upon admission to the nursery for a baseline score. Following the baseline score, newborns are scored at four-hour intervals. Depending on the results, the frequency of scoring can be increased to every two hours.[12] If the combined score is greater than or equal to 8 on any three

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ADDICTION SURGES IN THE UNITED STATES

Addiction has surged over the past decade and is closely related to the nation's ongoing prescription drug epidemic.[1-3] Following are findings that illustrate the increases in opioid and heroin usage and addiction:

- The number of prescriptions for opioids such as hydrocodone and oxycodone increased from about 76 million in 1991 to nearly 207 million in 2013.[2]
- In 2013, an estimated 517,000 people reported past-year heroin abuse or dependence, a nearly 150% increase since 2007.[1]
- About 75% of new heroin users first became addicted to prescription opioids.[1]
- Heroin use is reaching new populations, including women and middle-class users.[1]
- Heroin overdose death rates nearly quadrupled in the United States from 2002 to 2013.[1]
- Factors that may have contributed to the rise include the following:[1,4]
  - Dramatic increases in the number of pain management prescriptions written and dispensed (usually for chronic pain)
  - Greater social acceptance for using medications for pain management
  - Aggressive marketing campaigns by pharmaceutical companies

Notes

1 Jones CM, Logan J, Gladden RM, et al. Vital signs: demographic and substance use trends among heroin users, United States, 2002–2013. *MMWR Morb Mortal Wkly Rep* 2015 Jul 10;64(26):719-25.

2 Volkow ND. America's addiction to opioids: heroin and prescription drug abuse [online]. Senate Caucus on International Narcotics Control. 2014 May 14 [cited 2015 Aug 14]. http://www.drugabuse.gov/about-nida/legislative-activities/testimony-to-congress/2014/americas-addiction-to-opioids-heroin-prescription-drug-abuse

3 Warren MD, Miller AM, Traylor J, et al. Implementation of a statewide surveillance system for neonatal abstinence syndrome—Tennessee, 2013. *MMWR Morb Mortal Wkly Rep* 2015 Feb 13;64(5):125-8.

4 Calabresi M. Why America can't kick its painkiller problem. *Time* 2015 Jul 15;185(22):26-33.

consecutive ratings, the average of two scores is greater than or equal to 12, or the scores for two consecutive ratings are greater than or equal to 12, the newborn is assessed for pharmacologic treatment.[12]

Standardizing scoring methods. Neonatal Services, a joint venture between Nationwide Children's Hospital and five maternity hospitals in central Ohio, found that excessive variability in the scores recorded by the neonatal nurses complicated the management of newborns with NAS.[13]

The Finnegan scoring method should be objective rather than subjective, Wexelblatt said. "The nurses are all trained to do the Finnegan scoring system, and we rely on those scores to initiate treatment, wean treatment, or escalate treatment."[2]

Neonatal Services initiated a "train the trainer" program in which a nursing expert used an instructional video for key nurses to ensure they received specific training on how to best evaluate NAS symptoms. These "super users" then trained the rest of the nursing staff with video instruction, two practice exams, and an instruction manual with proper scoring definitions.[13]

Neonatal Services reduced its length of stay for newborns with NAS from 36 days to 18 days by training in the assessment of NAS symptoms using the Finnegan scoring system along with a standardized pharmacologic protocol.[13]

Pharmacologic Approaches

Drug therapy is indicated for moderate to severe NAS to ease the withdrawal process and prevent complications such as weight loss and seizures; however, unnecessary use of drugs could prolong withdrawal and the duration of hospitalization.[1] There are currently no uniformly accepted pharmacologic interventions or standardized treatments for NAS management.[1]

Most treatment strategies include gradual weaning of a single opioid.[14] Typically, clinicians use morphine or methadone as the first drug of choice.[14] A sedative, such as phenobarbital or clonidine, may be added as an additional medication when opioid treatment alone is ineffective.[14]

Standardized treatment. A multicenter cohort study of treatments and hospital outcomes in Ohio concluded that regardless of the initial opioid used in treatment of newborns with NAS, use of a standard treatment protocol with stringent weaning guidelines significantly reduced duration of pharmacologic intervention (17.7 versus 32.1 days, $P < .0001$) and length of stay (22.7 versus 32.1 days, $P = .004$).[14]

Nonpharmacologic Bundle

Nursing manages the nonpharmacologic bundle at Cincinnati Children's Hospital Medical Center and works with mothers and other family members, Wexelblatt said. "We rely on nurses for swaddling, decreasing stimulation, providing parental education, and helping the babies with their feedings," he said.[2]

"Learning how to feed the baby appropriately is essential since they have an uncoordinated suck," he said. "Knowing how to soothe the baby is very important.

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PROTECTING OUR INFANTS ACT

In November 2015, the president signed a bill requiring the Agency for Healthcare Research and Quality to report on prenatal opioid abuse and neonatal abstinence syndrome. The bill calls for examination of relevant literature, causes and treatment, and barriers to care for pregnant women to help develop recommendations for preventing, identifying, and treating opioid dependency.

The act can be accessed at https://www.congress.gov/bill/114th-congress/senate-bill/799.

We help the family learn the soothing techniques that will help their individual baby and help the family manage the stress of a baby that is going to cry more than a typical baby."[2]

Other nonpharmacologic interventions can include a quiet environment, with dim lighting and soft music, according to Maguire.[11] "We do a lot of comfort measures," she said. "We like the baby to be held a lot. These babies enjoy being rocked and enjoy low humming. They also do not like a lot of eye contact."

Breastfeeding support. The literature recommends breastfeeding for mothers who are part of a drug treatment program.[1] Breastfeeding is contraindicated if the mother is taking illicit drugs, abusing multiple drugs, or infected with HIV.[1] Multiple studies have confirmed that breast milk contains only minimal quantities of drugs used in the maintenance programs for drug-dependent women.[1] Breastfeeding increases bonding between the mother and newborn, enhances maternal confidence, and helps mothers feel involved in treating the newborn for withdrawal.[15]

"About half of our moms breastfeed," Maguire said. "And many of our moms are successful."

Other methods. A "cuddler" program in Phoenixville Hospital helps families who cannot always be with their newborns in the NICU,[16] according to Jayne Clemens, RN-C, NICU staff nurse. "If the parents are not available, we have volunteers who hold the babies," she said. Volunteers can include high school or college students or retired adults.[16]

Other methods used at Phoenixville Hospital to soothe the newborns include placing the newborn in a quiet and dark room that has the least amount of stimulation, Clemens said. "For some newborns, soothing music is helpful, but it depends on the baby," she said.[16]

Compassionate Treatment

Mothers may feel guilty that their baby is requiring treatment, and they may also feel that they are being judged by the staff doctors, nurses, therapists, and social workers. "We have been working on trying to improve the nonjudgmental care for these moms," Wexelblatt said.[2]

Substance abuse is a medical condition, Maguire said.[11] "We don't judge people with chronic diseases such as diabetes and hypertension," she said. "This is another medical condition. We remind the nurse that these women love these babies as any woman would love her baby."

Role models. Through role modeling and training, Maguire helps nurses look beyond judging the addicted mom.[11] Magee Womens Hospital has been treating mothers with substance abuse for about 13 years and has seen a 10-fold increase in NAS over the last 12 years.[11]

"In the ideal world, a mom's heart is so overflowing with love for her baby," Maguire said. "There are a lot of moms with substance abuse who have felt unloved for so long. Their cup is empty, and they don't have a lot to give to their babies. They are looking to their baby as a source of love for them," she said. "But their baby cannot provide this because of the physical process of going through withdrawal." Nurses work with mothers to help them understand the transient nature of withdrawal, Maguire said.[11]

The nurses learn to speak frankly with a mom who is already feeling guilty that her newborn is going through withdrawal, Maguire said. "This is quite a fragile time with moms. If we allow the guilt to fester, it doesn't do the mom any good."[11]

"We tell the moms that the bottom line is you can't change the past," she said. "You can learn from the past but cannot dwell on this. You have got to keep moving forward. Your baby only knows the future, and you will continue to grow with your baby."[11]

CONCLUSION

NAS is a growing problem in Pennsylvania and throughout the United States as use of prescribed and illicit drugs by pregnant women continues to escalate.[1,17] Effective use of a standardized method of NAS assessment (such as the Finnegan scoring system), medications, and a combination of nonpharmacologic interventions tailored to the newborn's individual needs are suggested to help newborns through the difficult time of drug withdrawal.[2,3] Nonjudgmental and compassionate care by all healthcare workers versed in the management of maternal substance abuse and NAS is recommended.[11]

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NOTES

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(See the following page for self-assessment questions.)

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LEARNING OBJECTIVES

- Identify the symptoms of neonatal abstinence syndrome (NAS).
- Recall the most commonly used NAS assessment tool.
- Recognize pharmacologic and nonpharmacologic interventions for newborns exhibiting NAS.
- Assess family interventions and techniques to help parents care for their newborn with NAS.

SELF-ASSESSMENT QUESTIONS

The following questions about this article may be useful for internal education an assessment. You may use the following examples or come up with your own questions.

1. The following are symptoms of the newborn exhibiting NAS *except*:
   a. High-pitched crying
   b. Increased appetite
   c. Sleep problems
   d. Seizures
2. Which of the following is the most commonly used NAS assessment tool?
   a. The Finnegan Neonatal Abstinence Scoring System
   b. The Neonatal Withdrawal Inventory
   c. The Neonatal Narcotic Withdrawal Index
   d. The Lipsitz tool
3. Which is the first drug class of choice typically used in NAS management?
   a. Benzodiazepines
   b. Barbiturates
   c. Anticholinergics
   d. Opioids
4. According to Kocherlakota, breastfeeding newborns who exhibit NAS is *not* recommended if the mother:
   a. Uses buprenorphine
   b. Participates in a treatment program
   c. Is HIV-positive
   d. Uses methadone
5. Which of the following nonpharmacologic interventions is helpful for newborns exhibiting NAS?
   a. Bright lights
   b. Soothing music
   c. Vigorous rocking
   d. Decreased room temperature

Question 6 refers to the following scenario:

Within a day of birth, a newborn exhibits high-pitched crying, severe tremors, and other signs of drug withdrawal. A scoring system is used to observe the newborn, and the score is increasing. When approached, the parents of the newborn deny maternal drug use.

6. Which of the following represents the best scenario and outcome:
   a. Tell the mother you believe she was taking opioids during her pregnancy and you will be notifying social services.
   b. Transfer the newborn to the neonatal intensive care unit before involving the parents.
   c. Meet with the parents, explain what is happening to their newborn, and determine a treatment plan.
   d. Keep the newborn in the nursery and have the nursing staff administer treatment.

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Patient Flow in the Emergency Department: Phase III—after Disposition Decision through Departure

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ABSTRACT

In 2013, Pennsylvania hospitals reported 23,749 events to the Pennsylvania Patient Safety Authority in which the emergency department (ED) was selected as the care area. Of these reports, 540 (2.3%) involved patients undergoing care in the time between disposition decision through departure from the ED (i.e., phase III); reported consequences ranged from no-harm events requiring monitoring to events resulting in harm or even death. Several components of this phase have potential safety hazards. Two hundred and thirty-nine events (44.3% of the 540 ED phase III events) involved monitoring the patient until an inpatient bed was available or until the patient was discharged or transferred, and 199 events (36.9%) were gaps in care unrecognized by ED personnel (i.e., identified by another caregiver or department). This article, the third in a series that addresses patient safety related to ED flow, focuses on strategies to improve processes of care and patient safety during ED phase III. (Pa Patient Saf Advis 2015 Dec;12[4]:132-40.)

Scan this code with your mobile device's QR reader to access the Authority's toolkit on this topic.

INTRODUCTION

For emergency department (ED) patients, the time between disposition decision and departure from the ED (i.e., phase III) often comprises waiting for discharge instructions or completed inpatient orders, transportation to another facility, or transfer to the next level of care (e.g., inpatient bed, procedural area). Most evaluations have been completed, emergent care has been provided, and disposition decisions have been made, and patients wait for that decision to be acted on. For caregivers, the primary function in phase III is to care for and monitor the patient until departure from the ED by way of discharge, transfer, or admission.

In 2010, the Pennsylvania Patient Safety Authority published an article that delineated the patient's ED stay into the following phases:[1]

- Phase I: patient arrival in the ED up to diagnostic evaluation
- Phase II: diagnostic evaluation through disposition decision
- Phase III: after disposition decision through departure from the ED

Figure 1 depicts each phase, including components and potential hazards to patient safety. The components of phase III are as follows:

- Monitoring of the patient until a bed is available or until the patient is discharged or transferred
- Communication or handoffs to the next facility, unit, or caregiver
- The discharge process, including patient teaching
- Transportation or transfer

Potential patient safety hazards during phase III include the following:

- Gaps in treatment responsibility and oversight
- Unmonitored patients, including patients who have inpatient bed assignments and are awaiting transfer; patients whose ED care is complete and who are waiting for inpatient orders, discharge, or transfer; and admitted patients who are boarders waiting in the ED for an undetermined length of time
- Rushed, incomplete, or inaccurate patient assignments
- Poor communication and handoffs
- Incomplete or no patient and family education
- Transportation and transfer difficulties

The March 2015 *Pennsylvania Patient Safety Advisory* article on phase II describes the components, potential patient safety hazards, risk reduction strategies, and best practices specific to the time from diagnostic testing through disposition decision.[2] This article addresses phase III of the ED flow experience and discusses risk reduction strategies and best practices.

METHODS

Analysts queried the Authority's Pennsylvania Patient Safety Reporting System (PA-PSRS) database for reports submitted during calendar year 2013 that identified the ED as the care area; facilities reported 23,749 such events. An illustration of the data analysis methodology, "Emergency Department (ED) Flow Phase III Methodology Algorithm," is available exclusively in the online version of this article at http://patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2015/Dec;12(4)/Pages/132.aspx.

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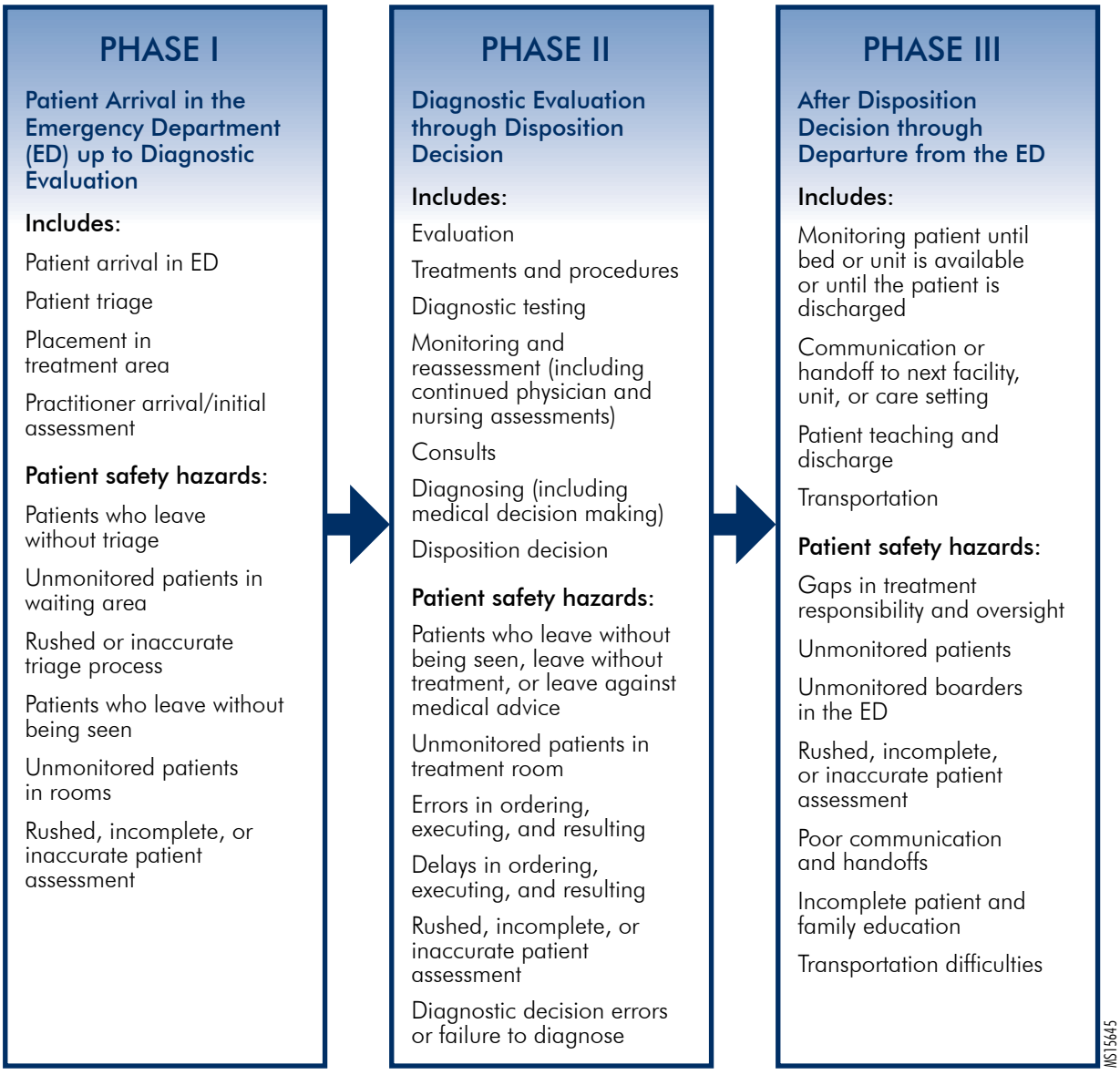
Figure 1. Emergency Department Flow Phases



Analysts expanded the data analysis performed for the phase II article and identified events associated with phase III by means of relevant keywords (e.g., "discharge," "dispo," "inpatient," "admit") in the narratives, resulting in 2,784 reports.

PA-PSRS uses an adaptation of the National Coordinating Council for Medication Error Reporting and Prevention harm index and the US Department of Veterans Affairs National Center for Patient Safety severity assessment code system to distinguish between harm and no-harm events.[3,4] The analysts excluded 2,164 of the 2,784 reports from the analysis because they were submitted as unsafe conditions or no-harm events (i.e., harm scores of A through C). Analysts retained for analysis the remaining 620 reports submitted as no-harm events

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requiring monitoring (i.e., harm score D) or as events resulting in harm or even death (i.e., harm scores E through I) and also included 221 phase III reports meeting the same harm criteria identified during the previous phase II analysis. Through individual analysis of the resulting 841 phase III events, analysts excluded remaining non-ED (n = 199), phase I (n = 3), and phase II (n = 99) reports, leaving 540 reports in the final data set.

Analysts conducted a review of the literature to identify risk reduction strategies and best practices for the management of the phase III components.

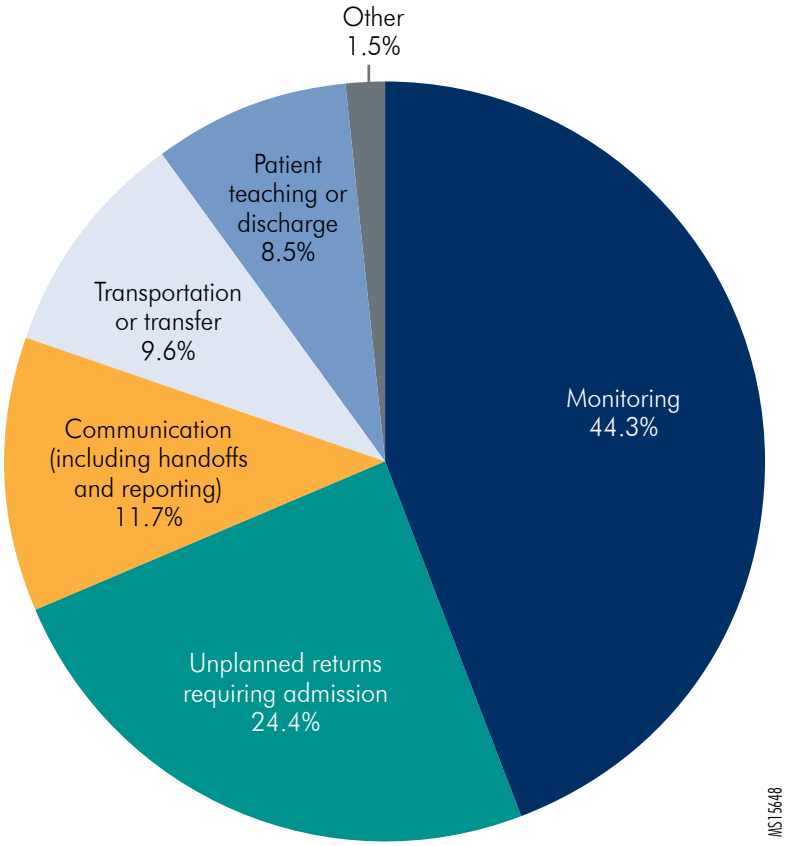
RESULTS

Analysts reviewed the 540 phase III event narratives and categorized the reports into one of the following components: monitoring, communication (including handoffs and reporting), patient teaching or discharge, transportation or transfer, unplanned returns requiring admission, or other. See Figure 2.

Once sorted by component, analysts reviewed the narratives and identified the following four types of key vulnerabilities (see also Figure 3):

1. Gaps unrecognized by ED personnel: events discovered by non-ED personnel (e.g., radiology personnel) or discovered after the patient left the ED
2. Delays: delays in care, treatment, or services
3. Insufficient oversight: events involving unclear oversight or lack of oversight responsibility
4. Lack of prompt transition: patients who were admitted but remained in the ED as "boarders"

Figure 2. Percentage of Emergency Department Flow Phase III Event Reports, by Component, Submitted to the Pennsylvania Patient Safety Authority in Calendar Year 2013 (N = 540)



Examples of Event Reports Related to ED Phase III Components

Monitoring. The predominant number of events reported in phase III involved monitoring (44.3%, n = 239) (e.g., falls, adverse reactions, complications), as depicted in the PA-PSRS event narratives below:*

> *An elderly patient with an extensive cardiac history was evaluated in the ED and was in the 302 process awaiting placement for behavioral health. Suddenly, the patient had a cardiac arrest, which was witnessed by staff; [patient was] resuscitated and admitted to the hospital.*

> *Patient was sitting up in the chair awaiting transport back to nursing home. RN [registered nurse] near the room heard a thump and found the patient lying against the wall complaining of left arm pain.*

The majority of events involving monitoring were unrecognized by ED personnel (53.1%, n = 127 of 239); for example:

> *A medication was ordered to be started in the ED prior to admission to the inpatient unit. The [attending] physician discovered that the treatment had not been started. Recommendation: admission orders need to be initiated when ordered regardless of the location of the patient.*

* The details of the PA-PSRS event narratives in this article have been modified to preserve confidentiality

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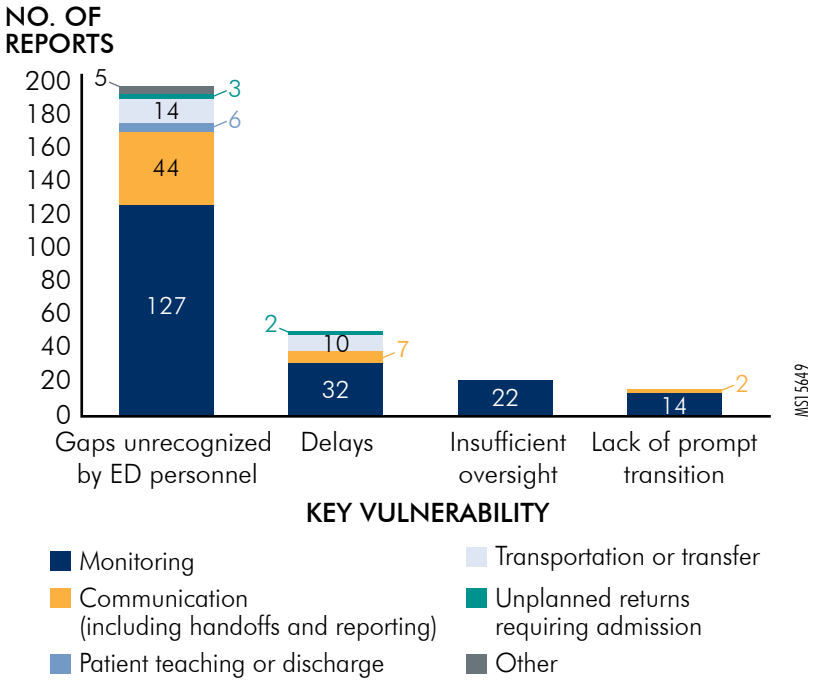
Figure 3. Number of Reports Mentioning Key Vulnerabilities Submitted to the Pennsylvania Patient Safety Authority in Calendar Year 2013 (N = 288), by Emergency Department (ED) Phase III Component



***Note*: Some reports did not specify vulnerabilities, and some identified more than one key vulnerability.**

> *The ED patient was admitted for nausea, vomiting, and abdominal pain and has a history significant for abdominal surgery. The patient was showing significant symptomatology and was ordered an x-ray and CAT [computerized axial tomography] scan. The patient was transported to the inpatient unit prior to having the imaging studies completed; this led to a multi-hour delay in diagnosis and treatment.*

Communication or handoffs. These events (e.g., inaccurate or inadequate medication reconciliation, inadequate reporting) represented 11.7% (n = 63) of the phase III reports; for example:

> *The patient reported that the ED medication list was not correct, as it contained medications that the patient was no longer taking. A family member stated they gave the ED a current medication list that was never sent to the unit with the patient.*
>
> *There was a delay in transferring the patient to the inpatient unit. There was confusion about the admission orders, and poor communication led to a delay in medication administration. The medication was administered once the error was discovered.*

The majority of events involving communication and handoffs were unrecognized by ED personnel (69.8%, n = 44 of 63); for example:

> *The receiving [inpatient] nurse was unaware that an SBAR [situation, background, assessment, and recommendation] was entered by the ED nurse. The patient arrived to the unit with a cardiac drip infusing. Because the admitting unit was not equipped to take patients on cardiac drips, the patient had to be transferred to a higher level of care.*
>
> *ED staff brought the patient to the inpatient unit but did not notify the unit staff. The siderails were left down, and the patient was not connected to the telemetry pack.*

Patient teaching or discharge. These events (e.g., inability to use devices, inadequate discharge instructions, omissions) represented 8.5% (n = 46) of the phase III reports; for example:

> *The patient was instructed [on the use of] crutches prior to disposition. The patient attempted to walk with crutches and fell and is [now] unable to bear weight on foot.*
>
> *The patient was treated with IV [intravenous] fluids and medication and was discharged. The [discharge] instructions indicated that the cause of the pain and elevated [white blood cell] count is uncertain, but there is no evidence of an acute surgical problem. The family complained about the [discharge instructions] because the only information communicated to them was via a handwritten note that did not [contain actual results].*

Patient and family teaching events were unrecognized by ED personnel 13.0% (n = 6 of 46) of the time, as represented below:

> *The patient was given the wrong prescription [upon discharge]. The pharmacy noticed the wrong name on the prescription and called the ED. The patient came back and [was given the correct prescription].*

Transportation or transfer. These events (e.g., falls, skin integrity issues,

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complications) represented 9.6% (n = 52) of the phase III reports; for example:

> *A patient was being transported out of the ED by ambulance attendants. The stretcher tilted over; the patient was strapped to the stretcher and sustained an injury to the arm and shoulder. The patient was brought back into the ED for treatment of abrasions. No other injuries noted. The patient was discharged.*

> *Following discharge from ED, the patient became [light-headed] while using the restroom in the waiting area, fell, and hit his head on the [sink].*

Transportation/transfer events were unrecognized by ED personnel 26.9% (n = 14 of 52) of the time, as represented below:

> *The patient was admitted with a [respiratory diagnosis] and was transported to CAT scan and ultrasound prior to being transported to the unit. The patient was to be on oxygen continuously but was transported without it. On arrival to the floor, [the patient's] oxygen saturation was in the 70s, [his] heart rate was tachycardic, and [he] was complaining of chest [tightness]. Oxygen was immediately applied and [he] received an EKG [electrocardiogram], lab work, and breathing treatment. [He] responded to treatment within a half hour.*

Unplanned returns requiring admission. These events (e.g., errors or complications related to procedures, treatments, or tests) represented 24.4% (n = 132) of the phase III reports; for example:

> *A [pediatric] patient was seen in the ED for nausea and vomiting and decreased urine output. The patient was discharged with a [gastrointestinal infection] diagnosis and given a prescription. The parents brought the patient back with worsening symptoms, and [the patient] was admitted.*

> *A patient was seen and discharged from the ED because teleradiology [verbally] reported that the ultrasound was negative. The written ultrasound report was positive for [thrombosis], and the patient was called back and admitted.*

Events of unplanned ED returns requiring admission were unrecognized by ED personnel 2.3% (n = 3 of 132) of the time, as seen in the example below:

> *The [ED patient's] initial CAT scan was read as negative by the [teleradiology service]. Several hours later, the [teleradiology service] called the ED to report that the CAT scan was positive. The patient was called back and admitted.*

Other. These events represented 1.5% (n = 8) of the phase III reports. As stated previously, these events did not meet the criteria for classification into any of the phase III components and were analyzed separately.

Examples of Event Reports Related to Key Vulnerabilities

There were 288 instances in which a key vulnerability was mentioned in the 540 ED flow phase III event report details. Some reports did not specify vulnerabilities, and some identified more than one key vulnerability.

Gaps unrecognized by ED personnel. This vulnerability was identified in 36.9% (n = 199) of the phase III reports. An example is as follows:

> *The ED patient was ordered [normal saline solution] at [100mL/hr]. Upon arrival to the inpatient unit the admitting nurse found [5% dextrose in water solution infusing at 100mL/hr].*

Delays. This vulnerability was identified in 9.4% (n = 51) of the phase III reports; for example:

> *There was a delay in transferring the [ED] patient to the inpatient unit due to [lack of bed] availability. There was a delay in medication administration due to confusion and poor communication.*

Insufficient oversight. This vulnerability was identified in 4.1% (n = 22) of the phase III reports; for example:

> *A [mental health] patient with [several] medical conditions was awaiting placement for [72 hours]. Psychiatric services did not provide care while the patient was in the ED.*

Lack of prompt transition. This vulnerability was identified in 3.0% (n = 16) of the phase III reports; for example:

> *A [psych] patient was in the ED for [48] hrs and did not receive [his] psych meds. The patient began acting out, which required [interventions]; the lack of prescribed medications may have [contributed to this behavior].*

DISCUSSION: IMPROVING FLOW AND PATIENT SAFETY

Monitoring/Rounding

Patients waiting to depart from the ED via discharge, transfer, or admission remain in the care of ED staff until the patient's departure. Routine monitoring (observing) of patients is a basic nursing intervention and can help prevent untoward events (e.g., falls).[5] Hourly *intentional* rounding promotes safety, comfort, and patient satisfaction.[5, 6] There are specific rounding elements to address with ED patients: pain management, plan of care, duration (i.e., length of stay), and expectation management.[6-9]

Toolkits, protocols, and policies are available for improving patient monitoring.[2,5,10] Hourly rounding has been associated with increased patient satisfaction and decreased number of falls with significant injury, call light use, and number of patients leaving the ED without being treated or against medical advice.[5,6,8,11] As a proactive intervention, hourly rounding

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enables nurses to anticipate and assess for safety hazards and patients' needs.[5]

Communication and Handoff

Patient handoffs are variable.[12-16] The handoff is not merely about communicating information from one caregiver to another but also involves transfer of care and responsibility for the patient.[12,14,15] Studies suggest that the handoff process is highly complex and may be optimized by standardization.[12,13,16]

One standardized method of communication that can be used to enhance handoffs is situation, background, assessment, and recommendation (SBAR). SBAR uses a predictable pattern of communication that allows for the recognition of missing information.[13] Practicing and evaluating the use of standardized methods of handoff communication can enhance patient safety.[13,16]

Transfer and Admission

Interfacility transfers. The Emergency Nurses Association's position statement on interfacility transfers recommends that transport teams have specialized training, patients be rapidly transferred with certain provisions, and patient safety and level of care be maintained.[17] The handoff communication strategies are of import and applicable to successful transfers, whether for transporting a patient back to a skilled nursing facility or to another facility for definitive care.[13,15,16]

Sethi and Subramanian, in their review of the literature, identified practice guidelines that promote "pre-transport coordination and communication, qualified and trained accompanying personnel, appropriate transport equipment, standard monitoring and documentation as key elements of a safe transfer."[18] Before transfer, the patient should be stabilized to the extent possible by the transferring facility.[18,19]

Admission processes. Once the decision to admit has been made, efficient processes can expedite the transfer of the patient to the inpatient unit.[20] Use of an admission consultant response time guideline was successful in reducing the time between disposition decision and inpatient departure from the ED.[21]

Studies have shown that high hospital inpatient occupancy impedes ED flow and affects inpatient occupancy of the ED, leading to prolonged ED stays and boarding.[20,22,23] One simulation study revealed that a hospital inpatient occupancy rate below 85% lowers the risk of hospital bed shortage, enabling the ED inpatient demands to be met.[24]

Efforts to improve inpatient bed flow include early alert systems for hospital-wide awareness of reduced bed availability, admission guidelines, daily bed huddles, early rounding practices, early discharge practices, and discharge lounges for inpatients waiting to be discharged.[20,22,23] Overcrowding calculators, such as the Emergency Department Work Index and the National Emergency Department Overcrowding Scale, are useful early warning systems.[25]

Improvements can be seen when hospitalists are involved in the admission process. Specifically, when management of ED admissions, department of medicine resources, and hospital bed occupancy is directed by a hospitalist, ED throughput and ambulance diversions are improved.[26,27]

Discharge Process and Patient/Family Teaching

Discharge planning and ensuring a safe transition to the home or community is a fundamental element of emergency care.[28] The Agency for Healthcare Research and Quality (AHRQ), in its 2014 report on improving the ED discharge process, identified three primary functions of the ED discharge process: "communicate with/educate patients," "support post-ED discharge care," and "coordinate care with other providers and services."[29] See "Characteristics of a High-Quality ED Discharge."

There are multiple factors that contribute to a poor discharge, including limited literacy.[30,31] The ED can be a noisy, chaotic environment with distractions and interruptions. Patients are anxious to leave once their care is complete. All of these conditions affect comprehension.[30] According to Alberti and Nannini's literature review on patient comprehension of

CHARACTERISTICS OF A HIGH-QUALITY ED DISCHARGE

A high-quality emergency department (ED) discharge contains three main characteristics:

1. It informs and educates patients on their diagnosis, prognosis, treatment plan, and expected course of illness. This includes informing patients of the details of their visit (e.g., treatments, tests, procedures).
2. It supports patients in receiving post-ED discharge care. This might include medications, home care for injuries, use of medical devices/equipment, further diagnostic testing, and further healthcare provider evaluation.
3. It coordinates ED care within the context of the healthcare system (e.g., other healthcare providers, social services).

Source: Agency for Healthcare Research and Quality. Improving the emergency department discharge process: environmental scan report [online]. AHRQ Publication No. 14(15)-0067-EF. 2014 Oct [cited 2015 Jun 24]. http://www.ahrq.gov/professionals/systems/hospital/edenvironmentalscan/index.html

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ED discharge instructions, clinicians do not routinely assess patients' comprehension, and actual patient comprehension was limited in the studies that used only verbal and/or written instructions.[30] Many interventions are available to improve patient and family teaching, such as multimedia tools, illustrations, simple text, and discharge facilitation.[28-30] Studies recommend using the "teach-back" method to enhance patient comprehension.[10,31]

Sharing clinical information with post-ED care providers (e.g., primary care physicians) is essential for ensuring continuation of care and timely follow-up.[32,33] One study identified eight best practices for safe care transitions, including sending summary and clinical information to the primary care physician and to other "receiving physicians upon discharge or transfer."[32] Measuring and evaluating the ED discharge process can enhance patient safety.[29]

Boarders

According to the American College of Emergency Physicians (ACEP), a boarded patient is "a patient who remains in the emergency department after the patient has been admitted to the facility, but has not been transferred to an inpatient unit."[34] ED overcrowding, including days spent boarding, has been associated with increased inpatient mortality.[35] ACEP published a list of hospital recommendations regarding boarding of admitted and intensive care patients in the ED, and this list can be accessed at https://www.acep.org/Clinical--Practice-Management/Boarding-of-Admitted-and-Intensive-Care-Patients-in-the-Emergency-Department.[36]

There are advantages to reducing boarding. According to the ACEP, "By reducing patient boarding, treatment of patients in non-treatment areas such as hallways can be limited, and the number of patients leaving prior to evaluation or completion of medical treatment can be reduced."[37] One study duplicated the inpatient care delivery model in the ED for boarders, including dedicated equipment and supplies, resulting in increased patient and staff satisfaction.[38] The Emergency Nurses Association supports a systems approach to improving patient flow.[39]

For psychiatric patients, the Illinois Hospital Association recommends specially trained staff and dedicated space providing specific areas in the ED or alternative locations in which the patient can remain for crisis stabilization. These areas should ensure privacy, comfort, and safety; be soothing and supportive; promote healing; and help deescalate agitated or psychotic patients.[40]

Gaps Unrecognized by ED Personnel

A large portion of the phase III events were unrecognized by ED personnel (i.e., were identified and reported by another caregiver or department). This data can provide valuable information when analyzed and considered for incorporation into the ED's performance improvement program.

An AHRQ study demonstrated that the diagnoses made in the ED differed from those made at the time of hospital discharge 10% of the time. The study evaluated an automated system for feedback to emergency medicine physicians about the concordance between their initial diagnoses and patients' final diagnostic outcomes and concluded that "timely followup is feasible in the ambulatory setting and may catch issues at an earlier stage."[41]

PATIENT FLOW BEST PRACTICES

Return Visits and Postdischarge Follow-Up

Once the patient is discharged from the ED, diagnostic test results may come back positive or with a discrepancy. Patients may leave the ED without their discharge instructions and prescriptions. These issues can contribute to patients returning to the ED for continued care or admission, as depicted in some PA-PSRS event narratives. Return visits to the ED can be considered a discharge failure or an indicator of poor initial care and may negatively affect patient safety, satisfaction, and care.[29,42,43]

Care coordination with ambulatory providers could reduce unplanned ED returns, but in their systematic review of the literature, Katz et al. found that ED care coordination interventions had variable effectiveness.[44] Having dedicated staff may address these issues.[45,46] One study showed a 17% improvement in completing follow-up cases within three days and an 80% reduction of follow-up cases delayed by more than seven days, attributable to the follow-up program.[45] One study identified system improvements when analyzing data on patients who returned to the ED, including improving physician-to-patient communication, acute pain control, and availability of community resources to vulnerable populations such as the elderly.[42]

In an interview, Lindsay Lion, BSN, RN, CEN, senior nurse navigator in the ED at Nazareth Hospital, described this new role as one of partnership with the older adults seeking emergency care.[47] The navigator calls patients who have been discharged from the ED to ensure they understand the importance of and know how to prioritize their discharge instructions, including follow-up appointments and filling prescriptions. Additionally, the navigator educates patients about medical problems, answers questions, offers emotional support, and connects patients with resources such as transportation and support groups.

Another study speculated that lack of a primary care physician contributed to a high ED return visit rate; however, the study identified that patients who returned to the ED within 30 days of an initial visit may have contacted their primary care physician before returning, and many were insured patients with a primary care physician who were able to see them that same day.[43] Ms. Lion also

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communicates with the patients' primary care physician to foster enhanced care coordination.[47] Early success is shown by increased Hospital Consumer Assessment of Healthcare Providers and Systems survey scores on the statement, "Staff cared about you as a person."[47]

Stony Brook University Hospital in Long Island, New York, has an enhanced ED follow-up program that uses dedicated nursing and clerical staff 7 days a week for 10 hours each day.[46] A computerized tracking board is used for chart reviews, clinical checks, test results, and callbacks. All nurse/patient interactions are documented in the electronic health record, and clerical staff fax information to the next provider of care. Service recovery, additional patient teaching, and improved communications with transitions in care are among the successful program outcomes.

LIMITATIONS

Data searched was limited to events reported under the ED care area; relevant reports for which an ED location was misclassified would not have been captured. Similarly, removing reports based on phase I and phase II keyword sorting at the beginning of the analysis may have eliminated some phase III reports. Relevant information is derived from the event type taxonomy and from free-text narratives in varying degree of detail, and in some cases, interpretation in context is made by the analysts.

CONCLUSION

Potential and actual safety hazards occur during phase III of the ED stay, from after disposition decision through departure. The monitoring component of this phase and gaps in care unrecognized by ED personnel were identified as vulnerabilities to patient safety. Analyzing and understanding all of the key components and vulnerabilities of this phase, employing risk reduction strategies and best practices in patient flow, and improving operations during phase III of ED flow and beyond can improve care delivery and coordination, minimize safety hazards, and directly contribute to the safety of patients in this phase of ED treatment.

ED discharge aftercare and care coordination are becoming ever more integral to the management of the ED patient, and it is essential that ED clinicians participate in the design and implementation of these processes. The Patient Protection and Affordable Care Act created a variety of incentives to promote care coordination, such as the patient-centered medical home model. Seamless communication and information sharing between the ED and the medical home (including primary physicians and after–ED care providers) is essential to process improvement, as well as education and support for patients once they return home.[33] The use of health information exchanges and patient portals may help form the structure for this direction.

NOTES

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Medication Errors Involving Overrides of Healthcare Technology

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ABSTRACT

Users can bypass many of the safety features incorporated in medication-use technologies that provide warnings about possible unsafe conditions or errors. Analysts reviewed medication error event reports that indicated the use of overrides submitted from January 2013 through December 2014 to the Pennsylvania Patient Safety Reporting System. Of the 583 event reports related to the use of overrides, the most commonly mentioned technology was automated dispensing cabinets (77.0%, n = 449), followed by computerized prescriber order entry (8.2%, n = 48) and bar-code medication administration devices (7.5%, n = 44). The most common classes of medications cited were antibiotics (12.0%, n = 70), opioids, (12.0%, n = 70), and anticoagulants (7.4%, n = 43); and 26.4% (n = 154) of the reports involved at least one high-alert medication. Organizations may consider developing criteria for alerts that focus on real chances of patient harm while preventing alert fatigue, minimizing the need for or use of overrides. (Pa Patient Saf Advis 2015 Dec;12[4]:141-8.)

INTRODUCTION

The use of technologies to prevent and detect medication errors has been increasing over the past decade. A stratified random sample survey of pharmacy directors at 1,435 general and children's hospitals in the United States found that the large majority (97.1%) of hospitals use automated dispensing cabinets (ADCs) in their medication distribution systems, 88.4% use bar-coded medication administration (BCMA) systems to verify patient identity and electronically check doses administered by nurses, 80.9% use computerized prescriber order entry (CPOE) systems, and 80.5% use smart infusion pumps (infusion pumps that incorporate medication safety software and can contain a comprehensive library of drugs, usual concentrations, dosing units [e.g., mcg/kg/min, units/hr], and dose limits [minimum/maximum] that can be set according to institution-established parameters[1]).[2]

Each of these healthcare technologies provide the capability to alert users to possible unsafe conditions or errors with the use of a medication. Many technologies can record the number and types of alerts presented to users, the alert overrides, and the user's stated explanation for overriding the alert (from a standard list or a free-text explanation). While technologies employed in the medication-use process can generate reports delineating overrides, these reports do not always capture all of the factors that led to the decision to override, or provide the result of an error in which an override played a role. Other systems, such as an organization's internal event reporting system, also can be used to help capture the factors contributing to an event.

Analysis of events reported through the Pennsylvania Patient Safety Reporting System (PA-PSRS) has identified medication errors which involve an override of healthcare technology. This analysis reviews reports submitted to the Pennsylvania Patient Safety Authority mentioning the use of overrides to delineate factors that led to overriding an alert and the results related to the use of an override.

METHODS

When reviewing events reported through PA-PSRS, Authority analysts can further classify reports using a tag for future query opportunities. Analysts queried the PA-PSRS database for events reported as medication errors to the Authority from January 2005 through December 2014 that had been tagged as events involving overrides. Analysts also queried the database using the keyword search terms "overri*," "overro*," "overid*," and "overo*," where the asterisk represents a wild-card to include multiple endings to each search term.

The query yielded 5,399 medication error reports. The medication name, route, patient care area, event description, and harm score, adapted from the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) harm index,[3] were provided by the reporting facility. When a medication name data field was left blank but the name was provided in the event description, an analyst adjusted the medication name field. The reports were evaluated to determine what factors were associated with medication errors involving the use of healthcare technology and an override.

Authority analysts focused on the last two calendar years, which yielded 790 reports. Two hundred seven (26.2%) of these reports were excluded because the error did not result from the use of an override, because "override" was used in the event description of an event that clinically warranted the use of an override (e.g., to obtain medication during an emergent situation), or because an override could not be performed. Five

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hundred eighty-three reports remained for qualitative analysis. Reports were analyzed and assigned a category or type of error (e.g., type of technology involved, potential cause of error) based on the analyst's interpretation of the event description. Analysts made note of events involving a high-alert medication, based on the *ISMP List of High-Alert Medications in Acute Care Settings*.[4]

RESULTS

Categorizing the reports by harm score shows that more than 75% of the events reached the patient (harm score = C through I) and only 0.3% (n = 2) resulted in patient harm (harm score = E through I) (Figure 1).

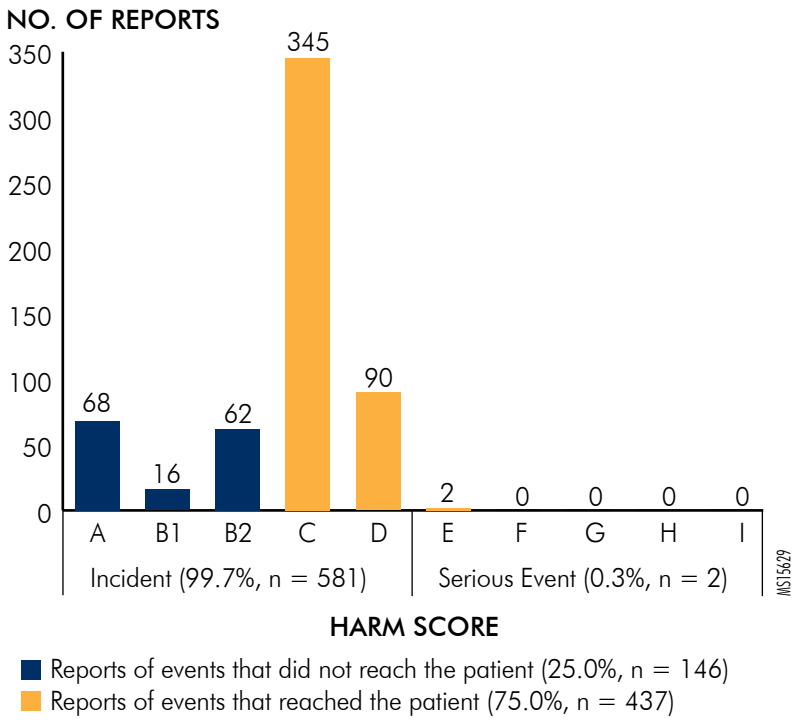
Overall, 57 unique types of care areas were associated with events involving an override; the most common were medical-surgical units. Intensive care units (ICUs) and emergency departments (EDs)—care areas that have patients with more acute conditions for which there may be a greater need to override an alert in order to obtain medications emergently—accounted for less than a quarter of the care areas cited in reports (Figure 2).

More than half of all reports involved elderly patients (65 years of age or older), and only 5.5% (n = 32) of the events involved a pediatric patient.

The most common classes of medications cited were antibiotics and opioids, with slightly more than a quarter of the events involving at least one high-alert medication.[4] Among events involving high-alert medications, the three classes most commonly cited were opioids (e.g., morphine), anticoagulants (e.g., warfarin, heparin), and insulin; combined, these medication classes represented 78.6% (n = 121 of 154) of the events involving a high-alert medication.

When looking at the types of technology that were overridden by users, over 75% of override events involved ADCs (Figure 3).

Figure 1. Harm Scores for Events Involving Overrides, as Reported to the Pennsylvania Patient Safety Authority, 2013 through 2014 (N = 583)



The most common type of event involving overrides of ADCs were unauthorized medications (e.g., obtaining a medication for a patient with no prescribed order for the patient), followed by wrong-drug events and wrong dosage form events (e.g., selecting a sustained-release product instead of the immediate-release form, selecting an oral formulation instead of the injection) (Figure 4). A majority of the unauthorized medication events specifically stated there were no orders for the medication, and over 30% of the unauthorized medication events involved a high-alert medication.

While most of the wrong-drug and wrong dosage form events did not include enough detail to determine additional causative factors for the event, 16.4% (n = 26 of 159 wrong-drug and wrong dosage form reports) mentioned situations in which medications were withdrawn "on override" before a pharmacist reviewed the order or when the pharmacy was closed.

The following are examples of events in which a healthcare practitioner obtained high-alert medications from an ADC using an override.*

> *Nursing thought that the warfarin was ordered per the warfarin comment on the MAR [medication administration record]. There was no order written for the warfarin on the MAR, and the nurse mistook the 2 in the warfarin comment as a 2 mg dose. The error was discovered by the pharmacy when reviewing the*

* The details of the PA-PSRS event narratives in this article have been modified to preserve confidentiality.

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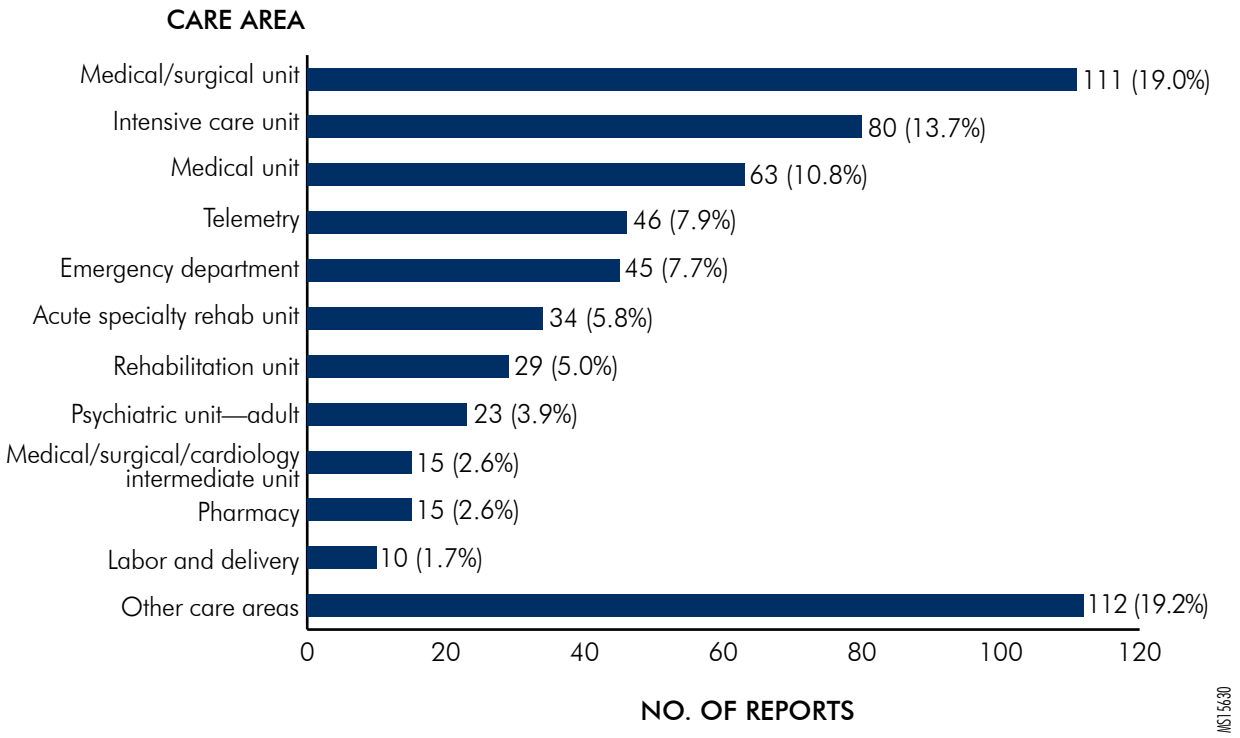
Figure 2. Care Areas for Events Involving Overrides, as Reported to the Pennsylvania Patient Safety Authority, 2013 through 2014 (N = 583)



profile override report the next day. The pharmacy called the unit to ask if there was an order written for this dose, and there was not. Upon review of the MAR and speaking to the nurse involved, it was discovered that the warfarin comment was mistaken for an actual dose.

Patient was ordered sliding scale insulin using Humulin® R [insulin human injection, USP (rDNA origin)] insulin. The nurse removed Humalog® [insulin lispro injection, USP (rDNA origin)] insulin from the ADC machine on override and administered this instead of Humulin R.

Order entered for oxyCODONE ER [extended release] 40 mg po TID [by mouth three times a day] as well as morphine ER 100 mg po TID. The pharmacist noted that this was unusual [concurrent prescriptions for two extended-release opioids] and put the order on pending status until clarified. The nurse told the pharmacist that since the patient was having pain, she had overridden and administered the oxyCODONE ER without pharmacy verification at a time when the pharmacy was open. Upon clarifying with the patient's pharmacy, the pharmacists determined that the patient was actually on oxyCODONE immediate release 40 mg po TID prn [as needed for] pain.

In 12.0% (n = 70 of 583) of the events, overrides occurred during the use of CPOE and/or pharmacist order entry systems. The most common types of alerts that were overridden were those for drug allergies, duplicate drug therapy, and wrong dose/overdosage (Figure 5). High-alert medications were reported in 31.4% (n = 22 of 70) of these events; anticoagulants (50.0%, n = 11 of 22) was the class of high-alert medications most often involved.

Almost 20% (n = 13 of 70) of the high-alert medication reports mentioned overrides of *both* CPOE and pharmacy order entry system alerts for a given order, with a prescriber overriding an alert and the pharmacist also overriding the same type of alert. Of the reports that cited only CPOE systems (n = 48), 12.5% (n = 6 of 48) mention practitioners other than prescribers (e.g., nurses, unit secretaries) entering the orders into the system.

The following are examples of reports of errors associated with overrides involving electronic order entry systems.

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Patient had a standing order for Coumadin® [warfarin sodium] 4 mg. The doctor ordered a 7.5 mg tablet but left the 4 mg order active. A duplicate therapy alert was generated and was overridden by the physician as "Not clinically significant." Pharmacist discontinued the existing 4 mg dose to avoid duplication of therapy, which could have resulted in patient getting 11.5 mg of Coumadin.

Lovenox® [enoxaparin sodium] treatment dose x1 ordered for patient in the ED. The physician received an alert since allergy field had heparin and related preparations. Physician entered override reason = "Give not a true allergy." Order verified and drug sent [by pharmacy] and was charted as given. Rapid response called the following morning. Platelets dropped to 30,000 platelets per microliter (mcL) [which is below the normal range]. However, after platelet value returned (and patient transferred off unit), pharmacist noticed the allergy field.

Patient's weight was accidentally entered into dose field by pharmacist. Patient received 74 units/kg/hr of heparin instead of 13 units/kg/hr, which exceeded maximum rate. Patient received 5,476 units of heparin over an hour instead of the ordered 962 units. Unclear why pharmacist overrode dose alert warning that fired. Nurse attempted to autoprogram pump but received alert and programmed pump manually.

A nurse took a telephone order from the doctor for potassium chloride 20 mEq po bid [by mouth twice a day], with the first dose given now. There was an override comment of "provider approved" entered, and the pharmacist verified the order without questioning if the patient should be on 2 separate potassium orders.

Overrides with the use of BCMA were cited in 7.5% (n = 44 of 583) of the events reported through PA-PSRS. The most common types of these events were wrong drug, wrong dosage form, and wrong dose/underdose (Figure 6). One out of four reports involving BCMA involved a high-alert medication.

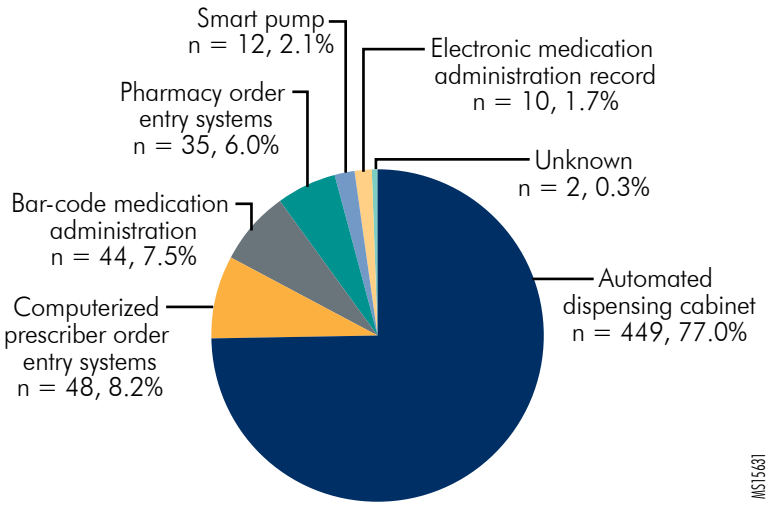
Following are examples of reports of errors associated with overrides involving BCMA.

Patient received twice daily morning medications early prior to dialysis, including MS Contin® [morphine sulfate extended release] and Cellcept® [mycophenolate mofetil]. When patient returned from dialysis, the nurse gave the morning medications, including those that had already been administered. Early dose warnings had fired, but nurse overrode warning.

The nurse gave the patient the 5 mg dose of Coumadin that was for another patient. She did scan the patient, but she scanned the label on the bag instead of scanning the drug. She did receive a warning stating that this was not for the right patient, but she continued on and overrode the warning. The patient did get the correct drug and dose, but only because the two patients were ordered the same thing. The other nurse ended up having to call us for a missing dose.

OxyCODONE [immediate release] 15 mg was dispensed from pharmacy instead of MS Contin 15 mg to [ADC]. Nurse removed [wrong] medication from Accudose and overrode the bar-code scan that indicated it was the wrong product.

Figure 3. Technologies Overridden in Events Involving Overrides as Reported to the Pennsylvania Patient Safety Authority, 2013 through 2014 (N = 583)



***Note*: Numbers add up to more than 583 because in 17 reports, multiple forms of technology were mentioned as being overridden within the same report.**

DISCUSSION

ADCs can be linked to pharmacy computer systems (or "profiled") so that a pharmacist must review the appropriateness of a medication order prior to administration—most notably identifying drugs to which patients are allergic, unsafe doses, or unrecognized food or drug interactions—and approve that order

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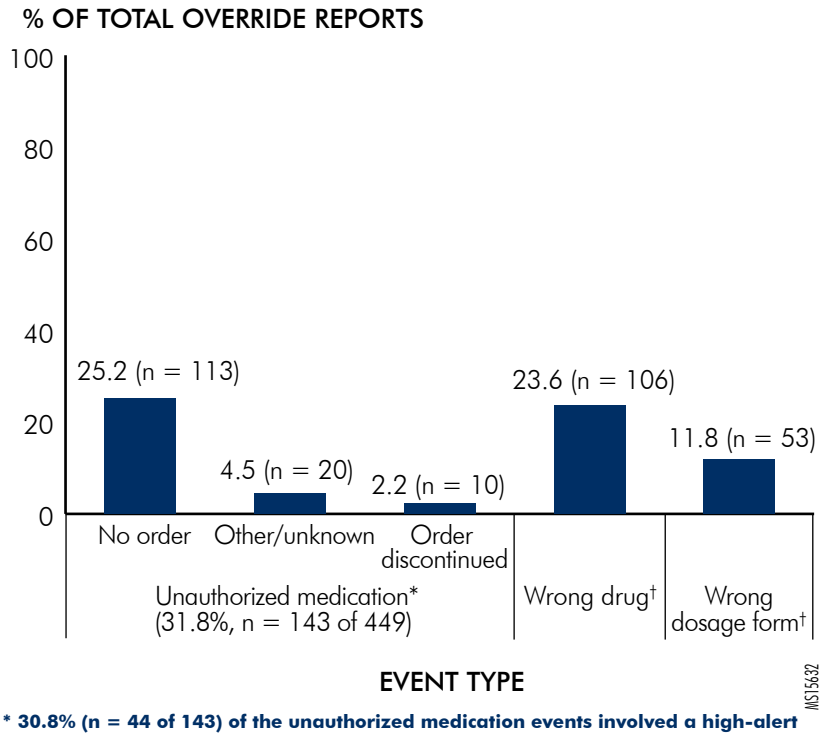
Figure 4. Common Event Types of Reports Involving Overrides of Automated Dispensing Cabinets, as Reported to the Pennsylvania Patient Safety Authority, 2013 through 2014 (N = 449)



*** 30.8% (n = 44 of 143) of the unauthorized medication events involved a high-alert medication.**
† 16.4% (n = 26 of 159) of the reports mentioned situations in which medications were withdrawn "on override" before a pharmacist reviewed the order or when the pharmacy was closed.

before a nurse is able to remove the medication from the ADC.[5] These devices also allow for the use of overrides to bypass the pharmacist's review of a medication order when assessment of the patient indicates that a delay in obtaining a medication from the ADC (e.g., to wait for a pharmacist's review of the order) would harm the patient.

Organizations have developed lists, commonly called an "override list," of medications that can be removed from an ADC without a pharmacy review of the order. If there is an *urgent* clinical need for administering a drug before a pharmacist can reasonably be expected to review the order and/or dispense the drug, it is important to have readily accessible medications available on override in locations such as the ED and ICU. Therefore, the term "override" takes on a different meaning with this technology, as practitioners are not overriding or bypassing a clinical alert presented to them but are removing a medication before the pharmacist's review of an order. This practice can be unsafe when this crucial clinical review is routinely bypassed for convenience ("normalized deviance") or to remedy process problems such as excessive order turnaround time. After a review of 470 medication overrides, Kester et al. noted that 11.7% of overrides involved variances with written orders, and 85.5% of those variances were not appropriately documented.[6]

CPOE and pharmacy order entry systems have clinical decision support (CDS) systems, which can provide warnings about wrong dosages or other related prescribing conflicts, interactive computer programs, or other tools that are designed to assist physicians and other healthcare professionals with decision making.[7] CDS systems provide various forms and levels of alerts to indicate possible issues with medication orders, such as allergies to the prescribed medications, excessive doses, and therapeutic duplications. Unfortunately, little attention may be given to how the accuracy of these alerts should be best aligned with their appearance and degree of interruption. Many of these alerts are "soft stop" alerts, which can be interruptive and the user can dismiss by providing a simple override of the warning. The display of excessive numbers of alerts can lead to the phenomenon often referred to as "alert fatigue." The way alerts are prioritized and presented to the user may be as important as which alerts are presented. Alerts for very serious clinical situations (i.e., true positive alerts) may be ignored when lost in a sea of less clinically important or irrelevant ones (i.e., false-positives).

In a study involving adult primary care practices affiliated with a teaching hospital, Weingart et al. showed that physicians overrode 91.2% of drug allergy alerts and 89.4% of high-severity drug interaction alerts.[8] The physician reviewers in this study determined that 36.5% of the alerts were inappropriate. Slight et al. conducted a study (which included primary care practices affiliated with two Harvard teaching hospitals with over 1,700 prescribers) that evaluated the appropriateness of providers' drug-drug interaction alert overrides, the reasons why they chose to override these alerts, and what actions they took as a consequence of the alert.[9] The authors found that 68.2% of the drug-drug interaction alert overrides were considered appropriate. In addition, a detailed chart review revealed that of the appropriate alert overrides for which the provider

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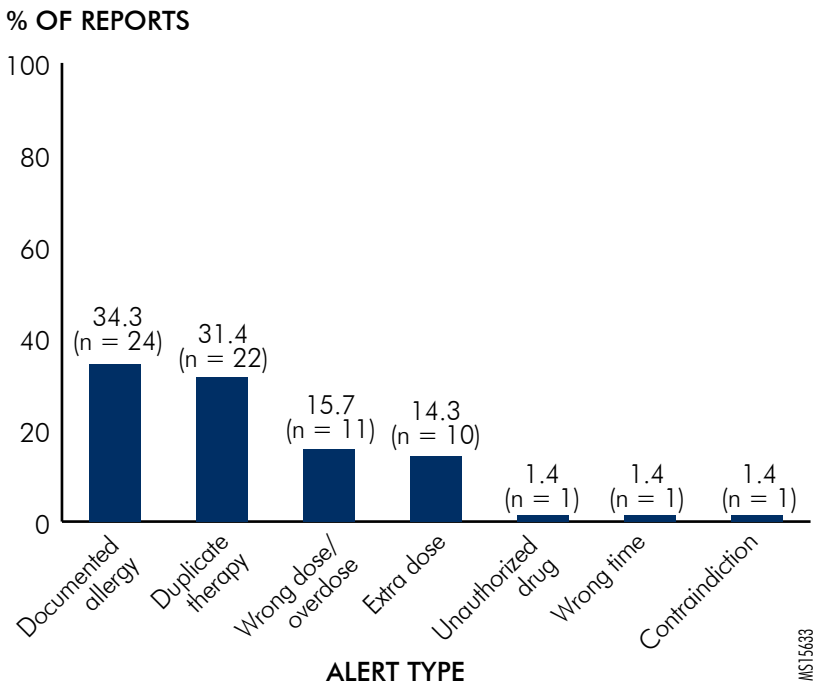
Figure 5. Types of Alerts Overridden in Computerized Prescriber Order Entry and Pharmacy Computer Systems, as Reported to the Pennsylvania Patient Safety Authority, 2013 through 2014 (N = 70)



indicated they would "monitor as recommended," only 35.5% actually did.

BCMA technology can improve medication safety through several levels of functionality.[10] At the most basic level, the system helps to verify that the right drug is being administered to the right patient in the right dose and at the right time. When one of these items does not match the patient record and order, most systems alert the practitioner prior to administration. For example, an alert may be presented when the patient does not have an active order or is allergic to the scanned medication or if the dosage strength scanned is higher than what was ordered. If BCMA systems detect mismatches between patient and medication or medication and medication order, audible and/or visual alerts are triggered.[11]

BCMA systems allow overrides if emergency administration of a medication is necessary, if the bar code on the medication's package is not recognized by the bar-code scanner, if the bar code is missing or unreadable, or if the patient's corresponding identification band cannot be scanned. In response to alerts, users either change their actions (e.g., find correct patient or medications) or override alerts and document their reasons for overriding the alerts. However, problems may occur when an alert is overridden. In a review of BCMA use at five hospitals that included analyzing BCMA override log data, Koppel et al. found that nurses overrode BCMA alerts for 4.2% of patients charted and for 10.3% of medications charted.[3] Possible consequences of those workarounds included administration of wrong medications, wrong doses, wrong times, and wrong formulations.

LIMITATIONS

In-depth analysis by the Authority of overrides associated with the use of technology occurring in Pennsylvania hospitals is limited by the information reported through PA-PSRS, including the event descriptions and reasons why the event occurred. As a result, additional override events and associated causes may have been reported but were not identified by the query and analysis.

RISK REDUCTION STRATEGIES

The medication error events submitted to the Authority involving the use of overrides when using technology reveal the complex nature and variety of factors that contribute to errors. Some of those factors were an extension of the unique challenges associated with the use of each type of technology; however, many of the factors were similar across all forms of technology. It is also important to understand that the use of overrides is not a primary problem with the use of healthcare technology but rather a symptom of a larger problem of poor decision support design. Unfortunately, most of the reports did not provide much explanatory information about the errors, causes, and contributing factors. Even so, these reports, observations from the Institute for Safe Medication Practices, and recommendations in the literature do offer strategies that healthcare facilities may consider to decrease risk in the medication-use process.

General Strategies

Strategies that can be applied to all of these technologies include the following:

- Improve the positive predictive value (e.g., the number of true positive alerts compared with all positive alerts) of alerts, and adjust the presentation of the alerts (e.g., interruptive versus noninterruptive) according to how accurate they are.

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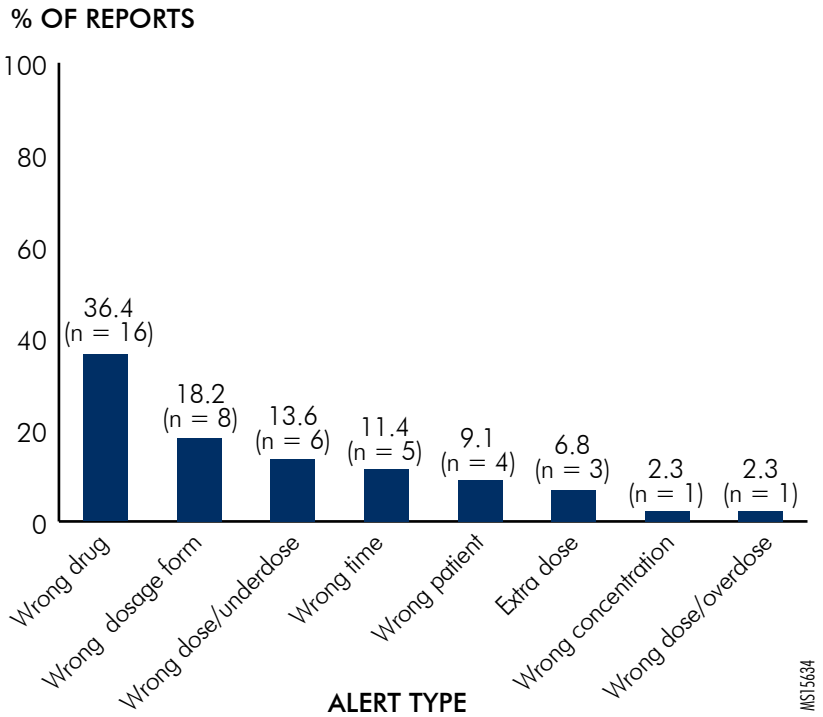
- Develop a mechanism to identify and remove alerts that provide little or no clinical value, which may contribute to alert fatigue.
- Solicit an explanation of the reasons or rationale for an override of alerts that are of high severity. Limit this strategy, as requiring an explanation for all alerts could further contribute to alert fatigue.
- Assess staff competency related to the safe use of technology and overrides, and provide education when indicated.
- Review and approve all override policies through the pharmacy and therapeutics (P&T) committee, medication safety committee, or an equivalent group.
- Review override reports to identify and address barriers to the safe use of healthcare technologies. Incorporate additional means to identify override hazards by reviewing the organization's medication error report data and external sources of information; conducting direct observation of the use of technology; and implementing conversations with end users to determine when and why staff use overrides.

Automated Dispensing Cabinets

The use of ADC overrides should be situationally dependent and should not occur merely because the desired medication is on a list of medications for which overrides are sometimes indicated.[12] While there may be a list of drugs with the potential to be obtained emergently, there may be many other situations when there is sufficient time for the pharmacist to review the medication prior to a nurse retrieving the dose. Establish criteria for system overrides that allow emergency access in circumstances in which waiting for a pharmacist to review the order before accessing the medication could adversely impact the patient's condition, but limit access before review in other circumstances.[12] Additional strategies include the following:

Figure 6. Types of Alerts Overridden in Bar-Coded Medication Administration Systems, as Reported to the Pennsylvania Patient Safety Authority, 2013 through 2014 (N = 44)



- Developing clearly stated organizational policies and criteria for system overrides that limit access to medications before orders have been reviewed and approved by a pharmacist[13]
- Implementing strategies to reduce the risk of an error when an override is used, such as the following:[11,14]
  - Limit the quantity and number of drug concentrations available.
  - Minimize the use of multidose containers.
  - Ensure medications available for override are unit specific and removed only when there is an emergent need.
  - Use a process whereby the drug and dose are checked against the patient's allergies, and weight as appropriate, to determine if the drug and dose are appropriate.
  - Provide preparation instructions if the nurse is required to reconstitute or dilute a medication.
  - Require an independent double check with another licensed healthcare provider when using the override function to remove an organization-identified high-alert medication.

Computerized Provider Order Entry Systems

To realize the benefits of CDS, CPOE and pharmacy order entry systems need to be implemented correctly and used effectively. Too many alerts could lead to the

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use of overrides, system rejection, or unanticipated outcomes such as an increased number of errors or adverse events.[15-17] Decreases in the volume of nuisance alerts have been shown to yield greater attention paid to potentially more valuable alerts.[18] Consider examining the alerts currently active in CPOE and pharmacy order entry systems, and evaluate if any may be turned off or relegated to a lower severity tier. Although vendor systems may allow alerts to be tiered, there is typically a significant amount of work necessary to vet any changes and carry out the technical work involved in the customization.

The combination of pharmacists' clinical knowledge of drugs and their experience with the interruptive alerts that have been present in pharmacy information systems for years provide pharmacists with a unique understanding of the many implications of implementing medication-related CDS.[2] If organizations are in the process of implementing a CPOE system, consider and evaluate CDS components before CPOE implementation, keeping in mind that a high number of interruptive alerts may even threaten clinician acceptance of CPOE. Prescribers, pharmacists, and other practitioners, as appropriate, should participate in the development of medication-related CDS and should work with medical leadership—either through the P&T committee, an informatics committee, or another interdisciplinary committee—to decide how and when medication-related CDS will be customized and implemented.[2]

CONCLUSION

Healthcare practitioners use overrides when using various technologies related to medication ordering and administration for a variety of reasons. Analysts identified 583 medication error events submitted to the Authority from 2013 through 2014 involving an override of technology that resulted in an error. A majority of event reports mentioned that these errors took place when healthcare practitioners were allowed to simply bypass a warning, with no other strategies in place to catch a resulting error.

Risk reduction strategies provided in this analysis may help organizations minimize the occurrence of override-related adverse events. Organizations may also consider providing criteria for the development of alerts (in any form of technology) that focus on real chances of patient harm while preventing alert fatigue.

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Strategies to Turn the Tide against Inappropriate Antibiotic Utilization

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ABSTRACT

Focusing on antibiotic utilization practices is a vital strategy to minimize the increasing incidence of both multidrug-resistant organisms (MDROs) and Clostridium difficile *infections. Pennsylvania Patient Safety Authority staff analyzed the incidence of MDROs and* C. difficile *in Pennsylvania hospitals and long-term care facilities (LTCFs), identified antibiotic prescribing practices in LTCFs, and researched strategies to help healthcare facilities build or enhance antibiotic stewardship. From April 2014 through March 2015, 19.0% of the total healthcare-associated infections in Pennsylvania were caused by MDROs, and 17.1% by* C. difficile. *Over the same time period, 1.9% of infections in LTCFs were associated with MDROs, and 7.3% with* C. difficile. *Analysis of Pennsylvania's LTCF infection events identified frequent use of fluoroquinolones and cephalosporins as initial antibiotics in multiple infection categories. A review of the literature revealed detailed strategies, including engaging physicians and senior leadership, developing and using an antibiogram, and providing education to healthcare workers to address identified practice gaps and barriers. Implementing these strategies will promote appropriate antibiotic use and help facilities develop and sustain a robust stewardship program to decrease the incidence of MDRO and* C. difficile *infections. (Pa Patient Saf Advis 2015 Dec;12[4]:149-57.)*

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INTRODUCTION

The increasing incidence of multidrug-resistant organism (MDRO) infections has become a safety concern for patients in hospitals and long-term care facilities (LTCFs) in Pennsylvania as well as nationally. Infections caused by drug-resistant organisms are more difficult to treat, incur greater treatment costs, and have greater morbidity and mortality than infections caused by organisms susceptible to antibiotics.[1-3] Inappropriate antibiotic usage contributes to the development of MDROs and *Clostridium difficile* infections, which together are responsible for more than two million infections and at least 37,000 deaths annually in the United States.[3] *C. difficile* infection, while not caused by an MDRO, is another adverse outcome related to antibiotic use. Antibiotics kill beneficial bacteria normally found in the colon; the absence of normal bacteria then allows *C. difficile* bacteria to multiply and cause gastrointestinal infection.[4] The antibiotics that are particularly associated with MDROs and *C. difficile* include clindamycin and antibiotics in the fluoroquinolone and extended-spectrum cephalosporin drug classes.[5-7]

Multiple professional societies and regulatory agencies have identified the need to address the threat of drug-resistant organisms and inappropriate antibiotic usage. Several organizations have released guidelines to assist in developing antibiotic stewardship programs to improve antibiotic utilization processes.[2,8-10] The *National Action Plan for Combating Antibiotic-Resistant Bacteria*, released by the White House in March 2015, includes specific goals and objectives to address drug resistance.[11] The Centers for Disease Control and Prevention (CDC) defines MDROs as epidemiologically significant organisms or pathogens that have one or more of the following characteristics: a tendency for transmission within healthcare facilities, antibiotic resistance, increased morbidity and mortality, or a newly discovered or reemerging pathogen.[12]

Focusing on antibiotic utilization practices is a vital component of strategies to minimize the incidence of both multidrug resistance and *C. difficile* infection. Many facilities are working toward antibiotic stewardship, but the implementation of a robust program is a complex undertaking. Based on facility responses to the Pennsylvania Patient Safety Authority's 2015 Antibiotic Stewardship Questionnaire, opportunities for improvement were identified in the areas of leadership support, accountability, expertise and support, action, tracking and reporting, and education.[13] To assist in implementing an antibiotic stewardship program, facilities can perform a gap analysis to evaluate their existing resources, identify key stakeholders, evaluate current antibiotic use, and determine potential barriers and data to be collected for analysis.[1,2,9] A process improvement team can assist in developing and sustaining a successful program. Tools to perform a gap analysis of antibiotic prescribing practices and assist facilities in targeting resources are provided in the *Pennsylvania Patient Safety Advisory* article "Antibiotic Stewardship in Hospitals and Long-Term Care Facilities: Building an Effective Program."[13]

METHODS

Analysts reviewed Pennsylvania hospital events reported through the National Healthcare Safety Network (NHSN) and LTCF events reported through the Pennsylvania Patient Safety Reporting System (PA-PSRS) for the 12-month period from April 2014 through March 2015 to determine the most common healthcare-associated infections (HAIs) and the rates of infection caused by epidemiologically significant organisms in Pennsylvania facilities. Analysts reviewed the PA-PSRS data of the same time frame to ascertain

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antibiotic prescribing patterns in LTCFs. Comparable information on prescribing patterns is not reported by hospitals.

Of the 230 hospitals actively reporting to NHSN as of March 31, 2015, data from 203 (88.3%) met validation criteria. Twenty-seven facilities were excluded from analysis:

- Twenty-four hospitals because patient-day entries were absent for at least one month of the time period
- Three hospitals because either the number of catheter-associated urinary tract infections (CAUTIs) was submitted without accompanying catheter-day entries or the number of central-line-associated bloodstream infections was submitted without accompanying central-line-day entries

Of the 702 LTCFs active in PA-PSRS as of March 31, 2015, data from 591 (84.2%) met validation criteria. One hundred eleven LTCFs were excluded from analysis:

- Eighty-one LTCFs because resident-day entries were absent for at least one month of the time period
- Twenty-nine LTCFs because occupancy was either above 100% or below 50% for at least one month of the time period*
- One LTCF because the number of CAUTIs was submitted without accompanying catheter-day entries

* Facility occupancy is calculated as the number of resident-days divided by the number of beds listed for each facility for each month. Then the quotient is divided by the number of days in each month.

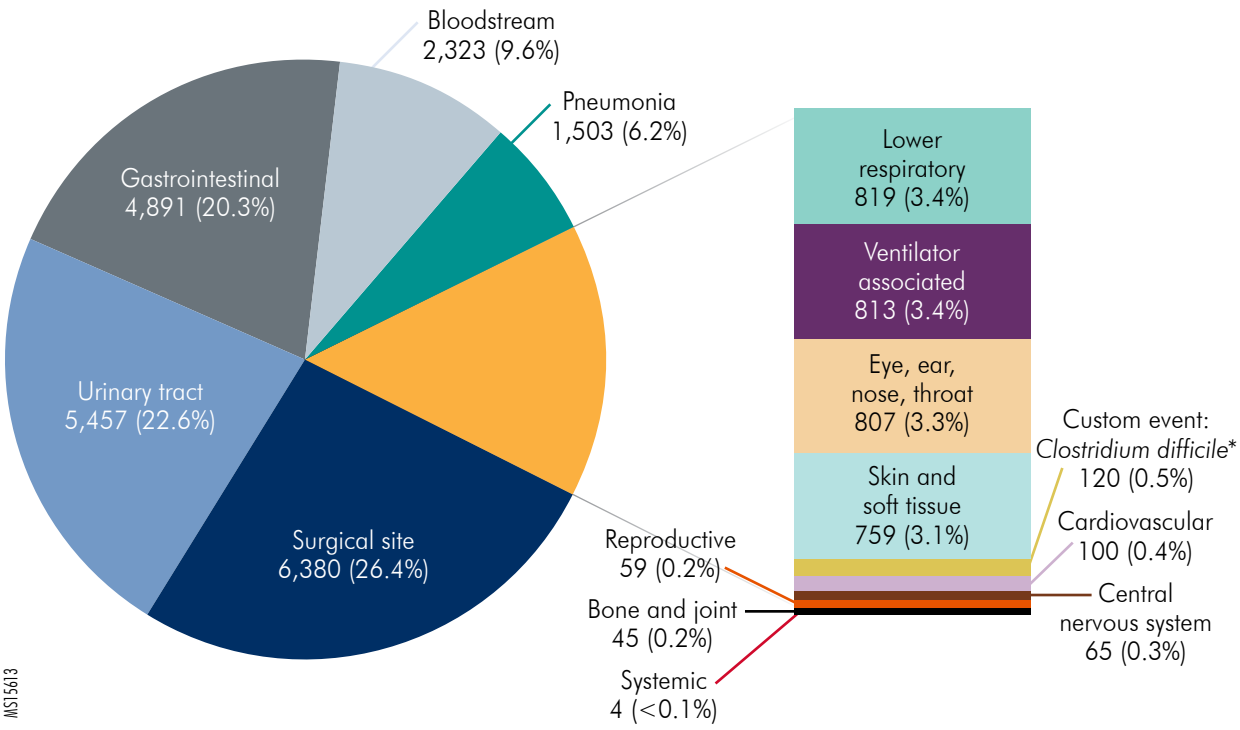
RESULTS

Hospitals

For the 12-month period, Pennsylvania hospitals reported 24,145 HAIs. The predominant types of infections reported were surgical site infection, gastrointestinal infection (GI), urinary tract infection (UTI), bloodstream infection (BSI), and pneumonia. See Figure 1.

Focusing further on epidemiologically significant organisms reveals that 4,594 (19.0%) of the reported infections were caused by MDROs and 4,121 (17.1%) by *C. difficile*. For the 12-month period, in Pennsylvania hospitals, this would average 23.6 new antibiotic-associated infections

Figure 1. Pennsylvania Healthcare-Associated Infections by Category



Source: **Healthcare-associated infection events reported by Pennsylvania hospitals to the National Healthcare Safety Network from April 2014 through March 2015 (N = 24,145).**
*** Custom event: *Clostridium difficile* are events entered into the National Healthcare Safety Network by facilities without a monthly reporting plan that includes *C. difficile* under the MDRO/CDAD (multidrug-resistant organism/*C. difficile*-associated disease) module.**

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occurring each day: 12.3 by MDROs and 11.3 by *C. difficile*. See Figure 2.

Long-Term Care

For the 12-month period, LTCFs reported 29,108 HAIs through PA-PSRS. The predominant type of infections was respiratory tract infections (39.7%). See Figure 3.

Of those HAIs, 1.9% (n = 545 of 29,108) were associated with MDROs. The most common MDRO was methicillin-resistant *Staphylococcus aureus*, and the category of HAI with the highest percentage of MDROs was BSIs (19.7%, n = 14 of 71). While *C. difficile* accounted for 7.3% (n = 2,109 of 29,108) of the total number of nursing home infections, 54.0% (n = 2,109 of 3,908) of GI infections were associated with *C. difficile*.

Analysis of Pennsylvania LTCFs' prescribing patterns in the identified time frame demonstrates frequent use of fluoroquinolones and cephalosporins as an initial antibiotic in multiple infection categories. See Figure 4.

DISCUSSION

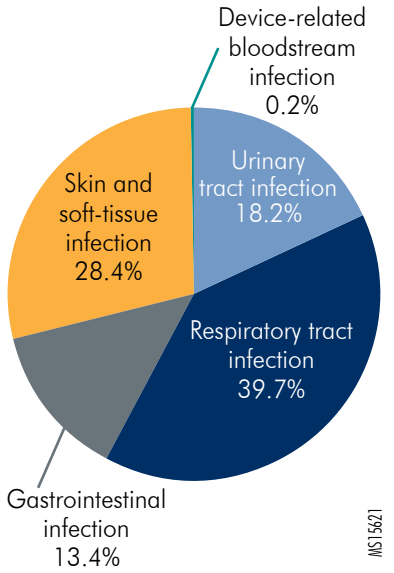
Antibiograms Encourage Responsible Use of Antibiotics

The antibiogram is a facility-specific, cumulative antimicrobial susceptibility data report that provides valuable information to guide antibiotic prescribing practices in both hospitals and LTCFs. This report utilizes microbiologic data from patient specimens to identify facility- and/or unit-specific antibiotic resistance patterns. Regular distribution of the current antibiogram provides useful information to help prescribing clinicians (1) select the most appropriate agents for initial empirical antimicrobial therapy, (2) improve outcomes among patients with infections, and (3) reduce inappropriate antibiotic use. Antibiograms are inexpensive, easily accessible, and facilitate identification of changes in facility or unit resistance patterns. Final selection of empiric therapy should be based on the patient's infection history and past antimicrobial use, as well as the local antibiogram.

General steps to plan, develop, and implement an antibiogram include the following:[8,14,15]

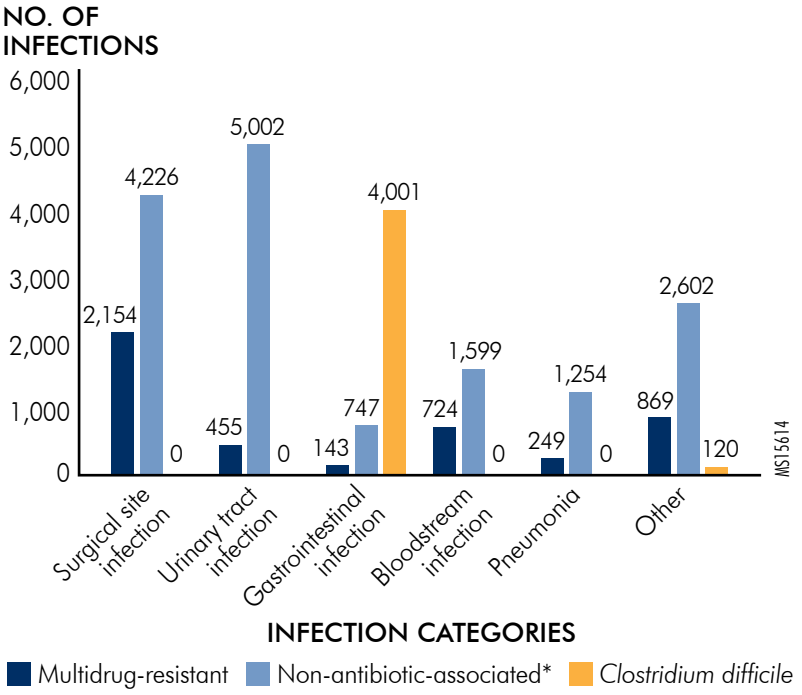
– Engage team members who have knowledge and understanding of culturing practices and infection control, such as the laboratory

Figure 3. Nursing Home Infections by Category



Source: **Healthcare-associated infection events reported by Pennsylvania nursing homes to the Pennsylvania Patient Safety Reporting System from April 2014 through March 2015.**

Figure 2. Hospital-Reported Healthcare-Associated Infections caused by Epidemiological Significant Organisms by Category



Source: **Healthcare-associated infection events reported by Pennsylvania hospitals to the National Healthcare Safety Network from April 2014 through March 2015 (N = 24,145).**
*** Infections not directly related to antibiotic use**

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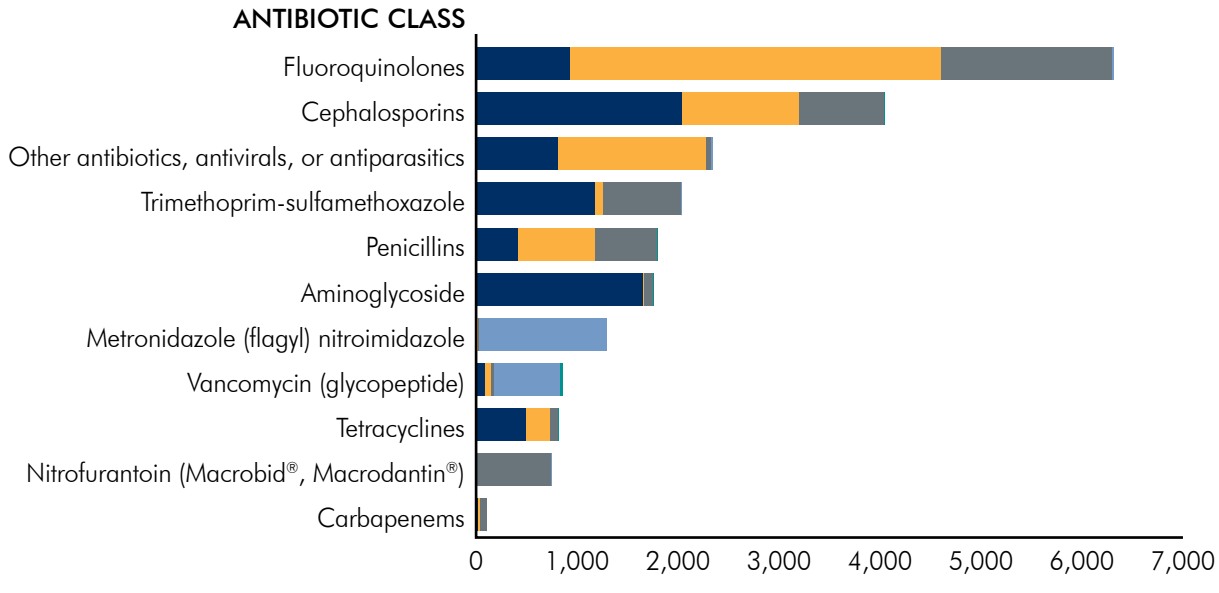
Figure 4. Nursing Home Initial Antibiotic Orders, by Infection Site



INFECTION SITE	Fluoroquinolones	Cephalosporins	Other antibiotics, antivirals, or antiparasitics	Trimethoprim-sulfamethoxazole	Penicillins	Aminoglycoside	Metronidazole (flagyl) nitroimidazole	Vancomycin (glycopeptide)	Tetracyclines	Nitrofurantoin (Macrobid®, Macrodantin®)	Carbapenems
Skin and soft tissue	922	2,031	806	1,170	407	1,651	7	86	486	4	15
Respiratory tract	3,684	1,161	1,468	88	770	13	11	57	243	9	20
Urinary tract	1,689	843	50	771	608	87	2	30	82	731	68
Gastrointestinal	16	8	15	3	5	1	1,269	660	0	1	0
Bloodstream	3	9	1	0	6	2	1	20	3	1	2

MS15620

Source: **Healthcare-associated infection events reported by Pennsylvania nursing homes to the Pennsylvania Patient Safety Reporting System from April 2014 through March 2015.**

microbiologist, infectious-disease consultant, medical director, pharmacist, and infection preventionist or infection prevention designee.

- Determine if the antibiogram will be unit- or facility-based.
- Develop the antibiogram with culture information, including the patient/resident name and identification number, culture identification number, date completed, and organisms and antibiotic sensitivities identified.
- Review the antibiogram to monitor trends in antimicrobial resistance within different areas of the facility.
- Distribute the antibiogram to all prescribing clinicians, and accompany distribution with education and instructions for use and interpretation.
- Monitor the use of the antibiogram in conjunction with culture sensitivity results to aid in antibiotic selection.

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Antibiotic Stewardship Program Core Elements

Many of the interventions to implement an antibiotic stewardship program are appropriate for both hospital and long-term care settings. The method of implementation of these elements will depend on the individual facility and staffing. Both acute and long-term care settings can benefit from performing a gap analysis of the current state of their antibiotic stewardship program. Appropriate measures for implementation can be selected from the CDC's core elements checklists and the Institute for Healthcare Improvement's Driver Diagram and Change Package.[8,16] While the number of published core elements may seem daunting, it is suggested that a facility begin with implementation of one or two strategies and then gradually add new strategies over time.

The Authority has developed a crosswalk of strategies for both hospitals and LTCFs that outlines stewardship activities in the areas of leadership, provider engagement, clinical action to improve antibiotic use, multidisciplinary support, and tracking and reporting antibiotic usage. See the Table.

ANTIBIOTIC STEWARDSHIP RESOURCES

Antibiotic Stewardship in Hospitals and Long-Term Care Facilities: Building an Effective Program
Pennsylvania Patient Safety Authority
http://patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2015/Jun;12(2)/Pages/71.aspx

Authority surveys of hospitals and long-term care facilities demonstrate opportunities for improvement in all facets of antibiotic stewardship. Inappropriate antibiotic use perpetuates and exacerbates antibiotic resistance. Antibiotic stewardship programs help to ensure optimal treatment for patients with infections and may enhance the length of time current antibiotics remain effective.

Appropriate Use of Medical Resources: Antimicrobial Stewardship Toolkit
American Hospital Association
http://www.ahaphysicianforum.org/resources/appropriate-use/antimicrobial/ASP-Toolkit-v3.pdf

This user guide provides information about how to start a new stewardship program or enhance an existing one, including tools, resources, references, and webinars for healthcare professionals, as well as patient resources.

National Action Plan for Combating Antibiotic-Resistant Bacteria
The White House
https://www.whitehouse.gov/sites/default/files/docs/national_action_plan_for_combating_antibotic-resistant_bacteria.pdf

The action plan outlines steps to implement the National Strategy for Combating Antibiotic-Resistant Bacteria and addresses the policy recommendations of the president's Council of Advisors on Science and Technology.

Nursing Home Antimicrobial Stewardship Modules
Agency for Healthcare Research and Quality
http://www.ahrq.gov/professionals/quality-patient-safety/patient-safety-resources/resources/nh-aspguide/index.html

These modules include four tested, evidence-based toolkits to help optimize antibiotic use.

Improve Prescribing Practices

In a patient with a suspected infection, best practices associated with optimal antibiotic use include the following:[6,8,16,17]

- Ensure that the patient always exhibits clinical symptoms consistent with state and national site-specific infection criteria.
- Complete the lab work required by the national criteria (e.g., culture and sensitivity, quick test, chest x-ray).
- Select the appropriate empiric antibiotic for the specific site of infection (narrowest-spectrum drug, dose, and duration consistent with state and national clinical syndrome and site-specific guidelines).
- Ensure a 48-hour time-out identifies the organism and culture sensitivities and assesses the quality of the culture. Ensure the quality of the lab test meets nationally accepted criteria (e.g., correct colony count, number of organisms, specimen type).
- Order the appropriate, narrowest-spectrum antibiotic based on the test results, national guidelines, and the facility's susceptibility patterns.

There are multiple opportunities in the prescribing decision process to stray from optimal practices. Inappropriate antibiotic use includes prescribing drugs that are unnecessary, no longer necessary (e.g., failure to change an empiric drug order), or incorrectly dosed, as well as using broad-spectrum agents when narrow-spectrum agents are appropriate for susceptible bacteria.[3] An example of this is ordering antibiotics for a patient with asymptomatic bacteriuria. A positive urine culture by itself does not denote an infection. These cases may not be being tracked for antibiotic usage because reporting is not necessary. Figure 5 may assist healthcare facility clinicians with antibiotic prescribing decisions.

(continued on page 156)

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Table. Antibiotic Stewardship Core Elements

CORE ELEMENTS	ACUTE	LONG-TERM CARE
IMPROVE LEADERSHIP, CULTURE, AND ACCOUNTABILITY		
Urge administrative and clinical directors to develop and champion goals to improve the use of antibiotics.	✓	✓
Communicate facility stewardship goals to clinicians and physicians in writing, in person, and at staff meetings.	✓	✓
Incorporate stewardship-related tasks in job descriptions and performance reviews.	✓	✓
Recruit a physician champion to be accountable for the antibiotic stewardship program.	✓	
Identify a facility leader accountable for antibiotic stewardship activities (e.g., medical director, director/assistant director of nursing, consultant pharmacist).		✓
Monitor if antibiotic stewardship policies are followed.	✓	✓
ENCOURAGE PROVIDER ENGAGEMENT		
Engage physicians in the development of the program.	✓	✓
Assist in developing guidelines and addressing reluctant physicians.	✓	✓
Promote the focus of optimal antibiotic use into the current process of care.	✓	✓
Work with providers, and follow up to address questions or concerns.	✓	✓
Monitor and provide regular, personalized feedback to physicians and advanced practice providers on antibiotic usage, prescribing habits, the incidence of drug-resistant organisms, and *Clostridium difficile* infections.	✓	✓
Require preauthorization and documented justification for broad-spectrum antibiotics.	✓	
Introduce specific treatment recommendations that are consistent with national guidelines, including recommendations to change intravenous (IV) to oral (PO) therapy.	✓	✓
Use prospective audit and provider feedback to monitor adherence to national guidelines for treatment.	✓	
Use a standard assessment and communication tool for residents suspected to have infections.		✓
IMPROVE ANTIBIOTIC USE		
Institute a policy that requires prescribers to document dose, duration, and indication for all antibiotic prescriptions.	✓	✓
Develop and institute infection-specific treatment guidelines, and monitor adherence to them.	✓	✓
Develop standardized diagnostic criteria for identifying patients with signs and syndromes suggesting specific types of infections and situations for which antibiotics are clearly not indicated.	✓	✓
Implement a formal procedure for all clinicians to review the appropriateness of empiric antibiotics 48 hours after the initial order (an "antibiotic time-out").	✓	✓
Consider having the physician lead or pharmacist review courses of antibiotic therapy for specific agents (prospective audit with feedback).	✓	✓
Produce a cumulative antibiotic susceptibility report (antibiogram).	✓	✓
Preauthorize dispensing of specific antibiotic agents.	✓	
Institute pharmacy-driven interventions (e.g., automatic IV to PO changes, automatic alert of duplicative therapy, time-sensitive stop orders, dose adjustment and optimization).	✓	
Develop a facility-specific algorithm for assessing residents and performing appropriate diagnostic testing (e.g., cultures) for specific infections.		✓
Implement a process for communicating antibiotic information on transfer or discharge.		✓
Implement an infection-specific intervention to improve antibiotic use.		✓

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Table. Antibiotic Stewardship Core Elements (continued)

CORE ELEMENTS	ACUTE	LONG-TERM CARE
ENGAGE MULTIDISCIPLINARY SUPPORT		
Identify unit champions to assist with education and monitoring.	✓	✓
Actively involve members of the team to develop an action plan and goals that are consistent with national stewardship guidelines.	✓	✓
Create a clear task list for each member of the stewardship team.	✓	✓
Engage quality improvement and safety committees in approving antibiotic stewardship goals.	✓	✓
Populate the stewardship program team with administrative, infection control, nursing, and physician personnel.	✓	✓
Include the pharmacist, laboratory staff, and infectious-diseases physician, as they have antibiotic expertise.	✓	
Work with the consultant pharmacist staff to review microbiology culture data to assess and guide antibiotic selection.		✓
Partner with the antibiotic stewardship team at the local hospitals.		✓
Engage an external infectious-diseases/stewardship consultant.		✓
TRACK AND REPORT ANTIBIOTIC USAGE AND CLINICAL OUTCOMES TO MEASURE IMPACT OF INTERVENTIONS		
Monitor for increasing rates of drug-resistant and *C. difficile* infections, and benchmark rates with comparable facilities.	✓	✓
Track adherence to prescribing and documenting the appropriate dose, duration, and use of the recommended agent for the indication.	✓	✓
Measure antibiotic usage in days of therapy by dividing the amount of each specific antibiotic administered to a patient by a standardized denominator (e.g., patient-days).	✓	✓
Track adverse reactions to antibiotics.	✓	✓
Monitor adherence to clinical assessment documentation and facility-specific treatment recommendations.	✓	✓
Provide facility-specific reports on antibiotic use and outcomes to clinical and nursing staff.	✓	✓
Evaluate antibiotic cost increases, and determine if the increases are caused by an increase in the actual cost of the drug or increased usage.	✓	✓
Track antibiotic usage in patients who are colonized or asymptomatic and in situations in which cultures have not been ordered.	✓	✓
Evaluate appropriate use of broad-spectrum versus narrow-spectrum drugs.	✓	✓
If in Pennsylvania, utilize Pennsylvania Patient Safety Reporting System analytic tools to benchmark facility data with peer and state rates.		✓
Monitor rates of new antibiotic starts per 1,000 resident-days.		✓
Perform point prevalence surveys of antibiotic use.		✓
OVERCOME FUNDING, INFORMATION TECHNOLOGY, TIME, AND EDUCATION CHALLENGES		
Engage senior leadership to dedicate personnel, financial, and information technology resources to the program.	✓	✓
Prioritize identified gaps, and develop action plans to address them with the stewardship team.	✓	✓
Work with departmental leadership to allow staff time to participate in stewardship projects.	✓	✓
Access national antibiotic stewardship guidelines.	✓	✓
Offer varying types of formal and informal education to clinical providers and nursing staff.	✓	✓
Use messaging, posters, and newsletters to communicate with staff.	✓	✓
Make a business case for antibiotic stewardship, and present it to leadership to demonstrate how stewardship leads to a return on investment.	✓	
Provide educational resources to clinicians and other relevant staff about antibiotic resistance.	✓	✓

Sources: Centers for Disease Control and Prevention. The core elements of antibiotic stewardship for nursing homes [online]. 2015 [cited 2015 Sep 1]. http://www.cdc.gov/longtermcare/prevention/antibiotic-stewardship.html
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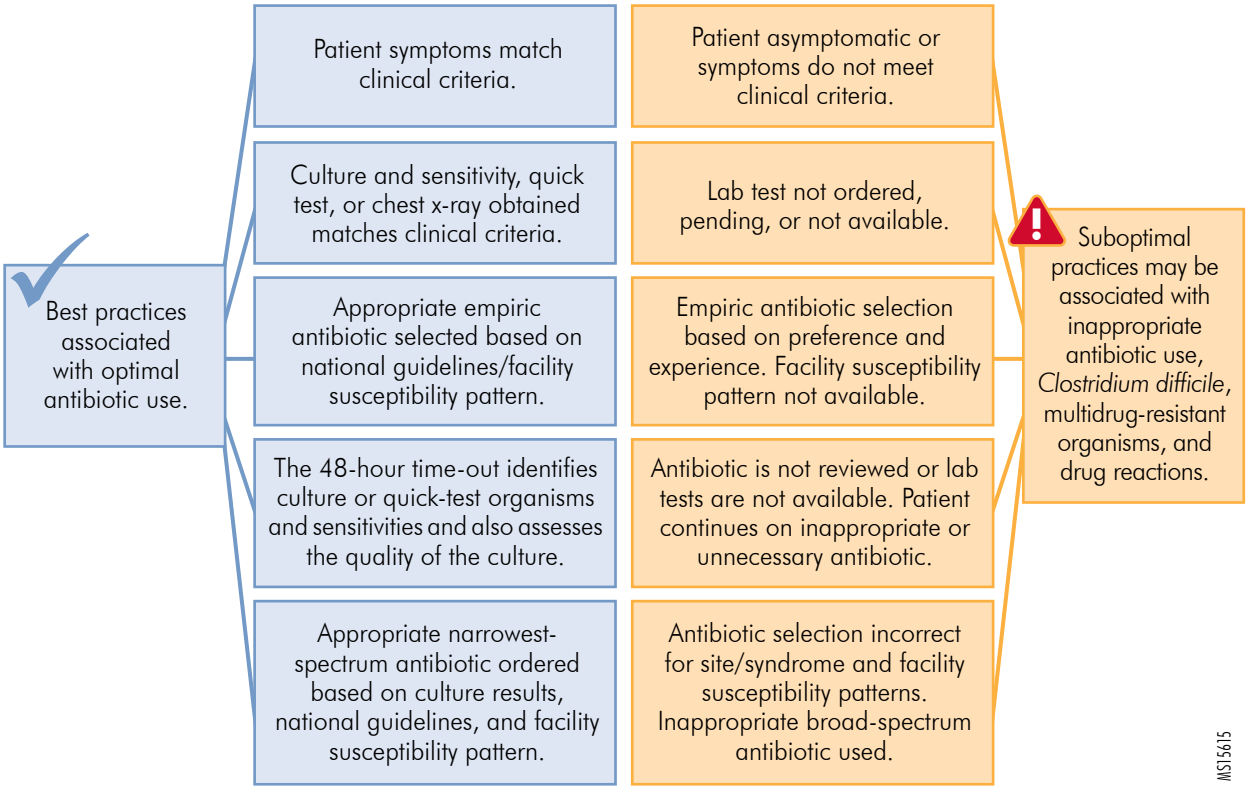
(continued from page 153)

Additional resources from federal and national agencies to assist hospitals and LTCFs implement a facility-specific antibiotic stewardship program are listed in "Antibiotic Stewardship Resources."

LIMITATIONS

For hospitals and LTCFs, reporting does not provide information on treatment changes based on culture results and treatment effectiveness. LTCFs have only been reporting antibiotic usage since April 2014, so trends are not yet apparent. Hospital reporting into NHSN identifies the organism cultured and the sensitivity information but does not collect prescribing patterns. Pennsylvania facilities do not report specific information on the impact of antibiograms and antibiotic stewardship programs. The Patient Safety Authority's 2015 Antibiotic Stewardship Questionnaire was a small sample study of 12 hospitals and 12 LTCFs.

Figure 5. Antibiotic Use Best Practices and Suboptimal Practices



Matches clinical criteria: Symptoms/labs consistent with the Pennsylvania Patient Safety Reporting System and National Healthcare Safety Network clinical criteria for infections.

Appropriate: Right drug, route, dose, and duration; necessity based on national site-specific guidelines; and compatible with facility susceptibility pattern (antibiogram).

Quality of specimens: Poor-quality specimens include mixed organisms, contaminated specimens, low colony count, or incorrect specimen type or retrieval.

Narrow spectrum: The narrowest-spectrum antibiotic is selected to achieve the adequate level of therapy.

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CONCLUSION

Pennsylvania healthcare facilities deal with a substantial number of infections caused by drug-resistant organisms and *C. difficile*, and inappropriate antibiotic usage is a key factor in the development of these infections. Implementing an antibiotic stewardship program will help direct the appropriate use of antibiotics; and improved patient care, decreased liability, and decreased survey deficiencies are powerful arguments for antibiotic stewardship. Antibiotic stewardship programs in both hospitals and LTCFs can be enhanced by identifying opportunities for improvement, engaging teams in implementing the core elements of antibiotic stewardship, using the facility-specific antimicrobial susceptibility data report, and improving prescribing practices.

Acknowledgments

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PROLONGED PRONE POSITIONING FOR PATIENTS WITH ACUTE RESPIRATORY DISTRESS SYNDROME

The Pennsylvania Patient Safety Authority received a request for guidelines and adverse event information about prolonged prone positioning (i.e., 16 or more consecutive hours) for patients with acute respiratory distress syndrome (ARDS). While early application of prolonged prone positioning for patients with severe ARDS has shown a reduction in patient mortality,[1,2] no formal evidence-based guidelines were found in the literature; however, there are contraindications associated with this intervention.

Before prone positioning is implemented, contraindications to consider include increased intracranial pressure, spinal instability, severe hemodynamic instability, recent abdominal surgery or open abdominal wounds, unstable fractures, pregnancy, eye trauma or injury, recent pacemaker insertion, maxillofacial injuries, tracheostomy or tracheal surgery, and extracorporeal membrane oxygenation.[3-5]

Authority analysts queried the Pennsylvania Patient Safety Reporting System (PA-PSRS) database for event narratives from the most recent 10 calendar years, 2005 through 2014, associated with prone positioning (i.e., keywords "prone" or "proning") used as an intervention for patients with ARDS, respiratory failure, or pneumonia. The search returned 167 event reports. Pressure ulcers accounted for the majority (82.6%, n = 138) of events reported, which is consistent with the literature.[1,2,6]

Other events related to prone positioning identified in PA-PSRS reports or in the literature include unintended extubations; broken or displaced teeth; skin tears, lacerations, or abrasions; edema of the face, eyes, or tongue; disconnected tubes or intravenous lines; ventilator-associated pneumonia; cardiac events; pneumothorax; and ischemic optic neuropathy.[1,2,6,7] Authority analysts were unable to determine the relative risks for these events because PA-PSRS does not collect data on the total incidence and duration of prone positioning.

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Simulation Can Improve the Healthcare Systems We Work Within

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Restroom in a restaurant that encourages employee handwashing. An essential resource is missing: soap.

The employees in the restaurant where the photograph was taken are well-trained, capable, and customer-friendly, but I fear they are not washing their hands correctly. I do not doubt their knowledge, skills, or motivation,[1] but I know they cannot wash their hands effectively because an essential resource is missing.

Stocking a restroom with soap is relatively simple; healthcare delivery is immeasurably more complex, but like the situation for the restaurant employees, the resources in our work environments, as well as the design of the environments themselves, impact our ability to provide effective, efficient, safe healthcare. Sometimes obtaining the equipment or supplies our patients need is neither easy nor efficient. In an emergency, we may have to obtain some of the necessary medications from a local automated dispensing system and some from the pharmacy; other supplies, perhaps the intravenous fluids, may have to be retrieved from a different storeroom. Knowing where to find resources is a critical skill required of all healthcare workers and is rarely intuitive.

Maybe the resource we need is not as simple—or concrete—as a standard supply item. Sometimes the perfect process or policy, crafted by intelligent and engaged subject matter experts, does not work well in actual clinical practice. Sometimes the electronic health record system, implemented with conscientious planning, creates a cumbersome workflow for the healthcare provider. Our efforts to provide the best patient care are affected by the systems we work within, and we work within extraordinarily complex socio-technical systems.

These socio-technical systems can be evaluated and enhanced using simulation, which allows us to test and incrementally improve a wide variety of processes. "Simulating" (by demonstrating) handwashing in the restaurant restroom in the example above would have quickly and succinctly demonstrated the missing resource—soap. Healthcare providers, administrators, insurers, and even patients are recognizing the power and versatility of simulation to improve healthcare.

Conceptually, simulation applications fit into three broad domains. The domains are not mutually exclusive but provide a framework for discussion. The first domain of

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simulation applications addresses the capabilities of *individuals*. Simulations can be designed to help individuals develop knowledge, technical skills (such as how to perform procedures), and nontechnical skills (such as how to engage in difficult conversations with patients or perhaps with colleagues). Simulation can be used as a formative process, to enhance the capabilities of individuals, or as a summative process, to assess or test those capabilities.

The second domain of simulation applications addresses the capabilities of *teams*. Simulation can be used to improve the knowledge, technical skills, and nontechnical skills of teams, addressing communication, leadership, delegation, shared mental models, situational awareness, and coordination.

As we increase our understanding of how to use simulation to the best advantage of our patients, there is a third application domain. This new frontier uses simulation to improve the healthcare *systems* we work within. No matter how skilled and engaged an individual or a team is, if the necessary resources are not readily available, the providers cannot accomplish their tasks efficiently or effectively. Capabilities in all three domains are needed for optimal patient care.

Unfortunately, sometimes deficits are discovered during a patient care event. Perhaps the oxygen tank is found to be empty during patient transport.[2] Perhaps the single-use defibrillator pads are not the same brand as the defibrillator. Perhaps the official policy does not take into account information that makes this particular patient's circumstances unique.

The third domain of simulation applications addresses improving the systems that surround (and integrate with) our patient care efforts. When simulations are conducted *in situ*, in actual patient care environments, we may discover and proactively mitigate hazards before they impact an actual patient. Evaluating the ability of employees to wash their hands *in situ*, in the pictured restaurant restroom, would have provided information that could have been missed in an artificial environment, such as a training center. Perceptive observers and astute healthcare providers may identify workarounds, which are, by their nature, clues to problems with the underlying processes. Unsafe conditions identified in this manner can be reported through the Pennsylvania Patient Safety Reporting System (PA-PSRS) using harm score A (unsafe conditions; circumstances that could cause adverse events).[3]

In addition to serendipitous hazard identification, facilities can use simulation as an intentional probe (e.g., to test new or renovated patient care environments). What path would the emergency response team follow to reach the patient promptly? Can members of the response team open all of the appropriate doors? Who will secure the elevator? Who will bring the emergency supply cart? Is the cart located close enough to allow sufficiently rapid retrieval? Changes can be implemented, evaluated, and refined using simulation as a testing process.

We can apply simulation testing even earlier: during planning, before walls are built and headwalls installed. Facilities can conduct simulations in room mock-ups to identify unintended consequences of design and procedural decisions. Will the emergency response buttons be located close enough to the patients' beds? Where are the best locations for computers, physiologic monitoring equipment, and hooks to hang fluids and medications? Will the patients' beds fit through the doorways? Even the best planning relies on "work as imagined"; simulation can bring our understanding closer to "work as done."

We can use simulation, particularly *in situ* simulation, to test and improve patient care processes and identify and mitigate hazards before they contribute to patient harm. Simulation is a powerful and adaptable tool that can be used to help us better understand, and improve, the complex socio-technical systems that impact patient care.

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SHARE PATIENT SAFETY BEST PRACTICES TO KEEP YOUR PATIENTS SAFE

The Pennsylvania Patient Safety Authority is committed to providing consumers of the healthcare industry with information they can use to receive quality care as a patient. Authority data shows the more a patient participates in his or her healthcare, the more likely he or she is to have a positive outcome when using the healthcare system.

Help your patients and their families participate more in their healthcare by making consumer tips available in your waiting rooms or patient areas.

REMEMBER TO ENCOURAGE YOUR PATIENTS TO SPEAK UP!

The Authority has published consumer tips on a variety of topics that include but are not limited to medication errors, wrong-site surgery, color-coded wristbands, C. difficile, methicillin-resistant *Staphylococcus aureus* (MRSA), negative-pressure wound therapy, magnetic resonance imaging (MRI) scans, lower respiratory tract infections, dialysis, and living wills.

PATIENT SAFETY AUTHORITY

An independent agency of the Commonwealth of Pennsylvania

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For more information, visit the Pennsylvania Patient Safety Authority website at www.patientsafetyauthority.org.

Scan this code with your mobile device's QR reader to access the Authority's Patient Safety Consumer Tips.

MS13019

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