Postdischarge Follow-Up Phone Call
The Case

A 63-year-old woman with a history of chronic obstructive pulmonary disease (COPD) presented with several days of a productive cough, shortness of breath, and fever. Based on her clinical history, physical exam, and diagnostic studies, she was diagnosed with community-acquired pneumonia and admitted to the hospital. She was treated with ceftriaxone and doxycycline, intravenous fluids, and supportive care. The patient improved rapidly over 48 hours and was discharged home (she lived with her daughter and grandson) with a prescription for doxycycline (an oral antibiotic) to complete a 7-day course and guaifenesin for a persistent cough.

Over the next few days following discharge, the patient's cough worsened, and the shortness of breath returned despite taking antibiotics. She called her primary care physician (PCP) to schedule an urgent appointment, but he was out of the country, and no appointments were available in the clinic. She also vaguely remembered being given a number at the hospital to call if she had any issues at home, but she could not locate the number in the large stack of papers she was given at discharge. As her symptoms worsened, she contemplated returning to the emergency department (ED).

That afternoon, she received a phone call from the hospital where she had been discharged. At this hospital, all patients discharged from the medicine service are called by a nurse within 3 days. The nurse asked a standard list of questions and learned about the worsening symptoms.

The nurse contacted the discharging team regarding the worsening cough and shortness of breath. The team was concerned that her pneumonia was returning and she was failing the doxycycline treatment. They contacted her local pharmacy and were able to prescribe levofloxacin (a broader spectrum antibiotic). The patient's daughter was able to get the prescription the same day and the patient began taking the levofloxacin.

The nurse who had called previously called again 2 days later to check on the patient. With the change in antibiotics, the patient felt much better with improving symptoms. She did not need to return to the hospital and was able to see her primary care doctor 2 weeks later. The discharging team was convinced that the follow-up phone call by the nurse had definitely prevented a return visit to the ED and potentially a readmission to the hospital.

Amended Lab Results: Communication Slip
The Case

A 25-year-old woman in her first pregnancy was seen at 33 weeks' gestation with new onset hypertension and a blood pressure of 140–150/90 mm Hg. Urinalysis revealed 2+ protein (100 mg/dL) on a random urine dipstick, and a urine protein/creatinine ratio was 0.5 mg/dL (normal up to 0.3 mg/dL). With a potential diagnosis of preeclampsia (new onset hypertension and proteinuria during pregnancy), she was admitted to the hospital for observation, fetal testing, and laboratory studies, including a 24-hour urine protein collection. In the absence of proteinuria, this syndrome is considered gestational hypertension, a less serious diagnosis, managed as an outpatient with either observation or antihypertensive medications.

The laboratory studies and 24-hour urine collection for proteinuria were checked by the obstetrics/gynecology (OB/GYN) resident in the hospital electronic medical record (EMR), where they were reported as normal. Assuming a diagnosis of gestational hypertension, the resident initiated discharge planning, including management with antihypertensive medications. However, the attending physician, noting the inconsistency between the dipstick proteinuria and negative result on the 24-hour urine, rechecked the laboratory results. Upon recheck, he observed that the laboratory had amended the report confirming the 24-hour protein collection was actually elevated and abnormal, confirming the diagnosis of preeclampsia. The patient's discharge was canceled.

In this instance, the amended laboratory result was recognized prior to discharge and a new management plan, which involved continued observation in the hospital, was implemented. No harm was done to the patient. She remained in the hospital for 5 days and was induced at 34 weeks for worsening preeclampsia. The mother and infant ultimately did well.

On later review, it was determined that the nature of this error centered upon the communication of an amended test or report. Although this hospital's policy mandated that the inpatient unit be notified about amended laboratory reports, notifying the physician was not part of the mandate. Consequently, the ordering physician was not alerted to the change in the laboratory report.

Poorly Advanced Directives
The Case

Cared for at home by his wife and family, an 82-year-old man with multiple chronic medical conditions described his overall health as declining recently. He saw a primary care physician, received home nurse visits, and had recently been referred to a geriatrician. The primary physician realized the need for end-of-life discussions but always ran of out of time due to the complexity and acuity of the patient's medical conditions.

One afternoon, the patient presented to the emergency department (ED) and was admitted to the hospital for delirium, an underlying infection, and acute kidney injury. During the hospitalization, the primary team engaged the patient and his family in advanced directive discussions, and the patient ultimately decided (with his family's blessing) on a do-not-resuscitate/do-not-intubate (DNR/DNI) order. After treatment for his infection, he returned to his baseline health status and was discharged home. The change in code status was communicated to the patient's primary physician.

Two days later, the patient returned to the same ED with altered mental status and impending respiratory failure. En route, the paramedic asked the distraught family members about advanced directives and they expressed a desire that "everything be done" to save their loved one. Despite the previously documented DNR/DNI order, the patient was intubated and remained on mechanical ventilation for 3 days. The family ultimately decided to withdraw life-sustaining interventions, and the patient died peacefully soon afterward.

E-prescribing: E for error?
Case & Commentary- Part 1:

A 63-year-old man with multiple medical problems was seen by his primary care doctor for a routine follow-up appointment. Despite receiving psychotherapy, the patient admitted that he continued to struggle with anxiety. In light of these complaints, the primary care doctor elected to prescribe an antianxiety agent, alprazolam. The clinic had just implemented electronic prescribing—the ability to electronically transmit a new prescription to a pharmacy. The physician reassured the patient that he didn't need a paper prescription and could simply go to the pharmacy to pick up his medications.

Electronic prescribing (e-prescribing) is the transmission, using electronic media, of prescriptions or prescription-related information from a prescriber (physician, nurse practitioner, etc.) to a pharmacy. The information may flow to a number of parties in addition to the pharmacy, such as a pharmacy benefit manager, health plan, or an intermediary, such as an e-prescribing network (a large centralized system to process electronic prescriptions). In its simplest form, as in this case, e-prescribing involves two-way transmissions between the point of care and the pharmacy.(1) E-prescribing is intended to replace writing out, faxing, or calling in prescriptions, and its many proposed benefits include safer, more efficient, and more cost-effective care.(2)

Because of these potential benefits, the federal government has put in place major incentives for providers to adopt e-prescribing (3) (Medicare Modernization Act, 2003) and to adopt electronic health records (EHRs) (4) through the meaningful use incentives (American Recovery and Reinvestment Act, 2009). According to a health information technology (IT) stimulus report published in 2009, the health IT incentives included in the federal stimulus law will significantly increase the rate of electronic prescribing and save $22 billion in drug and medical costs in the next decade.(5) The authors report that the e-prescribing savings would come from (i) informing doctors at the point of prescribing about the cost and clinical characteristics of medication options and letting doctors select the best and most affordable drugs, including more generic prescriptions; (ii) providing doctors with patients' medication histories to prevent harmful drug interactions and duplicate prescriptions; (iii) notifying physicians of pharmacy options, including mail-order and retail drug stores, to help curb patients' out-of-pocket costs; and (iv) reducing wait times and errors related to illegible handwriting by transmitting prescriptions electronically to pharmacies. The report also estimates that the increase in e-prescribing could prevent 3.5 million medication errors and 585,000 hospitalizations by 2018.

A recent literature review shows substantial evidence that e-prescribing can improve the safety, efficiency, and cost-effectiveness of patient care.(2) Several previous studies demonstrated the benefits of integrated clinical decision support, which requires the availability of accurate and complete pharmacy eligibility, benefit, and formulary information at the point of care. The availability of insurance coverage and copay information at the point of care can reduce the number of calls to providers seeking information for changes in medications to covered agents or requests for prior authorization information. Furthermore, the copay information offers an opportunity for providers to engage patients in their own care by involving the patient in deciding what agent the patient will receive based on cost and benefits. In addition, studies showed that clinical decision support systems change prescribing behavior and significantly lower prescription drug costs. In a Massachusetts study, the cost savings had a potential of reaching $845,000 per 100,000 patients.(6,7) A study at the Henry Ford Health System found

that e-prescribing was associated with an increase in the prescribing of generic drugs, lower administrative costs, and reductions in adverse drug events.(8)

While these benefits have been realized in many locations, successful e-prescribing on a truly broad scale has not been achieved. More widespread adoption depends on the coordinated actions of many stakeholders and the continuing evolution of standards, capabilities, and competencies to ensure that robust and accurate transmission of e-prescribing data and workflow processes are the rule rather than the exception.

Across the United States, the number of prescribers sending electronic prescriptions has increased since 2008. Recently, with the initial rollout of the meaningful use standards and incentive payments, this growth has been accelerated by adoption of EHRs. Standalone e-prescribing systems, which can create and refill prescriptions for individual patients, manage medications and view patient history, connect to a pharmacy or other drug dispensing site, and integrate with an electronic medical record (EMR) system, have actually dropped slightly, likely due to movement toward EHRs. The Surescripts National Progress Report is the primary source of information for e-prescribing adoption and use.(9) By the end of 2010, the Report found that there were 234,000 active e-prescribers, representing 34% of all office-based physicians in the nation. About 20% of eligible prescriptions were sent electronically in 2010, versus 12% in 2009. Drug Enforcement Administration regulatory changes that give prescribers the option of issuing prescriptions for controlled substances electronically should drive future growth of e-prescribing.

Case & Commentary- Part 2:

The clinic nurse entered the medications into the computer system. However, while entering the prescription for alprazolam, she inadvertently entered an additional medication, atenolol, a prescription intended for a different patient. Quickly recognizing her error, she deleted the e-prescription in the computer, assuming the order had been canceled.

Unfortunately, despite her efforts to cancel the atenolol order, the e-prescription went through to the pharmacy. When the patient arrived at the pharmacy, he was given both medications. Although he thought it was a bit strange to receive two medications for his problem, he was willing to do anything to reduce his anxiety. Consequently, he took both medications as instructed. A few days later, during his cardiology appointment, the error was noted, and the atenolol was discontinued.

Health IT, including e-prescribing, creates opportunities to improve patient safety that do not exist in paper-based systems. For example, paper-based systems cannot detect and alert clinicians of drug–drug interactions, whereas electronic decision support systems can. While evidence suggests that implementing new technology (including e-prescribing) improves patient safety, research has also demonstrated the potential for new technologies to result in unintended consequences.(10-17) In the case of e-prescribing in the ambulatory setting, chief among these unintended consequences is the potential for new errors introduced by computer-generated prescriptions.

A recent study reported the frequency, types, and causes of errors associated with outpatient computer-generated prescriptions.(18) Of 3850 prescriptions reviewed in the final sample originating from three different states, 452 (11.7%) contained 466 total errors, of which 163 (35.0%) were considered potential adverse drug events.(18) The most common error was omitted information (60.7% of all errors and 50.9% of potential adverse drug events). The information omitted most often was duration, dose, or frequency. Omission errors are relatively easy to overcome by designing an e-prescribing system where fields must be filled before a prescription can be completed. However, electronic systems have a more difficult time addressing certain safety issues, such as wrong patient or wrong diagnosis.

To maximize the benefits of e-prescribing, including improved transmission and reduced medication errors, both physician practice and pharmacy staff must use the system routinely to gain experience with it. However, not all physicians who implement health IT use the e-prescribing application to generate and transmit new prescriptions or renewals consistently. Similarly, not all community and mail-order pharmacies have the ability to receive new prescriptions electronically or to send electronic renewal requests. Some pharmacies have faced an additional challenge because they sometimes need to manually enter or edit prescription data into their own computer system, despite using an e-prescribing system.(19)

Several important steps have been proposed to improve the safety of e-prescribing. Three prescription fields commonly requiring manual manipulation include medication name, quantity, and patient instructions (also known as "Sig"). To address challenges related to drug name, experts have recommended that the National Council for Prescription Drug Programs (NCPDP) consider using a new technical standard, RxNorm, a standardized nomenclature for clinical drugs, in place of National Drug Code (NDC) Directory codes as the main identifier. The NDC for a drug is a unique identifier specific to a manufacturer, strength, dosage form, and package size. RxNorm could help reduce drug selection inefficiencies and potential errors by better conveying physicians' intent without requiring them to overspecify their choice. For example, from a drop-down menu in the e-prescribing system, a provider might select "minocycline tablet, 100 mg" that is considerably more expensive than a capsule. In the past, the provider would have written for "minocycline 100 mg" and allowed the pharmacist to select "capsules" in the system because of the cost difference. A pharmacist cannot change from tablets to capsules without calling the provider for authorization.

To improve on the quality of patient instructions in e-prescribing, the Structured and Codified Sig Format is being incorporated into the NCPDP SCRIPT transaction standards, moving from free text to a structured format. Currently, many e-prescriptions received at the pharmacy need to be rewritten in order to be understood by patients. For example, a provider will type patient instructions using the Latin Sig "t.i.d." in the text; the pharmacist will then need to replace "t.i.d." with "three times a day" so that the patient can understand the instructions. Moving from free text to a structured format for transmitting prescriptions between provider systems and pharmacy systems will allow providers to write more complete, clinically accurate, and unambiguous instructions. E-prescribing vendors could also explore ways to improve system design to mitigate existing problems with conflicting Sigs. Other recommendations include providing additional physician training and developing best practices to encourage physicians to send or call in amended prescription information to the pharmacy to avoid repeating mistakes.

In this case study, the primary care provider expected that the new e-prescribing system would deliver efficient and effective information in a timely fashion with little effort. Unfortunately, the clinic nurse entered the atenolol without checking the name and date of birth on the patient profile and then, after realizing her mistake, did not verify that the medication was deleted from the medication list before or after transmission to the pharmacy. In addition, the system allowed the nurse to prescribe on behalf of the doctor and transmit without first being verified by the doctor. The degree to which e-prescribing software includes forcing functions requiring prescribers to review order entry before transmission varies widely among different computerized prescribing systems. A function that requires the prescriber to review all prescriptions (including new, renewals, or changes) before sending would have listed the atenolol as a new prescription ready for transmission to the pharmacy. A return receipt of prescriptions that reach the pharmacy would also have alerted the nurse that two prescriptions arrived at the pharmacy. A required step to confirm deletions would also be useful, but could add extra steps to a workflow that is already complicated by new technology.

In addition to system functionalities that could have prevented dispensing the wrong medication to the wrong patient, many provider-focused interventions may be necessary to optimize medication safety. Providers need to continue to inform their patients of the name and appropriate use of medications when prescribed. If a patient is not sure why a particular medication was prescribed, they should be encouraged to talk to their doctor or pharmacist. Providing and reviewing a current medication list with patients as part of the visit summary would also help to identify discrepancies when they occur before the patient leaves the office. The sharing of patient care summaries at transitions of care as a requirement for meaningful use incentives should extend to include the pharmacist as a specialist in the care of each patient. Sharing such summaries can alert the pharmacist to treatments without appropriate diagnoses, as well as provide valuable clinical information to monitor management of chronic drug therapies.

Some steps health care providers should take to maximize safe e-prescribing performance in the future include:

Missing the Point—Eye Injury

The Case

A 31-year-old woman presented to the emergency department (ED) after suffering multiple lacerations during an assault. The patient stated it was unclear what weapon the assailant had used, but she thought it was a sharp blade of some kind. She had two linear lacerations on her right arm that were superficial and did not require suturing.

She also had a 3 cm linear laceration over her right eyelid. She denied any pain in the eye or vision changes. On examination, her pupillary response and ocular movements were intact. The ED provider did not formally check her visual acuity but asked her to close each eye separately and asked her if she noted any change in her vision (which she did not). The ED provider everted the lid (turned it up to see underneath) and the laceration did not appear to extend through the eyelid. He performed a fluorescence examination and did not note any corneal abrasion or evidence of injury to the globe. The eyelid laceration was sutured without complication. An ophthalmologist was not consulted.

The patient presented to a different hospital 10 days later complaining of eye pain. At that time, she reported to providers that her vision had been poor in the right eye since the attack. She was referred to an ophthalmologist and found to have a ruptured globe. She was taken to the operating room for repair and found to have a 4 mm cut in the cornea that extended 7 mm into the sclera (globe of the eye). This laceration was directly beneath the laceration in her eyelid. The defects in the cornea and sclera were repaired, but she had some residual pain and mild visual deficits after the procedure.

More Treatment—Better Care?

The Case

The patient is a 27-year-old female who presented to a 250-bed community hospital with numbness and tingling of her hands and feet. She was promptly evaluated by a neurologist and diagnosed with Guillain-Barré syndrome. Once the diagnosis was established, she was started on plasmapheresis using a Quinton catheter placed by interventional radiology. She received six treatments over 12 days, then another two treatments a week later. The patient's indwelling catheter remained in for the entire course of therapy. Toward the end of the 3rd week of treatment, she developed a fever of 101 degrees and an elevated white blood cell count (WBC). Vancomycin was started empirically and the Quinton catheter removed for a presumed line infection. After 48 hours, she was afebrile, and her WBC returned to normal. Blood cultures were negative.

At the time that the diagnosis was made, the Medical Director of Case Management contacted the neurologist to provide him with the 2010 evidence-based guidelines on the use of plasmapheresis in Guillain-Barré syndrome published by the American Society of Apheresis (http://www.ncbi.nlm.nih.gov/pubmed/20568098). This guideline recommends five to six treatments over 10–14 days, with data indicating that additional treatments are only indicated for relapse. The Medical Director reviewed the risks of plasmapheresis with the physician and asked him to follow the recommended treatment course rather than treating the patient as he had treated the previous Guillain-Barré syndrome patient, who had received 20 treatments over 40 days. At that time, when the neurologist and nephrologist who ordered this were asked why so many treatments were given, they both responded that the patient was improving so they felt that more treatments would help him recover even more.

Order Interrupted by Text: Multitasking Mishap

The Case

A 56-year-old man with dementia was admitted to an academic medical center from a nursing home for replacement of a percutaneous endoscopic gastrostomy (PEG) tube, which had become dislodged and was no longer functioning. The patient had a distant history of an intracardiac mural thrombus and was on long-term anticoagulation with warfarin. At the time of admission, his international normalized ratio (INR) was 1.4 (the INR is a measure of anticoagulation intensity in patients treated with warfarin). Since the goal INR was 2.0–3.0, he was not adequately anticoagulated and was at risk for stroke from the cardiac thrombus.

He underwent successful PEG tube replacement on hospital day one. Later that day, the resident on the team decided to prescribe warfarin 10 mg per day (an increase over his usual dose of 5 mg/day) for 3 days to try to increase his INR into the target range.

On hospital day two, when the resident and intern were rounding with the attending, they discussed the plan for ongoing anticoagulation. As the patient had been on warfarin for many years, the attending wanted to confirm that the intracardiac thrombus was still present to justify ongoing anticoagulation. The attending stated clearly to the resident that they should stop the warfarin until they could obtain an echocardiogram of the heart.

This academic medical center had a robust computerized physician order entry (CPOE) system that allowed providers to enter orders using handheld devices and smartphones. While the team was rounding with the attending, the resident was able to enter orders in real time as team members evaluated patients.

When the attending stated they should stop the anticoagulation for this patient, the resident began to enter the order into her smartphone. As she was entering the order, the resident received a text message from a friend regarding an upcoming party, and she confirmed her attendance through text messaging. The team moved on to the next problem.

The resident never completed the order to discontinue the warfarin, and the patient continued to receive 10 mg each day for the next 3 days. Because everyone on the team thought the medication had been stopped, no one checked the patient's INR. In addition, because of the robust CPOE system, neither the intern nor resident reviewed the medication list for the next few days so no one recognized that the patient was still receiving the warfarin.

On hospital day four, the patient developed shortness of breath, tachycardia, and hypotension (low blood pressure). An echocardiogram revealed hemopericardium (blood filling the sack around the heart) with evidence of tamponade (pressure from the blood limiting his heart function). He required emergency open heart surgery (pericardiocentesis and pericardial window) to remove the blood. His INR was 8.5 at the time, indicating he was overanticoagulated—his blood was too thin. The team felt he had suffered spontaneous bleeding into the pericardium from receiving the extra doses of warfarin.

The patient survived the operation and ultimately was discharged back to the nursing home after a 3-week hospital stay.

Liver Failure After Chemotherapy: Did We Forget Something?

The Case

A 51-year-old Cantonese-speaking female with a history of stage 3 breast cancer had been receiving neoadjuvant chemotherapy. Of note, the oncology service had checked her liver function tests prior to chemotherapy, and they were found to be normal. Hepatitis serologies were not checked prior to administration of chemotherapy. Well into receipt of her chemotherapy, the patient complained of fever, rash, and bone pain and was subsequently admitted to the general medicine service. Admitting labs were notable for a mild transaminitis,

but repeat testing of liver function tests was not performed during this hospitalization nor were hepatitis serologies checked. Cultures of blood and urine were negative, and her symptoms were attributed to pegfilgrastim (fever, bone pain) and paclitaxel (rash). Two days later, the patient presented with abdominal pain and AST of 9986 U/L, ALT 4366 U/L, and an INR of 2.3. Shortly thereafter, she became encephalopathic, requiring endotracheal intubation. Subsequent review of her outside records revealed chronic hepatitis B, diagnosed 15 years earlier, with surface antigen positivity. The patient had no knowledge of her hepatitis B diagnosis. The patient was started on entecavir for her reactivation of hepatitis B and transferred to a liver transplant center. Luckily, she has made a complete recovery from her liver failure and is receiving chronic therapy for her hepatitis B, along with treatment for her breast cancer.

Analysis of the case revealed that the oncology department lacked a standard practice to check hepatitis serologies on patients prior to initiation of chemotherapy. Moreover, the admitting team erred by not considering the possibility of hepatitis as the cause of the patient's fever, rash, and transaminitis.

The Case for Patient Flow Management

The Case

A 52-year-old woman with a history of major depression, posttraumatic stress disorder, and alcohol abuse was hospitalized for suicidality in March. After several weeks of inpatient treatment, the patient stabilized and was discharged back to her (outpatient) psychiatrist, a resident in the final year of training and due to graduate at the end of June. The patient saw this physician multiple times during April, May, and early June. At her last visit before the academic year-end transfer, the patient was not given a follow-up appointment because the clinic schedules for incoming residents, who would begin on July 1st, were neither finalized nor operational in the electronic scheduling system. Per existing protocol, the patient was asked to contact the clinic in July to set up an appointment with her new psychiatrist.

The patient did not call to schedule an appointment and was not prompted to do so. The incoming resident psychiatrist recognized this a month after starting (the resident had been given a brief sign-out by the outgoing resident that included this patient's tenuous condition) and contacted the patient to set up an initial visit. Because the resident's schedule was already booked through August, the patient was not seen until early September, at which point the patient stated that she felt better. She set up another appointment for later that month and told the resident that her primary care provider had given her sufficient medication refills.

Unfortunately, the patient did not make her second scheduled appointment. The patient's daughter notified the resident that the patient had died after driving her car into a tree. Autopsy results indicated alcohol and drug intoxication. While there was no way to be certain, a review of the case by the involved clinicians raised the possibility that the patient's 3-month hiatus (from last appointment with the outgoing resident in early June until the appointment with her new physician in early September) may have contributed to her demise.

Near Miss with Bedside Medications

The Case

A 77-year-old man on anticoagulation for a history of recent deep venous thrombosis presented to the emergency department (ED) with dizziness. In the ED, he had a heart rate of 44 beats per minute, which was felt to explain his symptoms. On further history, he revealed that he had recently increased his beta-blocker, a blood pressure medication that slows the heart.

The ED physician was concerned about the prospect of his heart rate slowing further. She ordered a syringe of atropine be placed at the bedside so it could be injected urgently if he needed it (atropine is a powerful anti-cholinergic medication that is given in emergent situations to raise the heart rate; it can cause rapid heart rate and severe confusion if used inappropriately).

Fortunately, the patient's heart rate improved while he was in the ED, and the plan was to discharge him home on a lower dose of his beta-blocker. Of note, his level of anticoagulation (i.e., his international normalized ratio [INR]) on warfarin (oral blood thinner) was found to be low. So, along with decreasing his beta-blocker dose, the plan included having him inject himself with low-molecular-weight heparin (LMWH) at home for a few days to ensure adequate anticoagulation while waiting for his INR to rise into the target range.

The pharmacist came to the ED to teach the patient how to do the subcutaneous LMWH injections, which would be required twice a day. The patient seemed to have some difficulty in understanding the medications, but the pharmacist felt comfortable with the plan to discharge him to home. She gave him 10 syringes pre-filled with the appropriate dose of LMWH to take home until he could be seen in the anticoagulation clinic.

When the patient was packing up everything from the ED, he took not only the boxes of LMWH, but also the box with the syringe of atropine that was still sitting by his bedside.

At home the next day, he tried to inject himself with the atropine but the liquid squirted all over his stomach (the atropine syringe does not have a needle as it is usually injected directly into a peripheral IV). Confused, he called the pharmacist. When the pharmacist had him spell the name on the box, she realized what had happened and had him discard the atropine. Fortunately, the patient was not harmed.

The Dropped "No"
The Case

A 62-year-old man with a history of cirrhosis was admitted with increasing abdominal girth and swelling in his legs. Because the leg swelling was somewhat more pronounced in his right leg, the team ordered an ultrasound to rule out a deep venous thrombosis (DVT) or blood clot. The ultrasound showed no DVT—this finding was communicated verbally to the primary team. However, on dictation, the first word "No" was obscured by the dictation system click that occurs when the speaker initiates recording. As a result, the truncated report read, "DVT is seen…" rather than "No DVT is seen…" Based on the verbal communication with the radiologist, the primary team proceeded under the (correct) understanding that the ultrasound had been negative.

Unfortunately, when the patient developed a heart arrhythmia (atrial fibrillation) two nights later (a Saturday), the night float resident looked at the (incorrect) report. Believing that the patient had a DVT, the resident appropriately worried that part of the blood clot had broken off, travelled to the lung, and caused a pulmonary embolus. When the primary team returned in the morning, the night float alerted them to this read. The primary team's resident paged radiology and spoke with the on-call radiologist (a resident) who was at another site and, therefore, did not have access to the image. The on-call resident was able to pull up the report—which appeared to indicate that there was a DVT—and reassured the primary team that the original reader was one of the best.

Because the patient was a poor candidate for anticoagulation, a filter was placed in the inferior vena cava (IVC)—a major blood vessel that transports blood to the lung. Concerned that a read had changed (from the verbal sign-out the radiology attending had given the resident to the official read) without a call to the team, the attending on the primary team filed an incident report. When the radiologist was contacted about the incident report, she remembered the patient and that he did not have a DVT. She was able to listen to the dictation and hear the click that obscured the "No" at the beginning of the report. Once the mistake was discovered, the IVC filter was removed (about 2 days after it was placed). Fortunately, the patient tolerated the procedures well.

Mobility Lost in the ICU

The Case

A 56-year-old man with insulin-dependent diabetes, hypertension, and chronic kidney disease was admitted to a trauma service after injuries suffered from an assault and battery. The patient's injuries included a left shoulder dislocation and a minimally displaced fracture of a thoracic vertebral body without any neurologic compromise. Shortly after admission, the patient developed altered mental status and increasing hypoxia, requiring mechanical ventilation. This led to a prolonged intensive care unit (ICU) stay for respiratory failure from an ischemic cardiac event and aspiration pneumonia.

Following 6 weeks of hospitalization, the patient was significantly deconditioned despite slow and steady improvements overall. As he was transferred out of the ICU, the physical therapist (PT) was consulted to assist in the rehabilitation process. After reviewing the medical records, the PT noted the initial shoulder injury on admission. In addition to providing a general assessment, the PT expressed concern that the shoulder injury had now progressed to involve significant limitation in range of motion and function with associated pain. The PT felt this may have been preventable with earlier and aggressive physical therapy interventions while in the ICU.

Communication Failure—Who's in Charge?

The Case

A 20-month-old boy was admitted to the intensive care unit (ICU) following a Fontan surgical procedure for hypoplastic left heart syndrome. The child initially made good progress. He was weaned from inotropic support and tolerated enteral liquids on the first postoperative day. That

evening the child developed respiratory distress with acidosis and fever. The resident physician notified the on-call ICU attending, who came in from home to manage the child's respiratory status. The surgeon called from home to check on the child at midnight and spoke with the resident, who indicated that the child had suffered respiratory deterioration and that the ICU attending was at the bedside managing the patient. The surgeon requested an echocardiogram but did not speak directly to the ICU attending, and the cardiology fellow who performed the echocardiogram communicated results to the surgeon, the child's attending of record for this admission.

After stabilizing and monitoring the child's respiratory status, the ICU attending returned home. The resident communicated with the ICU attending by phone and pager through the rest of the night, as the child's status was not improving as expected. The resident assumed the ICU attending was communicating with the surgeon, and did not contact the surgeon or cardiologist. The child suffered a cardiac arrest at 7:00 AM from low cardiac output. The surgeon and cardiologist arrived in the ICU for rounds just minutes before the arrest. Despite aggressive resuscitation efforts, the child suffered massive brain injury and subsequently died.

In post-event debriefings, staff identified several issues in the care of this patient. The attending surgeon and cardiologist were only briefed on the initial respiratory distress and did not have a complete picture of the child's condition; similarly, the ICU attending focused on stabilizing the child's respiratory status and missed his low cardiac output. There was confusion among the resident physicians and nursing staff about who was coordinating the child's care, and a lack of awareness of how to ensure effective team communication when multiple attending physicians are involved in caring for a child. The residents and nurses noted that having the ICU attending physician at the bedside left them with the impression that the surgeon and cardiologist were being updated about the child's continuing deterioration. The nurse observed the resident on the phone frequently discussing the case, and did not realize that no one was communicating with the other physicians involved. The resident and nurse either did not recognize the need to escalate the case beyond the ICU attending, or were not comfortable doing so. The surgeon and cardiologist were under the impression the child's issues were respiratory, not multi-system, and because of this, as well as the belief that the attending ICU physician was in-house throughout the night, neither of them recognized a need to go to the hospital to evaluate the child.

Central, not Epidural
The Case

A 55-year-old man with lung cancer recently had the lower lobe of his left lung removed. Post-operatively, he was awake, alert, and oriented to time, place, and person. He was, however, malnourished from his cancer and experiencing significant pain at the surgical site. He had a chest tube and a urinary catheter in place, but was breathing on his own. The patient's pain was well controlled with fentanyl and bupivacaine administered through an epidural catheter. He was receiving total parenteral nutrition (TPN) and lipids through a central venous catheter inserted in his left jugular vein.

Nurse A, assigned to the patient, left the unit for her regularly scheduled break. Before leaving, she prepared a new bottle of lipids and left it at the bedside, as the current bottle would run out

while she was off the floor. When the old bottle of lipids was empty, Nurse B, covering the patient during the primary nurse's break, inadvertently attached the new lipid bottle to the Y-site of the epidural tubing rather than the central venous line.

Upon her return, Nurse A noted that the new bottle of lipids was infusing but did not check the lines. Lipids infused into the epidural catheter for several hours. The problem was not discovered until the nurses on the next shift made rounds and checked the patient's tubing. Fortunately, the patient experienced no adverse effects from the infusion of lipids into his epidural space.

Situational (Un)Awareness

The Case

A 75-year-old man was admitted on a Tuesday evening with abdominal pain, jaundice, and elevated liver function tests, including a bilirubin of 10.3 mg/dL. His CT scan demonstrated clear signs of acute cholangitis (an infection in the biliary tree, in this case due to blockage by gall stones). An order for IV antibiotics every 6 hours was placed electronically at 8:00 PM, and arrangements were made for an endoscopic retrograde cholangiopancreatography the following day to relieve the obstruction. On Wednesday morning rounds, the attending physician learned that the patient had not yet received any doses of antibiotic.

Subsequent analysis of the delay found the following: When an order is entered in the computerized provider order entry (CPOE) system, the computer assigns it a "next logical time for administration." In this case, the order placed at 8:00 PM on Tuesday was assigned a "next logical administration time" of Wednesday at 00:00. The pharmacist, uncomfortable with a 4-hour delay, manually overrode midnight and entered "9:00 PM," but the computer converted that to 9:00 PM on Wednesday, a change he did not notice. Nurses from two shifts—the night shift on Tuesday and the day shift on Wednesday—cared for this seriously ill patient, and none questioned why he wasn't receiving antibiotics or why the antibiotics were not scheduled to be given until 24 hours after admission.

The Safety and Quality of Long Term Care

The Case

A 64-year-old woman with a past medical history of morbid obesity, type II diabetes mellitus, recurrent urinary tract infections, and depression was a resident of a long-term care facility (a skilled nursing facility) due to multiple chronic illnesses. At baseline, she used a wheelchair for mobility and required some assistance with activities of daily living (ADLs).

During an unassisted transfer from her wheelchair to her bed she slipped and fell. She immediately complained of hip pain and was transferred to an acute care hospital. She was found to have a left hip fracture as a result of the fall and underwent an uncomplicated surgical repair. She was ultimately readmitted to the original skilled nursing facility with severely limited mobility secondary to the surgery. At the time of readmission, she was essentially bedbound, unable to transfer to a chair or her wheelchair.

A few weeks later, she continued to remain bedbound with little progress in her functional status. One morning when the nurse was delivering her morning medications, the patient was found to be confused and combative where previously she had been alert, oriented, and always very pleasant. She was febrile to 102°F and had a blood pressure of 110/70 mm Hg, which was lower than her usual. Because of concerns for an acute infection, she was transferred to an acute care hospital.

At the hospital, a full examination revealed a very deep pressure ulcer in her sacrum (stage IV full thickness ulcer), which had developed at the long-term care facility after her hip fracture. Unfortunately, likely secondary to an infection of the pressure ulcer, she developed septic shock and died 3 days later despite maximal efforts.

A Seasonal Care Transition Failure

The Case

A 70-year-old healthy man presented to his primary care doctor—a third-year internal medicine resident—for routine follow-up. The resident was in his final month of training, and would leave the institution for fellowship at the completion of his residency.

After discussion, the provider sent off a prostate-specific antigen (PSA) test to screen the patient for prostate cancer. The patient's past PSA tests had always been normal. Unfortunately, this time his PSA returned markedly elevated at 83 ng/ml—a level at which cancer is a near certainty. The patient was not immediately notified as the electronic alert (via an existing electronic health record) was sent to the patient's primary care provider. However, because this provider had graduated and left the program before the alert returned, and there was no system to ensure smooth handoffs to oncoming residents, the alert went unread.

Eight months later, the patient presented with new onset low back pain. Imaging tests confirmed metastatic prostate cancer and also uncovered the missed follow-up of the elevated PSA.

Patient Safety and Adherence to Self-Administered Medications

The Case

A 30-year-old man, with HIV and a recent diagnosis of central nervous system (CNS) toxoplasmosis, returned to the emergency department (ED) of a community hospital for the third time in two weeks.

Two months earlier, the patient was diagnosed at a university hospital with toxoplasmosis, based on characteristic brain lesions on MRI and presence of the parasite's DNA in his cerebrospinal fluid (via polymerase chain reaction). He was discharged on standard treatment for CNS toxoplasmosis (pyrimethamine, sulfadiazine, and folinic acid) and HIV disease (anti-retroviral medications). Two weeks before this ED visit, he was admitted to the community hospital with seizures. Imaging showed no change in the brain lesions. He was discharged on the anti-seizure medication phenytoin. The day before this ED visit, the patient had a second seizure that led to a motor vehicle accident. He was brought to the community hospital's ED, an MRI of his brain showed no change, and he was discharged home.

He returned the next day, this time complaining of new onset right-sided weakness. Compared to the MRI one day earlier, CT showed increased swelling of his brain and compression of his frontal lobe. Medical staff were now worried that this patient had treatment-resistant toxoplasmosis or another brain disease, and transferred him to the university hospital where the original diagnosis had been made.

During the workup at the university hospital, the patient said that his symptoms had improved after he was initially discharged two months earlier. However, one month earlier, he ran out of his medications for toxoplasmosis. He did not have any refills and did not know how to obtain refills. He continued the anti-retroviral HIV medications for which he had refills. Soon after stopping the toxoplasmosis medications he began to experience headaches, then seizures and other symptoms that led to his multiple presentations over the prior two weeks. The patient was restarted on appropriate therapy for CNS toxoplasmosis and his symptoms improved.

Watch the Warfarin!
Case & Commentary—Part 1:

A frail 80-year-old man with a past medical history of dementia, falls, and atrial fibrillation presented to the hospital with confusion and weakness. Based on his examination, laboratory tests, and chest x-ray, he was diagnosed with community-acquired pneumonia. He was treated with ceftriaxone and doxycycline (antibiotics) for his pneumonia. He was on long-standing anticoagulation with warfarin for his atrial fibrillation, and this medication was continued while he was in the hospital.

After 48 hours he was clinically improved and back to his baseline, according to his daughter. Of note, his international normalized ratio (INR) was 2.4 at the time of discharge so he was appropriately anticoagulated on the warfarin. He was prescribed oral doxycycline for 5 more days for his pneumonia. There were no changes made to any of the medications he was taking before the hospitalization, including the warfarin.

A week later, in routine laboratory testing with his primary care doctor, he was found to have an INR of 4.0 (an abnormally high level that is associated with an increased risk of bleeding). Fortunately, even though he had fallen twice in the previous week, he had no significant bleeding.

Warfarin is a commonly prescribed oral anticoagulant, with 30 million prescriptions written per year in the United States alone.(1) When taken correctly, it effectively reduces the risk of thromboembolism, including the risk of stroke in patients with atrial fibrillation (the indication for this patient).(2) Unfortunately, warfarin has unpredictable, weight-independent therapeutic effects due to complexities of metabolism, diet, and interaction with other medications.(3) As a result, patients must have regular measurements of their international normalized ratio (INR) and frequent adjustments of warfarin dosing to keep their INR in a therapeutic range, most commonly between 2.0 and 3.0. Subtherapeutic (below-target) INRs result in an increased risk for thromboembolism, while supratherapeutic INRs raise the bleeding risk.(4) Patients face particular risk for both subtherapeutic and supratherapeutic INR levels during hospitalization due to the initiation or continuation of warfarin in the context of medication changes, acute illness,

dietary adjustments, and care transitions; INR control has correspondingly been shown to be worse in the peri-hospitalization period.(5) Warfarin is responsible for 8% of all adverse drug events following hospital discharge, including more than one-in-six visits to emergency departments among elderly patients for adverse drug events.(6,7) The patient described in this case was fortunate in that his INR, though approaching dangerously high levels, had not yet led to any bleeding.

In the presented case, it is worth noting several aspects of warfarin care that were appropriately managed. The medical team correctly continued the patient's warfarin on admission; patients in whom warfarin is held (often a temptation of inpatient physicians borne out of a concern for excessive anticoagulation) often experience drops in their INR values to dangerously low levels and are at risk for thromboembolic events until the medication is restarted.(8) The medical team was also correct to check the patient's INR at discharge, since they had treated the patient with antibiotics (ceftriaxone and doxycycline) that may increase INR levels.(9) And finally, the outpatient physician was correct to recheck the INR at 1 week, even though the previous value was therapeutic at 2.4. Patients who have been on chronic warfarin with a stable and therapeutic INR usually have their INR rechecked at 28 (or more) day intervals (3), but in this case the hospitalization was recognized as a potentially destabilizing event and so the INR was rechecked early.

The excessively high INR and elevated bleeding risk in this case do, however, highlight several important aspects of safely discharging patients on warfarin. For the case patient, who was chronically taking warfarin, the medical team could have scheduled an earlier follow up with the primary care doctor specifically for INR testing in the setting of recent acute illness and new antibiotic prescriptions.(10) It is reasonable to recommend that patients who had changes in their warfarin dose, had new medications started, or experienced medical issues that might affect the INR be scheduled to get a follow-up INR within a week of discharge. Although the patient's INR on discharge was therapeutic, the medical team should have anticipated that it was likely to increase since he had only been in the hospital for two days and was being prescribed medications known to interact with warfarin. The medical team probably should have also either spoken directly with the primary care doctor at the time of discharge, or immediately faxed a discharge summary or letter to convey the last measured INR, the new medication list, and the recommended period of follow-up; these steps are particularly important to coordinating care if the inpatient and outpatient electronic medical records are not fully integrated.(5)

Finally, while this patient was on chronic warfarin, patients newly started on warfarin are at a much higher risk of complications, including major hemorrhage, than those continued on it.(11) For new patients especially, an inadequate understanding of warfarin—by both patients and caregivers—can significantly impair adherence and result in harm.(12) The inpatient team should thus carefully communicate not just with the outpatient team in arranging follow up, but also with patients or their caregivers regarding how best to take warfarin safely, using standardized education forms and checklists, which can significantly improve adherence and reduce adverse outcomes.(13)

Case & Commentary—Part 2:

His warfarin was adjusted and ultimately his INR returned to the target range of 2.0 to 3.0. Unfortunately, this required multiple visits to the primary care doctor's office for blood tests. As the patient was debilitated and easily confused because of his dementia, the need for repeated visits placed a substantial burden on his daughter, who was his main caretaker.

At the end of the patient's fourth visit in 2 weeks to see the primary care doctor, his daughter was frustrated with the process. She asked the primary care doctor, "Is this the only way to manage his blood thinners? Is there a better way? Will there be a better and easier way in the future?"

There have been many efforts directed at improving the safe use of warfarin, including the use of point-of-care machines that allow patients to check their own INR at home (as opposed to having to go to a lab or a clinical office). These machines are accurate, acceptable to patients, and effective when used in conjunction with self-management.(14) The use of dedicated anticoagulation clinics has also been shown to improve INR control.(15) Algorithms have been developed to standardize warfarin dose titration, with some shown to improve overall time patients spend in therapeutic INR range.(16) Some of these algorithms have been computerized and deployed over the Internet, providing instructions directly to patients and improving time in therapeutic range even more than an anticoagulation management service or "Coumadin clinic."(17) Taken collectively, these developments signal a movement towards a more standardized, streamlined, and patient-centered approach to anticoagulation, which could improve the quality and convenience of warfarin therapy. Though the case patient may not have been a good candidate for self-monitoring given his dementia, a caregiver such as his daughter could potentially be taught how to use a home INR machine and adjust his warfarin dose.

However, the most revolutionary changes may come from the development of newer oral anticoagulants, from factor Xa inhibitors such as rivaroxaban and apixaban to direct thrombin inhibitors such as dabigatran. These drugs have few drug–drug interactions, are not subject to variations in diet, and, unlike warfarin, provide stable levels of anticoagulation at a fixed dose and, most importantly, require no dose adjustments or INR monitoring. Dabigatran, which was approved by the US Food and Drug Administration in 2010 for patients with atrial fibrillation, has been shown to be as effective as, if not more effective than warfarin in preventing stroke in atrial fibrillation, with potentially fewer bleeding complications.(18) Though dabigatran is far more expensive per pill than warfarin, preliminary analysis has shown it to be reasonably cost effective, largely due to the high indirect costs associated with INR testing and monitoring.(19)

Unfortunately, these newer oral anticoagulants have significant limitations of their own. Dabigatran, taken twice daily, requires a higher level of adherence than warfarin (taken daily), and patients who do not take it on schedule may have compromised efficacy. In addition, the anticoagulant effect of these newer agents is irreversible, unlike warfarin, which can complicate management for patients who develop acute bleeding complications. Finally, dabigatran is renally cleared and therefore not recommended for people with severe renal insufficiency (20), ensuring that warfarin will continue to be an important anticoagulant for specific populations. For many patients, however, including the patient in this case, the new anticoagulants will present attractive alternatives to chronic warfarin therapy. Should the case patient's warfarin continue to be a management challenge, changing to dabigatran may be a reasonable alternative.

In summary, the best practices for the management of warfarin at hospital discharge should focus on the following factors:

Say It Again
The Case

A 72-year-old man was admitted to the hospital with community-acquired pneumonia and hyponatremia. During his third hospital night, the on-call physician was contacted by the charge nurse, who had received a "critical panic value" call for a potassium level of 2.2 (normal=3.5-5). The physician began writing for an EKG and immediate potassium supplementation. While writing the orders, he quickly glanced in the electronic health record to see what the patient's previous potassium levels were. To his surprise, he discovered that the patient didn't have a potassium level listed in the computer for that day; nor was there evidence that one had been ordered or drawn.

After calling the charge nurse back, they discovered the panic value was intended for a different patient with a similar last name on the unit. It was unclear if a "read-back" occurred between the lab tech and the charge nurse, who was covering for the patient's bedside nurse while the latter was on her break. Luckily, this was a "near miss"—the patient did not receive the unnecessary and potentially dangerous potassium supplementation and had an otherwise uneventful hospital course.

Routine Goes Awry
The Case

A 6-year-old girl with a history of asthma and chronic adenotonsillitis was referred to a surgeon and scheduled for a tonsillectomy and adenoidectomy. She was in otherwise good health, had never received anesthesia in the past, and was experiencing no acute symptoms at the time of surgery. After an uneventful surgical procedure, the patient was rapidly extubated with spontaneous ventilation and stable vital signs. Within an hour, however, the patient became hypoxic with an inability to ventilate spontaneously, and required reintubation. The etiology of the need for reintubation was unclear but thought to be related to sedation and analgesia administered during and after the case. The patient ultimately recovered with no additional complications and was discharged home with her parents.

Because of the reintubation, the case generated additional review and discussion, including concerns expressed by the parents about the safety of what they believed was a routine surgical procedure done on children every day.

The ECG Is Not Normal
Case & Commentary—Part 1:

My healthy and active 13-year-old daughter had a syncopal attack—she just passed out. This was the first time she had ever been sick. Her blood pressure and pulse were normal right after the event and she recovered quickly. I was a bit shaken up and because I was not sure of the cause, I took her to see her pediatrician. The pediatrician felt it was probably dehydration (my

daughter is an athlete), but wanted an electrocardiogram (ECG). The ECG was performed, and as we were leaving the office I asked the front desk clerk for a copy of the ECG. I think the clerk recognized me as a physician on staff and handed it to me. As I walked away, my heart nearly stopped. The ECG was not normal. My daughter's ECG was not normal. The rate was 44 beats per minute, and the tracing met criteria for left ventricular hypertrophy.

My mind raced, filled with the worst diseases I could imagine. Syncope combined with an abnormal ECG is never a good combination. I immediately paged a pediatric cardiologist colleague. He responded by phone that the heart rate was too low even for an athletic child and she should get an echocardiogram and Holter monitoring. I panicked even further and couldn't get the terrifying vision of my daughter frail, sick, and dying in a hospital bed out of my head.

It is probably safe to say that every physician in the world has, at some point, provided a close relative with medical care, be it an off-the-cuff opinion or a long-term clinical commitment. That assumption makes this practice the single most common ethical violation committed in medicine, for most advisory bodies specifically warn against it.

The ban on caring for family members is longstanding. At the turn of the 19th century, in what is considered the first modern code of medical ethics, British physician Sir Thomas Percival wrote that doctors should depend on their colleagues to care for sick relatives, for "solicitude obscures the judgment."(1) In 1847, the founders of the newborn American Medical Association (AMA) elaborated: "... the natural anxiety and solicitude which [a physician] experiences at the sickness of a wife, a child, or any one who by the ties of consanguinity is rendered peculiarly dear to him, tend to obscure his judgment, and produce timidity and irresolution in his practice."(2)

The sentiment endures in the AMA code's most recent iteration ("Physicians generally should not treat themselves or members of their immediate families. Professional objectivity may be compromised....").(3) Medicare will not pay for services physicians provide to immediate relatives (presumably this decision reflects a fear of fraudulent claims as much as a purely ethical deliberation).(4)

Nonetheless, the practice is almost universal. A 1991 survey of doctors staffing a Midwestern community hospital found that 97% of respondents had provided a medical service for a family member, ranging from free drug samples (72%) to written prescriptions (80%) to surgery both elective (9%) and emergent (4%).(5) At another midwestern hospital 74% of physicians reported treating their own children for minor acute illness.(6) If the child had a fever, most called the child's actual pediatrician, but parents who were pediatricians were likely to treat both afebrile and febrile children themselves. The care these doctor/parents provided included otoscopy, chest auscultation, and antibiotic prescribing. Most cited "convenience" as the major reason for their care, as well as confidence in their own diagnostic skills; few were motivated by cost savings or privacy issues.

The majority of these in-family medical encounters probably end uneventfully. There is no data to characterize the ones that do not, but anecdotes abound. More than a third of surveyed physicians stated they had observed a colleague become "inappropriately involved" in a family member's care by vetoing indicated procedures or demanding unnecessary or contraindicated

ones.(5) Some were guilty of the opposite, providing care that was cursory or inadequate. In a small survey of pediatricians in a single Vermont community, most respondents agreed that doctors' children came to the office less often for acute care than other children did, and often later than was optimal.(7) They noted that sometimes the children of physicians had only cursory attention paid to social issues or behavioral problems.

The list of other potential risks from keeping medical care in the family is a long one.(8) Some are primarily medical issues: for instance, doctors are unlikely to perform a full, intimate physical exam on a relative. One physician recalls performing a "half-hearted" abdominal exam on his wife when she complained of pain shortly after suffering an apparent miscarriage, coming up with no diagnosis, and feeling "overwhelmed and resentful." She turned out to have a large tubal pregnancy.(8) Similarly, doctors are unlikely to take a full social history from a relative, particularly from their own offspring, and pertinent but difficult questions about sexual activities or substance use may go unasked. They may try to spare a relative from undergoing painful procedures, even if indicated. They may leap to diagnoses, either in their own field of expertise or far afield. Once involved in a case, they may have difficult time backing off and admitting it is time for a consultant to step in.

The social risks from the arrangement are equally perilous: the dynamics of even the best-adjusted family are apt to be irrevocably changed if a doctor–patient relationship is superimposed for too long on that of husband and wife or parent and child.

But the doctor/father in this case was guilty of none of the above sins. He was not trying to be his child's doctor; he was simply trying to ease their passage through the medical system with a shortcut around that unbearable wait between the performance of a test and the delivery of the result. What could be wrong with that?

Case & Commentary—Part 2:

I called my daughter's pediatrician to ask for referrals and another appointment to see her later that day, telling the front desk that I was both a physician and the parent. The pediatrician hadn't seen the ECG but she approved the referral, and we were able to get an appointment for the echocardiogram the same day (likely due to my position on staff). After the test, we returned to see the pediatrician. I breathed an incredible sigh of relief as the echocardiogram turned out normal. The pediatrician reexamined my daughter and found her heart, lungs, and complete examination normal. We decided not to proceed with the Holter monitoring, and to allow my daughter to play soccer the next day.

The following week, I stopped by to see the pediatric cardiologist with whom I had spoken and showed him the ECG. He read it and felt that the slow heart rate and the other changes were actually normal for a healthy athletic 13-year-old. I was now feeling much better about everything.

He scanned the tracing into the medical record and e-mailed me a PDF. I was speaking with my wife later in the day and she wanted to see the ECG, as she had not seen it yet (she is not a physician). I e-mailed her a copy and she called me a minute later. "This is not her ECG. It's an

ECG from some 24-year-old male." I opened the file and sure enough—it was the ECG I looked at, but it was not my daughter's. It was not her ECG at all. It would have been obvious to me had I looked at the name and noticed it was wrong. All of this was a mistake.

Editorial Note: The physician (case submitter) further reflected on what he learned from this experience. His thoughts:

"Clearly, as a physician, I made an error in not making sure the tracing I was handed was from the patient in focus. Secondly, I used my physician status to force decisions along a path. I didn't give time for the pediatrician to even interpret the real ECG; she took my word that it was abnormal. The cardiologist took my word, to the point of scanning the document, interpreting it, and entering it into the medical record. They believed what I told them. The echo was done prior to the cardiologist looking at the ECG.

My recommendations are as follows: The root cause of this error was getting the wrong ECG in the first place. The front desk worker at the cardiac center simply printed out the wrong tracing and handed it to me. It turns out that our hospital has rules against this. I was thinking at the time the ECG was handed to me that at my hospital a patient cannot request medical information from any other source than the medical records department. I was thinking this because I had been made aware the week prior that it was considered a patient privacy violation to send a copy of a patient evaluation to the patient themselves. This is something I have done for years so the patient can bring my evaluation to their various doctor visits and improve the communication of information. That is no longer allowed at my hospital, and now I understand for good reason. Medical records personnel do consider patient identification very important, and therefore likely do not make this error as often. If this practice had been followed, the clerk at the cardiology desk would have said to me, 'Sir, I cannot do that. But you can go to medical records and get a copy there.' Had I done it the right way, I am sure I would have gotten the correct information."

This case illustrates that even a small step over the line between parent and doctor can have, if not catastrophic, certainly sobering consequences. What exactly happened here? A parent-turned-doctor cast a professional eye over a test result that made little clinical sense. Presumably he, like the rest of us, sees similar reports fairly often in his professional life. But instead of running through the usual possibilities (Did somebody mislabel the blood tubes? Is something screwy going on in the lab? Am I looking at the wrong chart?), his mind began to gallop in circles like a crazed steer. Call a consultant, get a test, double back around to another consultant, cancel another test, and stop, panting, when everything begins to evaporate (as nonexistent health emergencies often do).

Of course, had he been a layperson, like his wife, his eye would have moved immediately from the indecipherable squiggles of the cardiogram to the name on the tracing and the entire episode would have been over before it began.

The case highlights some of the safety issues we know well in the modern digitalized hospital, where a single errant stroke on a keyboard can cause chaos. Back in the old days, paper charts often took on oddly human personalities, the thin and crisp folders of the healthy easily distinguishable from the huge, dog-eared volumes of the sick. Identity mixups still occurred, but

probably somewhat less frequently than they do now, for in Times Roman Bold on an LCD screen every patient's record looks alike.

Hospitals are deploying computerized tools to cope with this landscape. The scannable patient wristband, for instance, reduces identity errors during the administration of medications.(9) Out in the nurses' station, however, at least in my hospital, it remains quite easy for a harried resident to order Mr. X's methadone for Mr. Y, and Mr. A's Coumadin for Mr. Z. (I was involved in both of these events. The Coumadin error was caught downstream by an alert nurse; the methadone error, unfortunately, was not.) Wristband systems, at least in their present incarnation, do not avert this kind of identity error.

The case highlights privacy issues as well. It is precisely to forestall test results being confused and accidentally revealed to third parties that some hospitals specify that only the medical records department may provide patients with any portion of their record, including individual test results. This policy was actually in effect in the author's own hospital, he writes, "and now I understand for good reason." Had he gone about obtaining the test "the right way," he continues, "I am sure I would have gotten the correct information."

These are the smaller lessons from this case. The big lesson simply reinforces what doctors knew centuries ago: When you love a patient too well you generally cannot take good care of that patient. Interestingly, this piece of wisdom flies directly in the face of one of the other tenets of modern medical practice, the oft-quoted maxim of Harvard's Dr. Francis W. Peabody that "the secret of the care of the patient is in caring for the patient."(10)

How to interpret this apparent contradiction? A philosopher could write volumes on the subject, but the brief version is that either extreme of affection risks destroying the immensely delicate fabric of medical care. Too little love is bad, but too much can be worse. The doctor who manages to balance in between—for a single patient, or for a practice of thousands—has skills worth calibrating and emulating.

Outbreak
The Case

A 36-year-old healthy man developed an acute febrile illness associated with a vesicular rash. He presented to an urgent care clinic where he was diagnosed with varicella infection ("chicken pox"). The patient did not recall a sick contact or exposure to varicella, but he did report working in an emergency department (ED). He was initially treated with oral acyclovir, but the progression of his lesions eventually required a brief hospitalization for dehydration and acute renal failure. His condition ultimately improved and his symptoms resolved.

The ED worker later learned from his supervisor that a patient had presented to the ED with chicken pox during one of his shifts, and his exposure likely occurred at that time. He raised concern that his illness could have been prevented had proper procedures been in place. His case prompted extensive discussion of infection control procedures among the ED leadership, given that many ED providers were exposed to this highly communicable disease.

Pocket Syringe Swap

The Case

A 58-year-old man, scheduled for aortoiliac artery bypass graft, had an epidural catheter placed for postoperative pain management. Surgery proceeded uneventfully under general anesthesia. During the closure of the surgical incision, the surgery fellow drew 12 mL of 0.25% bupivacaine (a local anesthetic) into a 12 mL labeled syringe of which 4 mL was injected into the epidural space. The fellow subsequently placed the bupivacaine syringe with the remaining 8 mL of the drug in the pocket of his scrub suit.

Anticipating the conclusion of surgery, the fellow prepared a second 12 mL syringe drawing up 4 mL of neostigmine (4 mg) and 4 mL of glycopyrrolate (0.8 mg) totaling 8 mL and labeled it, adding this syringe to the same pocket of his scrubs. At the conclusion of the surgical procedure, the attending asked the fellow to reverse the neuromuscular block with neostigmine and glycopyrrolate. The fellow pulled a syringe out of his pocket, assumed it contained the neostigmine and glycopyrrolate, and injected 6 mL and then placed the syringe back in his pocket.

After 3 minutes, the patient still appeared weak (i.e., with residual neuromuscular blockade), and the attending requested administration of an additional 1 mg of neostigmine. When the fellow retrieved a syringe from his pocket, he recognized that he had previously pulled the wrong syringe and inadvertently administered bupivacaine, the anesthetic, rather than neostigmine/glycopyrrolate. Once the correct medication was administered, neuromuscular blockade was reversed. Although the patient was not harmed by the erroneous intravenous (IV) administration of bupivacaine, he potentially could have been.

Duty to Disclose Someone Else's Error?

The Case

A healthy 4-year-old boy presented to an emergency department (ED) with 3 days of vomiting associated with lethargy and fevers. He had been exposed to another child with streptococcal pharyngitis (strep throat) the previous week but otherwise had been well until the symptoms began. He received a full evaluation in the ED. He was found to have a low-grade fever and was a little sleepy with some redness in his throat. The laboratory tests were unremarkable and a head computed tomography (CT) was reported as normal by the radiologist. A rapid test for streptococcal pharyngitis was positive.

The child was admitted to the hospital for ongoing care and given intravenous hydration and antibiotics. Over the next 24 hours, the child became increasingly confused, disoriented, and lethargic. The following morning, his condition worsened and he had a respiratory arrest. He was placed on a ventilator and transferred to the intensive care unit (ICU).

In the ICU, he was noted to have fixed and dilated pupils on neurologic exam, a sign of serious neurologic injury. A repeat CT scan of the brain revealed severe cerebral edema (swelling of the brain) with evidence of herniation of the brain through the base of the skull.

He was transferred from this hospital to a tertiary care center for ongoing management. At the tertiary care center, the child was evaluated by neurology and neurosurgical teams. Further testing revealed a diagnosis of venous sinus thromboses (blood clots in the veins of the brain), which had led to edema and herniation. Unfortunately, the brain damage was too advanced and the child was determined to have no chance to survive.

As part of their routine evaluation, the neurology, neurosurgical teams, and the radiologists at the tertiary care center reviewed the CT scan that had been done in the original ED. Although the findings were subtle, they found that the scan was not normal (as had been reported) but demonstrated clear evidence of cerebral edema. The initial hospital had not recognized these findings and therefore had not pursued further work-up for the cause, which would have been indicated. The neurology and neurosurgical teams thought that if the brain swelling had been recognized at the time, the child could have been transferred earlier, received surgical management, and might have survived.

When it was clear the child could not survive, the pediatricians met with the mother and father to explain that their child was brain dead. Angry and upset, the parents asked repeatedly, "How could this happen? How could the CT scan have been normal and then be so bad in less than 48 hours?"

Due to concerns of legal liability, the hospital administration and the risk management department at the tertiary care hospital had instructed the physicians and other providers to not disclose the misinterpretation of the original CT scan. In fact, they were instructed not to comment on the care provided by the initial hospital in any way. Therefore the parents were never told that an error had been made that may have contributed to their child's death.

Are We Pushing Graduate Nurses Too Fast?

The Case

A middle-aged man was admitted to the surgical intensive care unit (SICU) following a complex surgical procedure performed for pancreatic cancer. He was on a ventilator, and several attempts to wean had been unsuccessful. The patient was also in acute renal failure. His current treatment included vasoactive drugs, intravenous fluids and nutrients, sedation, continuous renal replacement therapy (CRRT), and mechanical ventilation.

The registered nurse (RN) caring for this patient had completed nursing school 1 year earlier and had worked in this SICU since graduation; she had completed the hospital-based CRRT training in the prior month. In this hospital, RNs who regularly cared for SICU patients administered CRRT along with other care needed by the patient. RNs received special training in this technique from expert nurses in this hospital and received a certificate from the hospital after demonstrating their knowledge and skill.

The CRRT machine is supposed to have a bag of dialysate (solution with the appropriate chemicals and nutrients) infusing, and an ultrafiltrate bag connected to an outflow line, collecting the fluid being removed from the patient. During a conversation between two more senior nurses in the central nursing station, one glanced at the CRRT machine and noticed no dialysate bags;

instead, there were two sets of ultrafiltrate bags. One set, full to capacity, was appropriately hooked into the ultrafiltrate line; the other empty set was hooked to the dialysate line. The senior nurse immediately stopped the CRRT machine and questioned the new graduate nurse caring for the patient. The newly trained nurse stated that there were no more bags of dialysate on the unit and she was trying to maintain the machine until some new bags arrived.

Before the new bags arrived and the CRRT could be restarted, the patient deteriorated and was taken back to surgery. He expired not long after from a perforated bowel.

Although the nurse's error in setting up the CRRT machine was not the direct cause of the patient's death, it did raise many questions. CRRT is a high-risk procedure that is handled differently by different hospitals. In some, only specially trained dialysis nurses administer this treatment; in others; the nurses on the units receive in-service training and manage the CRRT themselves. Questions that confronted the staff and critical care director for this unit were how to restructure the orientation and training programs to ensure that staff performing high-risk procedures were sufficiently prepared to anticipate problems, plan ahead, troubleshoot, and safely carry out the therapy.

Dropping the Ball Despite an Integrated EMR

The Case

A patient followed at a community-based clinic that is part of a large health care system with an inpatient/outpatient electronic medical record (EMR) presented to the emergency department (ED) with a fractured humerus. The patient was seen by a physicians assistant (PA), treated with a sling and analgesics, and referred to an orthopedics consultant. The referral was made through the system's EMR referral module.

The appointment had to be rescheduled twice due to transportation problems. The health care system caring for the patient has a quality standard that a patient must be seen in follow-up within 30 days of a referral. The hospital automatically cancels appointments when patients miss them to minimize black marks on these 30-day reports and asks the original ordering provider to enter a new consult request to restart the 30-day clock.

A secretary at the hospital canceled the appointment, as per protocol, and assumed that the ordering physician would receive an automatic notice of the cancellation, which would then prompt her to enter another referral request. However, because the ordering provider was the PA from the ED, not the primary care physician (PCP), the latter did not receive notification that the appointment was canceled. Presumably, the PA and ED physician, who did receive the notice, thought the PCP had also received the notice and was taking responsibility for the patient's follow-up care, and so they took no action.

Luckily, the error was recognized when the patient finally saw his PCP. At that point, an orthopedics referral was made. While the error led to a delay in follow-up, the patient had no further complications.

Volume Too Low: In and Out

The Case

A 22-month-old infant was admitted to the hospital in the late afternoon with a viral infection. He had a complex past medical history including congenital heart disease, poor feeding requiring a gastric tube, and delayed cognitive development. At the time of admission, he was moderately ill appearing but remained interactive with his mother and hospital staff. He was given appropriate therapies for his viral infection.

Later in the evening, the infant drank 2 ounces (60 mL) of a liquid nutritional drink and then went to sleep; this was the sum total of his fluid consumption since hospital admission. The child slept well and in the morning his vital signs were all normal. He remained interactive but seemed a bit sleepy. His total urine output overnight as documented by the nurse was 50 mL (a low urine output given his weight of 10 kg). The night nurse communicated the minimal intake of fluids and poor urine output to the day nurse at the 7:00 AM change of shift.

The day nurse, busy caring for other patients, failed to appreciate the significance of the low intake and output. Over the next few hours, the infant became more somnolent and less responsive. His aunt assumed this was due to the viral infection, and the child was not evaluated by the nurse during this time. When his mother returned in the early afternoon, she found her son to be lethargic and acting strangely. Evaluation by the intern revealed a low blood pressure, high heart rate, decreased muscle tone, and decreased responsiveness to stimulation. Stat labs revealed severe hypoglycemia and dehydration. The infant was transferred to the pediatric intensive care unit where an IV was placed and he was given intravenous fluids and intravenous glucose. He required 2 days in the intensive care unit but did not experience any long-term consequences.

Silent Pain in the Neck

The Case

A 60-year-old man with no significant past medical history underwent an elective anterior cervical discectomy for persistent right arm weakness due to cervical stenosis. After an uncomplicated procedure, the patient was transferred to a surgical unit with stable vital signs. Later that night, he developed tightness and swelling on the right side of his neck. The nurse notified the covering physician, who asked about stridor or other respiratory symptoms. When told they were absent, he recommended continued close observation. Over the next few hours, the patient's symptoms persisted, and he noted the onset of mild dysphagia. The nurse contacted the in-house intensivist, who evaluated the patient and once again found no evidence of respiratory distress or stridor.

A few hours later, the patient stood up from bed to use the urinal, began coughing, turned cyanotic, and fell to the floor unconscious. Cardiopulmonary resuscitation was started, but the patient's airway was significantly compromised by a now obvious neck hematoma. An emergent tracheostomy was performed at the bedside and the patient was transferred to the intensive care unit.

This postoperative complication led to a prolonged hospitalization. The patient was discharged to a skilled nursing facility, where he required lengthy rehabilitation services.

Paradoxical Pulse

The Case

An 80-year-old man with paroxysmal atrial fibrillation and symptomatic bradycardia underwent successful pacemaker placement as an outpatient. The patient was restarted on his warfarin therapy and returned home with no complaints.

A week later, the patient developed new diffuse chest discomfort that progressed over the ensuing 24 hours to include associated dyspnea and nausea. He presented to the emergency department (ED) for evaluation where he was noted to be afebrile with a blood pressure of 113/66, heart rate of 95, and an oxygen saturation of 99% on room air. On physical examination, he appeared comfortable and in no distress. His cardiac exam was notable only for flat neck veins, an irregularly irregular rhythm, a well-healed pacer site, and no peripheral edema. Laboratory studies revealed a stable hemoglobin level, a negative troponin, and an INR of 2.6 (within the therapeutic range), but a slightly elevated creatinine and a new transaminitis (elevated liver tests) compared to a week ago. An electrocardiogram showed atrial fibrillation but no evidence of ischemia. Imaging studies included a chest x-ray, which was normal, and a computed tomography (CT) scan of the abdomen, which revealed a pericardial effusion but no hepatobiliary pathology.

The ED physician discussed the case and CT findings with the on-call cardiologist who recommended admission but no need for an urgent echocardiogram given the normal vital signs and the patient's clinical stability. The following day, the patient's echocardiogram confirmed a large pericardial effusion "without tamponade" physiology. Providers continued to remark about the patient's clinical stability based on vital signs and appearance. Later that day, the patient became acutely hypotensive, developed ventricular tachycardia and pulseless electrical activity, and required emergent resuscitative measures, including large drainage of a pericardial effusion to relieve his cardiac tamponade. While surviving the emergent resuscitation, the patient ultimately suffered additional complications and passed away after a prolonged hospital course.

One Toxic Drug Is Not Like Another

Case & Commentary: Part 1

A 50-year-old man was diagnosed with chronic hepatitis C (viral load of 2,500,000 IU/mL) by his internist, who also happened to be an oncologist. This physician was comfortable with chemotherapeutic agents and decided to treat his patient's hepatitis C virus (HCV) without referring him to a hepatologist. He saw this patient in the hospital's outpatient oncology unit. The physician started treatment with weekly injections of pegylated interferon (which is also used for some cancers) and daily oral ribavirin.

While this case raises a number of important issues regarding scope of practice, licensure, credentialing, and board certification, the primary issue is the ability of this physician to

recognize his limitations, especially given his decision to venture outside his primary area of practice. Robust research data now exist showing that physicians, like all people, do not self-assess their knowledge and skills accurately when done in isolation (1,2), and that effective self-assessment requires incorporating external data in what Eva and Regehr label "self-directed assessment seeking."(3) Yet, even when physicians receive external feedback regarding their performance, a recent study found that processing and incorporating the data and feedback are complex and require time, skill, and often, assistance from others.(4) Learning how best to facilitate practice-based improvement is an important area of research.

In this case, we would hope the physician would seek answers to a series of questions before providing treatment: What are the current guidelines and recommendations for the treatment of hepatitis C? Are pre-treatment tests and evaluations needed to safely provide a potentially toxic therapy? What is my experience with these drugs? And so on. Gruppen and Frohna provide a useful framework for decision-making when caring for patients outside one's usual scope of practice.(5) Their framework recognizes that clinical reasoning is a complex process that starts when the physician develops a *problem representation*. This critical step occurs when the physician performs an accurate and appropriately targeted medical interview and physical examination that is tightly integrated with the physician's working memory (the "hard drive") to determine what is happening with the patient. Before initiating action, the next step, called *evaluation*, requires physicians to ask what gaps might exist in their understanding of the patient's condition, including treatment.(5,6) This critical step is often skipped, especially by experienced physicians, who may be overly confident in their knowledge base.(7-8) This particular case is a set-up for error—a physician experienced in another discipline that uses toxic, high-risk medications believes he or she has the knowledge and skill to care for a condition outside his or her primary scope of practice, largely because there is some overlap between the medications used in this specialty and those potentially required for this patient.

Where do credentialing and board certification fit in these situations? (See Table.) Board certification was originally created to help define new disciplines in medicine and set standards of excellence in practice. Although technically a voluntary process, board certification is now required for employment and credentialing by most hospitals and health plans. Originally, physicians who were certified at the completion of their training were given a lifetime certificate, but all boards now offer only time-limited certificates. In internal medicine, certification became time-limited in 1990, and over the past 10 years the American Board of Internal Medicine (ABIM), along with the other 23 specialty boards under the auspices of the American Board of Medical Specialties (ABMS), instituted maintenance-of-certification (MOC) programs that require physicians to self-assess their knowledge, evaluate their performance in practice, and pass an examination every 10 years.(9) Whether they possess a time-limited certificate or not, physicians can enroll in the MOC program at any time and take advantage of the self-assessment tools to address gaps in their knowledge and practice performance. Relevant to this particular situation, the ABIM MOC program has a Web-based tool called *practice improvement modules* (PIMs), one of which is devoted to caring for patients with hepatitis C.(10)

Currently, licensure does not specifically address this kind of situation. The approach to licensure in the United States is highly fragmented among nearly 70 state medical boards. There is no specialty-specific licensure; the license authorizes the practice of medicine in general.

Currently, renewal of a medical license mostly involves just passing a criminal background check and accruing some amount of continuing medical education (CME) credits that varies from state to state. This legal framework relies on physicians and health care systems to self-regulate scope of practice via credentialing and local monitoring processes. However, similar to recent developments in board certification, the Federation of State Medical Boards (FSMB) is embarking on the development of maintenance-of-licensure (MOL) programs that seek to improve the assessment of practicing physicians.(11) This approach could be "tailored" to a physician's scope of practice—if this physician decides to provide hepatitis C care, MOL assessments could be targeted at the quality of care for these patients. This would represent a profound change, especially if a physician's individual scope of practice was regulated through licensure, because it would potentially allow physicians to move into areas not originally part of their discipline-specific training (in this case, oncology).

While not developing assessments outside the boundaries of their disciplines, certification boards are experimenting with new pathways in MOC that allow for more focus within a discipline. For example, ABIM has begun a small experiment designed for general internists who focus their practice in the hospital setting (called the *focused practice in hospital medicine program*).(12) In addition to providing the self-directed assessment tools, certification boards are exploring other pathways within the MOC program for individuals who may either wish to focus their practice over time or develop additional proficiencies in a specific medical area.

However, the question remains whether this physician should be the principal physician providing front-line therapy for hepatitis C patients. There are no easy answers here. For example, the physician might be located in an underserved area with too few hepatologists and/or gastroenterologists to see all hepatitis C patients. Furthermore, new discoveries and technologies are always emerging and transforming patient care. Even new treatments and technologies within a discipline will continue to press physicians to acquire new knowledge, skills, and attitudes, making a certification acquired 5–10 years previously potentially misleading if the physician has not kept up his or her skills. Regardless of the structured programs that may exist to help physicians either focus or expand their scope of practice, they will never be perfect or encompass all situations. Therefore, the critical step is the need for physicians to recognize when they are moving outside their scope of practice and appropriately initiate mindful practice and reflection. The physician who does this asks not, "Can I care for this patient?" but rather, "Should I?" If the answer to the latter question is yes, then, "What gaps do I currently have that I will need to address? Who can I consult to help me acquire new knowledge and skills? How will I know if the treatment I am providing is effective and safe?"(3,13)

Case & Commentary: Part 2

Prior to therapy, the physician did not refer the patient for a liver biopsy nor did he obtain a hepatitis C genotype or baseline complete blood count or thyroid stimulating hormone. After 6 weeks of therapy, the HCV viral load was unchanged, and the patient now exhibited pancytopenia. The physician responded by decreasing the interferon dose to every 2 weeks but continued the ribavirin at full dose. He didn't obtain a viral load at 12 weeks. After 9 months of treatment, a viral load was repeated and was again found to be more than 2,000,000 IU/mL. Treatment was continued without change.

Three months later, the insurance company denied the hospital's bill, and the medical director for case management was asked to prepare an appeal letter. In drafting the letter, the medical director realized that this patient's care didn't comport with HCV treatment guidelines. The improper care included: (i) no liver biopsy to see if the patient met the criteria for treatment; (ii) no genotype performed to help guide length of therapy; (iii) no baseline laboratory tests to see if the patient's pancytopenia was preexisting or due to the medications; and (iv) no 12-week viral load to assess response. Moreover, when the patient was found to have pancytopenia, interferon was decreased to every other week rather than reducing the ribavirin dose or continuing the interferon at half-strength weekly dosing, as per guidelines. When the viral load at 9 months showed no response, treatment was continued, exposing the patient to a toxic medication with little possibility of benefit.

Concerned for the patient's safety and well-being, the medical director instructed the clinic staff to discontinue the interferon and insisted that the physician refer the patient to a hepatologist.

The follow-up data nicely, but soberly, highlight this physician's numerous gaps in competency in treating hepatitis C and his failure to recognize these gaps until a medical director intervened. This case reinforces the critical importance of ongoing assessment of physicians. As emphasized above, physicians should be actively seeking assessment from external sources.(3,14) This is the only way to address the blind spots we all have. This physician, and his patient, would have benefitted greatly from external input and assessment. From my perspective, the response of this medical director is absolutely on target. I believe the professional organizations, from medical practices to hospital to medical societies and certification boards, must set the expectation that when a physician wanders outside his or her defined or normal scope of practice, it is a professional imperative that the physician seeks external guidance and input.

Turning back to certification, a fair question is whether current certification processes truly make a difference and identify important gaps in physician competence. The short answer is that certification processes do identify physicians who provide poorer levels of care and can help them improve the quality of care they provide.(15-17) In addition to setting expectations, certification boards, along with medical societies and others, can facilitate improvement by providing assessment methods and tools to help physicians discover gaps in competencies and then provide guidance on how to best address and close those gaps.(15,18) As cognitive neuroscientist Itiel Dror recently highlighted, assessment and learning should be tightly intertwined, and it is illogical to think of either as a separate activity.(19)

All the certification boards recognize the need to improve both initial certification and MOC programs.(9) The MOC programs will become more continuous over the next several years, allowing physicians to perform more frequent targeted "biopsies" of competence. Many tools already exist within the MOC programs that allow physicians to assess their performance and learn new material within the MOC program. The boards continue to explore more efficient and effective modes of self-assessment, especially around scope-of-practice issues, such as the focused practice of hospital medicine program.(12) Finally, ABMS is actively collaborating with FSMB to align the various elements of MOC and MOL when appropriate. Credentialing bodies, licensing boards, and certification boards will need to take the scope-of-practice issues head-on and develop new policies that guide when and how physicians can engage in new and different

clinical care activities. Such policies will be difficult to develop in a country where individualism is so highly prized (20) and autonomy is a deeply entrenched value among physicians.(21) Nonetheless, setting clear expectations will go a long way in changing our current approach to this issue and has real potential to prevent patient harm.

Everyone involved in the care of patients must be willing to report to appropriate entities when they believe a physician is impaired or may be operating outside his or her scope of practice and potentially endangering patients. Impeding this change in culture is the lack of robust, systematic assessment approaches, fear of retribution, and the sense of futility that nothing can or will be done.(22) This is when licensing boards, certification boards, and medical societies can assist by creating and providing good assessment tools and methods and by working collaboratively to help physicians who need remediation or wish to make a change in their practice.(22) While the physician in this case may very well have had the best of intentions, his decision to provide care outside his scope led to patient harm. All of us often fail to recognize our limitations and need systematic processes of assessment to identify and fill gaps in competency.

Failure to Reevaluate
The Case

A 61-year-old woman receiving palliative chemotherapy for non–small-cell lung cancer at a community hospital developed methicillin-resistant *staphylococcus aureus* (MRSA) bacteremia and endophthalmitis originating from her port. Vancomycin 1.25 grams intravenously twice daily was initiated, and the patient was transferred to a large academic medical center for ophthalmologic consultation and further treatment. Vancomycin was continued upon transfer until she was found to have a rapidly rising serum creatinine (Scr). The initial Scr was 0.4 mg/dL at the community hospital; it had increased to 0.8 mg/dL on admission to the receiving facility and was apparently interpreted as "normal," since it still fell within "normal" range. The patient was recognized to be in acute renal failure when her creatinine reached 1.09 mg/dL the day after transfer. Notably, the vancomycin trough at this time was 64 mg/L. The vancomycin blood level had not been checked previously throughout her treatment.

As a result of her renal failure, the patient rapidly developed non-anion gap metabolic acidosis and, 5 days after transfer, required urgent dialysis for volume overload and worsening acid-base status. Urine and blood studies failed to identify a clear cause of her renal failure. At present, the patient continues to be anuric and dialysis dependent, and she will likely leave the hospital receiving palliative chemotherapy and a 6-week course of vancomycin. She has a new tunneled catheter for ongoing dialysis treatments.

Milliliters vs. Milligrams

The Case

A 32-year-old man was admitted to the hospital after a vehicle collision and multiple traumatic injuries. His evaluation showed acute cerebral edema. An order for intravenous dexamethasone was written, with the dosing schedule specified as "10 mg IV stat, then 8 mg q 6 hrs x 2 doses,

then 4 mg q 6 hrs x 2 doses, then 4 mg q 6 hrs for 2 doses, then 2 mg q 6 hrs x 2 doses." The pharmacist processed the order, dispensing a multidose 4 mg/mL 5 mL vial to the unit. The vial, containing a total of 20 mg dexamethasone, was anticipated to furnish the stat 10 mg dose and the second 8 mg dose to be given 6 hours later. The pharmacist labeled the vial, instructing the nurse regarding the necessary volume (mL) to be drawn from the vial to provide the appropriate dose (mg). After 1 hour, the nurse called the pharmacist requesting more dexamethasone, stating there was no medication available for the second dose. After questioning the nurse, the pharmacist determined that the patient was given the entire vial (20 mg) as the initial (stat) dose, a twofold overdose. The attending physician was contacted and informed of the error. Since the patient was given only one dose, no harm was expected. Subsequent dexamethasone doses were given as ordered, with close monitoring for adverse effects.

The Forgotten Turn

Case & Commentary: Part 1

A 79-year-old woman with mild dementia presented to the emergency department (ED) after sustaining a mechanical fall at home. She was ambulatory with a walker and had slipped on a rug. In the ED, she was found to have right hip and left humerus fractures. Because of her two fractures, she was unable to move in bed without severe pain or without assistance. She was admitted to the hospital for surgical management of her hip fracture.

Because of a bed shortage, the patient remained in the ED for 8 hours before being transferred to an inpatient room during the change in nursing shifts at 7:00 AM. Because of a mechanical problem with one of the beds, the patient was kept in the same bed she had been in from the ED (a thin and firm mattress).

The day nurse found the patient to be confused but oriented, pleasant, and clinically stable; the patient complained of pain with any movement. The nurse began his admission assessment but was interrupted multiple times because of acute issues with other patients. He gave the patient her morning medications but was unable to provide any further interventions.

In mid-afternoon, the nurse and patient care assistant came to turn and bathe the patient, and discovered a moderate-sized stage II pressure ulcer (partial-thickness skin loss resulting in ulceration) on her left hip.

Incidence and Significance

What occurred in this case is not unusual: in acute care hospitals, pressure ulcer incidence after hip fracture ranges from 36.1% (United States) to up to 66% (Europe).(1,2) But the problem is not limited to immobilized orthopedic patients: overall pressure ulcer incidence in hospitalized adults ranges from 4% to 38%, making this a significant issue for patients, caregivers, health care insurers, and hospitals.(3) Patients with pressure ulcers are at risk for pain, distress, increased costs, increased length of stay, delay in transfer to acute rehabilitation, increased caregiver burden, infection, and even death.(4,5) The estimated costs of managing a single full-thickness

pressure ulcer in one patient can be as much as $70,000; in 2006, inpatient treatment of pressure ulcers cost more than $11 billion nationally.(6)

Pressure ulcers have also received considerable attention from regulatory bodies and payers. In 2007, the Centers for Medicare & Medicaid Services (CMS) listed hospital-acquired pressure ulcers as one of eight conditions that are common, costly, and "reasonably preventable."(7) Based on this declaration, CMS stopped reimbursing hospitals for these complications when they occur in hospitalized patients. In addition, many states require mandatory reporting of hospital-acquired pressure ulcers, with the possibility of associated fines.(7) Lastly, non-profit health care organizations that target quality, affordable, and safe health care such as The Leapfrog Group and the National Quality Forum have pushed for transparency in reporting of individual hospital pressure ulcer rates.

Definitions and Staging

The National Pressure Ulcer Advisory Panel defines a pressure ulcer as "a localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear and/or friction."(8) Underlying mechanisms whereby tissue compression leads to tissue damage are still not entirely understood. Pressure ulcers are generally graded or described in six stages (Table 1).

Early Risk Assessment and Intervention

Early identification of patients at risk requires awareness and clinical expertise and may be the most important component of preventing pressure ulcers. To aid in risk assessment, many institutions employ standardized protocols in combination with validated risk assessment tools like the Braden and the Norton scales. These tools are well described in a recent guideline on pressure ulcer prevention.(9) Multiple known risk factors contribute to the development of pressure ulcers in the hospital, many of which occur in patients with hip fracture, as in this case. Some of the most common risk factors include immobility, altered mental status or delirium, pain, fecal incontinence, and malnutrition (a common problem in elderly patients). Undiagnosed or underlying peripheral arterial disease (PAD) or peripheral neuropathy puts patients at a higher risk for heel ulcers.(10) Other risk factors include history of a previous pressure ulcer, hypotension, or resuscitation efforts either prior to admission or in the ED, unique anatomical focal points including severe kyphoscoliosis or other unusual skeletal anomalies, and previous radiation therapy to the pelvis or chest (Table 2).

The Importance of Skin Assessment and the Challenge of Early Pressure Ulcer Identification

To identify any existing pressure ulcers, a thorough assessment of the skin should be completed as soon as possible after patients arrive at the hospital. (Medicare's "no pay for errors" policy permits payment to a receiving hospital if the patient's pressure ulcer was documented as present at the time of admission, yet another reason for a thorough intake assessment.) The most common sites for pressure ulcers occurring in hospitalized patients are the sacrum, coccyx,

buttocks, and heels (up to 66% of hip fracture patients develop a heel ulcer).(10) Skin changes identified on or after admission may mimic other conditions, making accurate diagnosis challenging. This is particularly true in the sacral/buttocks region, where skin tears, bruises, herpes simplex lesions, incontinence-associated dermatitis, and fungal infections are all commonly confused with pressure ulcers. Rapid onset of purple discoloration in the sacral/buttocks area is also seen with skin failure at the end of life.(11) When there is uncertainty, staff should treat lesions that *may be* a pressure ulcer *as a pressure ulcer* and begin regular repositioning and other interventions (see below).

While experts are clearly better at diagnosing pressure ulcers than less well-trained individuals, even experienced caregivers find it challenging to identify pressure ulcers early in their development. Animal studies and experience with pressure ulcers associated with surgery have revealed that skin changes associated with deeper tissue ischemia may not be apparent for up to 5 days or more after the injury.(12) Even before skin changes are apparent, pressure ulcers may cause pain, which can be an early warning sign for staff. However, the pain or discomfort may not be clearly communicated by non–English-speaking patients or patients with delirium or dementia, may not be felt by patients with neuropathy, or may be unrecognized in the setting of other illness or injury (such as a concurrent hip fracture).

Because of these issues, at the University of California San Francisco, we have chosen to immediately place all hip fracture patients on a high-level pressure redistribution surface (a type of mattress that uses air or fluid to redistribute the patient's weight across the entire surface, limiting focal points of pressure) and with their heels floated with a pillow lengthwise under the calf. Patients who are put on pressure redistribution surfaces in the ED or on the inpatient unit remain on the surface when transported to Radiology and the operating room. At our last random audit, we found no pressure ulcers in 32 hip fracture patients cared for during a 3-month period. While treatment of all hip fracture patients with a pressure redistribution surface is not a new idea (13), it is inconsistently used in this high-risk population.(14)

The patient in this case was found to have a stage II left hip ulcer about 16 hours after admission to the ED (from 11:00 PM to mid-afternoon). How might this have been prevented? As discussed, it may have been evolving on admission but invisible on the skin. So even if the skin could have been assessed amid the challenge of multiple fractures, it may not have been apparent. With her hip fracture, immobility, pain, and delirium, this patient should have been identified as very high risk and immediately placed on a high-level pressure redistribution surface. In addition, the high-risk status identified in the ED ideally could have been communicated to the admitting unit so early preventive interventions could be initiated.

Case & Commentary: Part 2

Upon review of the records, there was no documentation of a skin assessment at any point in her hospitalization. Furthermore, it became clear the patient had not been moved in her bed since her time in the ED, which likely led to the rapid development of this pressure ulcer.

Pressure ulcers can occur in as little as 2-6 hours.(3) All hip fracture patients may have an early evolving pressure ulcer given the many opportunities for immobility prior to hospital arrival (Table 3). Notably, the patient in this case had fractures on both sides of her body, which would make a full skin examination challenging. However, an early skin assessment with documentation should have been performed. The appropriate documentation is no longer just the domain of the nursing assessment. Changes in CMS reimbursement (not paying for pressure ulcers that develop in the hospital) are based only on coded *physician* documentation. Thus, physicians should document all pressure ulcers on admission and throughout the entire hospitalization. Hospitals should identify a collaborative practice to facilitate this; a pressure ulcer identified on a nurse assessment must be pointed out to the treating physician, who needs to document it in the medical record.

What could (or should) have been done to prevent the development of this pressure ulcer? The first principle is that even if the skin assessment had been done, hospitals should not rely on skin changes for interventions to begin. High-risk patients should be identified before the development of any pressure ulcer. Most preventive measures focus on maintaining intact skin and minimizing prolonged periods of focused pressure.

Bundled interventions including risk assessment, skin assessment, support surface assessment, nutritional screening, moisture management, optimizing fluids and hydration, and regular repositioning are effective methods used in hospitals today to "package" preventive efforts.(15) Determining the best surface for the patient can be challenging, as every hospital owns or rents a variety of alternative surfaces to protect patients from pressure ulcer development. Many guidelines err on recommending the most advanced surfaces only for management of full-thickness ulcers, when they should also be used for high-risk individuals on the "'front end"—*before* an ulcer occurs, or to minimize pressure in an evolving ulcer. Management of excess moisture includes regular toileting, frequent changing of absorbent pads, protection of the skin with barrier ointments, and the appropriate use of stool diversion options (i.e., indwelling rectal tubes). Shared recognition of high-risk patients can be important. In our facility, to identify these patients, staff members place a SKIN ALERT sticker on the outside of the chart, along with signs at the bedside. Some hospitals use color-coded armbands to identify patients at risk for pressure ulcers. Guidelines suggest that patients at risk for pressure ulcers should be repositioned at a minimum of every 2 hours.(10) Cues for repositioning have included clocks at the bedside to notify when to turn, overhead music played at regular intervals, and pagers that remind staff to turn patients every 2-4 hours. Concerning optimizing nutrition and hydration status, patients at risk for pressure ulcers (in particular those with recent weight loss, low body mass index, or hypoalbuminemia) should be seen by a registered dietitian to generate a nutritional plan. Other detailed preventive interventions are noted in the recently published guidelines.

Technology or creative use of devices can help with ensuring that multiple interventions are implemented. Computerized alerts can remind staff that they have not completed their full assessment or have missed one aspect of the bundled interventions. At our facility, having small portable mirrors attached to the blood pressure machines has assisted staff in assessing the skin in challenging locations when they are assessing the patients' vital signs. Empowerment of the bedside nurse as the focal point for protecting patients along with strong support from all levels of administration is key to a successful pressure ulcer prevention program. In fact, many believe that having an interdisciplinary team of health care providers is the optimal approach for identifying and preventing pressure ulcers.

Not all pressure ulcers are avoidable, but every pressure ulcer occurring in hospitals today should provide an opportunity to analyze current systems that might need to be modified to prevent a similar occurrence and should be done as part of all hospital pressure ulcer prevention programs.(16)

Challenges for the Future

Until we have a better understanding of pressure ulcer etiology and management of risk factors, effective interventions should focus on early identification of high-risk patients and skin changes at admission along with early implementation of preventive measures. Gaps still remain in protecting patients from pressure ulcers during patient transport, both to and from the hospital, and within the hospital. The impact of pressure ulcers on patients and their families, the hospital, and health care costs underscores the need for continued focus on this challenging patient safety problem.

Reconciling Records
The Cases

Case 1. A patient receiving care at a Veterans Affairs (VA) outpatient clinic was admitted to a local teaching hospital. When discharged, he was instructed to "resume" taking torsemide, although he had never taken this powerful diuretic previously. In his first follow-up appointment with his usual physician at the VA outpatient clinic, he requested a refill of the torsemide. His medication record showed that he had been taking terazosin for benign prostatic hyperplasia prior to the hospitalization; there was no record of his being on torsemide. When questioned about it, the patient said he had told the emergency department (ED) staff that he was taking a medicine whose name started with the letter T to make him urinate. The ED staff had entered torsemide into the electronic medical record. When discharged, this came up as an at-home medication, and he was instructed to resume taking it. When he came to see his primary MD at the VA clinic requesting a medication he didn't need and hadn't taken before, the error was detected.

Case 2. At another local teaching hospital, a family had given incorrect data to the ED staff (including listing the patient as being on prednisolone rather than prednisone), and the physicians caring for the patient had simply checked off the option to continue the home medications. When the records were carefully reviewed by a physician consulting for an upcoming cardiac procedure, almost all of the medications were found to be incorrect. Had the cardiologist assumed that the other physicians and nurses had accurately entered the medications, the errors would have gone undetected, and the patient's chronic steroid dependence might have not been appropriately addressed perioperatively. Fortunately, no harm occurred.

Mother's Milk, but Whose Mother?

The Case

A 2-month-old otherwise healthy infant was admitted to the hospital to rule out sepsis. The infant had been exclusively breastfed since the time of his birth.

In light of the difficulties associated with regular breastfeeding in the hospital, the mother stored her pumped breast milk in the refrigerator on the infant's ward in the hospital. At the time of the first feeding, a nurse's aide retrieved a bottle from the refrigerator, a bottle labeled only with the mother's room number and two initials. Approximately 5 minutes later, after giving the child 15 mL of the breast milk, the mother noticed that the initials on the bottle were not those of her son and called a staff member to the room, who promptly involved the child's main nurse.

The nurse and nurse's aide reviewed the events and suggested to the mother that the administered milk might, in fact, be hers—despite the fact that the initials on the bottle were not those of her child. Upon further review, it was noted that the initials matched those of the nurse's aide who separated the original milk container into small feeding bottles. The mother, skeptical that the milk was hers, asked that the nurses search the refrigerator. There, they found another bottle, labeled with the room number and the child's initials, that clearly was the mother's milk. In other words, they confirmed that the patient had unquestionably received 15 mL of the wrong human milk.

On further investigation, they learned that the mistaken milk sample actually belonged to the patient who previously occupied that room. Although that patient had since been discharged, the breast milk remained in the refrigerator. An infectious diseases consult subsequently counseled the family regarding potential risks from using the wrong breast milk. Additional laboratory testing revealed that no infectious transmission had occurred, and no other objective harm was identified by the time of discharge.

Treatment Challenges After Discharge

Case & Commentary: Part 1

Family members brought a 66-year-old man to the emergency department (ED) with acute-on-chronic altered mental status. Several years earlier, the patient had a craniotomy for a brain tumor, which had resulted in mental retardation. The ED obtained routine laboratory tests (including urinalysis and complete blood count [CBC]) that indicated a urinary tract infection

(UTI). After a urine culture was obtained in the ED, the patient was started on vancomycin and admitted to the hospital. By day 3, he showed marked improvement and, according to his family, was returning to his "usual self." He was switched to trimethoprim–sulfamethoxazole, an antibiotic he could take by mouth, and discharged home. The plan was for the patient to follow up with his primary care physician in 2 weeks.

Adverse events associated with hospital care may occur even after a patient has been discharged. For example, patients discharged from the hospital within the past week account for approximately 2.3 million ED visits per year; 10% of those visits relate to complications from the recent hospitalization.(1) While the ED staff manages many patients who seek follow-up care after discharge, a full 20% of all Medicare patients are readmitted to the hospital within 30 days.(2) One study concluded that 9%–48% of hospital readmissions are preventable.(3) Given the patient morbidity and health care costs associated with readmission, hospitals and physicians have begun to analyze the discharge process. Common problems surrounding the discharge process include adverse drug events, nosocomial infections, procedural complications, and diagnostic and therapeutic errors.(4)

The transition in care prompted by patient discharge differs significantly from intra-hospital transitions (e.g., end-of-shift handoffs). Intra-hospital care transitions involve two clearly defined care teams (transferring and receiving) that operate within the same health information system and have relatively easy access to one another. Increasingly, the transfer of care involves standardized communication between each team's respective physician and nurse to complete the handoff. Role clarity and standardized handoffs result in the receiving care team understanding that they are now in charge of the patient's care. Even if the transfer of care is done poorly, the patient still is in the hospital and is surrounded by physicians, nurses, and other staff that can assist if the patient becomes ill.

At discharge, however, there is an ambiguity over who owns the care of the patient between discharge and the patient's first appointment with a physician. Furthermore, hospital-based care teams and primary care physicians often exist in different health care systems that are geographically separated and use siloed health information systems. This separation creates significant obstacles to communication, resulting in poor handoff of the care plan, including any pending test results. Finally, patients often have poor access to primary care, resulting in patients having no medical support at crucial times during their postdischarge recovery. Consequently, patient care suffers, and often, patients recently discharged return to the hospital for further care.

Case & Commentary: Part 2

Eleven days later, the patient's family brought him back to the ED after he had become increasingly disoriented and confused. His white blood cell count, which had been normal previously, was now very high (31,000), and his blood pressure was lower than usual. He was

admitted to the hospital with the diagnosis of severe sepsis. The admitting nurse noticed that the urine culture results from his prior hospital admission indicated that the patient's infection was not sensitive to trimethoprim–sulfamethoxazole. These test results had become available 2 days after the patient's discharge but had not been reviewed by any of the hospital clinicians responsible for his care or forwarded to his primary care physician. As a result, the patient had continued to take the trimethoprim–sulfamethoxazole. His second hospitalization lasted 7 days. With the correct antibiotic, he made a full recovery.

This case highlights the common challenges surrounding the discharge process. First, patient work-ups are often incomplete and are left to the patient's primary care physician to finish.(5) Outstanding lab results can cause avoidable treatment and diagnosis delays, as with this patient receiving treatment with the wrong antibiotic. Second, the lack of direct (e.g., physician-to-physician phone call) or indirect (e.g., delivery of the discharge summary) communication between the discharging care team and the primary care physician most certainly contributed to this patient's worsening health. Had the patient's discharging care team alerted his primary care physician about the pending urine cultures, the patient could have gotten the correct antibiotics for his UTI. Sadly, though, direct communication between physicians occurs only 3%–20% of the time, and the discharge summary is available at the patient's first follow-up appointment only 12%–34% of the time.(6,7) Third, patients discharged from the hospital often need additional medical attention as they recover from their illness. This need for transitional care is evidenced by the fact that timely follow-up with a nurse or primary care physician can help patients receive the care they need after discharge and help reduce re-hospitalization rates.(8,9) Unfortunately, this patient did not see a physician soon enough after discharge, his condition deteriorated, and he returned to the ED.

As illustrated by this case, tests pending at discharge (TPADs) are common, occurring with approximately 40% of patients discharged from the hospital.(10) Almost 10% of TPADs potentially require physician action.(10) Consequently, failure to follow up on TPADs can lead to delays or missed opportunities for diagnosis and treatment of illnesses.(11) Moreover, the impact of TPADs extends beyond the patient. In fact, failure to follow up on TPADs is the source of 25% of all diagnosis-related malpractice lawsuits for one insurer.(12)

The epidemiology of TPADs has not been well studied. At our institution, we found that almost 82% of our TPADs were microbiology data (e.g., blood or sputum cultures) followed by toxicology (3.4%) and urine studies (3.0%).(13) Other tests commonly ordered in the hospital, like CBCs and chemistry panels, are rarely pending at discharge simply because their turnaround time is, on average, a few hours. As is evident from the case described above, microbiology tests have a high potential to impact patient care and require timely follow-up to ensure correct treatment. However, because, more often than not, microbiology TPADs do not alter the care plan, physicians have difficulty prioritizing TPAD management as part of their busy daily workflow.

Despite a call to action by The Joint Commission in 2005 (14), managing TPADs remains a low priority for health care providers. In a survey of the leaders of seven Divisions of Hospital Medicine at academic centers across the country, along with the leaders of seven departments at our institution, we found that most leaders recognized the importance of TPAD follow-up, but none had a formal policy requiring their physicians to complete timely follow-up of TPADs.(15) The majority of the leaders did not use a systems-based approach to TPAD management, relying instead on individual physicians to ensure timely TPAD follow-up.(15) Yet relying on individual providers to complete timely TPAD follow-up is inadequate at best. Had a system been in place to ensure that a physician—either the discharging team or the patient's primary care physician—followed up on the pending urine cultures and antibiotic sensitivities, this patient would not have become ill again.

The lack of systems to help physicians manage pending tests efficiently is a sore spot for many health care providers. In fact, Poon and colleagues (10) found that neither hospitalists nor primary care physicians are satisfied with how they manage pending tests. Recently, however, studies have identified techniques to help physicians improve their ability to identify and manage pending test results.(16,17) First, physicians and practices that have high patient safety awareness manage pending tests more effectively. Second, the presence of technology, especially an electronic medical record, improved the ability of physicians to manage pending tests.

Several large programs have focused on improving the discharge process for patients. These projects, including Project RED (Re-Engineering the Discharge [18]), Project BOOST (Better Outcomes for Older adults Through Safer Transitions [19]), and the Care Transitions Initiative (20), share common interventions. These interventions include:

- Improving patient and family education by using the "Teach Back" method and patient-friendly discharge forms.
- Improving medication education and reconciliation at discharge.
- Improving communication between the discharging physician and the provider or care team assuming care for the patient.
- Increasing access to health care professionals during the discharge period by providing a discharge "coach," postdischarge phone calls, and scheduling appointments for patients with their primary care physician within 1 week of discharge.

While these efforts vary in cost and resource use, they have been shown to improve the care of patients at the time of discharge.(18,20) Such efforts will likely become even more valuable when the Centers for Medicare and Medicaid Services limits its reimbursements to hospitals for patients readmitted within 30 days of discharge, as is presently planned.

In summary, transitions of care, and in particular, the discharge process, are ripe with opportunity for patient harm. One such opportunity for harm occurs when test results are pending at the time of a care transition. Despite their best intentions, practitioners cannot manage these tests on their own. It is imperative, therefore, that physicians work with their practice or health system to

develop systematic, computer-based processes to ensure timely follow-up of pending test results. Until these processes are in place, patients will continue to suffer harm.

The Deadly Duo

The Case

A 29-year-old man with a history of depression and possible psychosis was found unconscious and unresponsive at home and was brought to the emergency department. He was tachycardic, hypertensive, and unresponsive to painful stimuli. His electrocardiogram revealed tachycardia, QT prolongation, QRS widening, and a nonspecific intraventricular conduction delay, all evidence of potentially dangerous heart rhythms. He was intubated for airway protection and given activated charcoal through a nasogastric tube to treat a presumed drug overdose. He was also treated with a bicarbonate drip, which can help suppress overdose-related arrhythmias.

Further history obtained from the paramedics revealed that the patient had been prescribed amitriptyline (a tricyclic antidepressant) and risperidone (an antipsychotic medication) by his primary care physician to treat his psychiatric conditions. Empty bottles of both were found on the floor near the patient at his home, and it was presumed that he had overdosed on the medications as a suicide attempt. The patient survived the episode without any life-threatening arrhythmias and was transferred to an inpatient psychiatric ward once he was stabilized.

"Recurrent" Appendicitis

The Case

An 85-year-old man presented to the emergency department (ED) with right lower quadrant pain. On physical examination, the patient showed rebound tenderness with guarding. He received a CT scan of his abdomen, which revealed an inflamed, dilated appendix with surrounding inflammatory changes. The patient was taken to the operating room (OR) for laparoscopic appendectomy. The surgeon had recently joined the medical staff after completing a general surgery residency and then a breast surgery fellowship, and so was still subject to proctoring. The operative report notes that two other surgeons came into the OR to confirm that the appendix was removed with no retained tissue.

Postoperatively, the patient continued to have right lower quadrant pain, which led to a repeat CT scan showing inflammatory changes in the right pericecal region. Because the pathological specimen from the appendectomy had not yet been read, the pathologist was called to determine whether there were some findings that might explain the patient's persistent symptoms. When she examined the specimen, she found no appendiceal tissue.

The patient was emergently taken back to the OR, and the appendix was located and excised. The patient had a stormy postoperative course, complicated by aspiration pneumonia requiring intubation, but ultimately made a full recovery.

Dangerous Dialysis

The Case

A 48-year-old man with a long history of diabetes and end-stage renal disease (ESRD) on hemodialysis arrived at his outpatient dialysis center for his scheduled Friday morning session. Before starting dialysis, his nephrologist sat down next to him and stated that a serious error had occurred at the dialysis center. The nephrologist told the patient that, for a number of dialysis sessions, he had been dialyzed using a dialysis membrane that had been inappropriately reused, which meant that he had been exposed to another patient's blood many times.

The dialysis center was actually not sure which dialysis membrane had been reused, so they couldn't identify the specific patients affected by this error. Thus, they were informing all patients who had potentially been exposed to a communicable disease. At this dialysis center, many patients had HIV and hepatitis C, so it was conceivable that this particular patient had been exposed.

The patient was tested for HIV and hepatitis viruses and was treated for 3 months with postexposure prophylaxis for HIV. Ultimately, repeated blood tests were negative for HIV and hepatitis, meaning that the patient did not experience any long-term consequences.

Emergent Triage Miss

The Case

A 42-year-old woman presented to a busy urban emergency department (ED) and approached the triage nurse. The patient told the triage nurse that she had "3 days of face and tongue swelling." She also said that, in the previous 2 weeks, she had two intensive care unit (ICU) admissions for similar complaints and that she had required intubation in one of those instances.

The triage nurse documented that the patient was "speaking in full sentences" and "swallowing secretions." The vital signs at triage, including respiratory rate and oxygen saturation, were normal. The triage nurse decided that this was "urgent" and not "emergent," and therefore the patient was asked to wait in the waiting room.

The patient sat in the waiting room for more than 2 hours before she was finally placed into a room in the ED. It was another hour after that before a physician evaluated her. By that time, her tongue and throat had swollen substantially, and she was having difficulty breathing. She required emergency intubation, a potentially dangerous and high-risk procedure, and aggressive treatment with intravenous epinephrine, steroids, and nebulizers.

The patient was given a diagnosis of angioedema—rapid swelling of the skin and tissues around the mouth and throat. She was admitted to the ICU and had an uncomplicated 5-day hospital stay. The patient experienced no major long-term consequences.

The case was discussed in the departmental quality conference. When asked why she did not bring the patient into the ED more emergently, the triage nurse responded, "I didn't think the patient was telling the truth about her recent intubation."

Missed Patient Assignment: Is Anyone There?

The Case

In one hospital, nurses' patient assignments were communicated by listing the room numbers next to each nurse's name in a computerized tool. At the beginning of a new shift, the oncoming nurses listen to the taped report for each patient in their assigned rooms.

At the start of one particular evening shift, a nurse was assigned five rooms to cover per the paper assignment list. However, the taped report for one of the bed locations was empty. She concluded that the room had been vacated and was now available for a new admission or transfer.

The nurse made rounds on each of the patients for whom she had a report at the beginning of the shift, completing the assessments, medications, and treatments for each one. Mid-shift, the charge nurse inquired if there were any status changes or other pertinent information regarding any of the assigned patients. The nurse stated that there were none. Near the end of the shift, the nurse recorded a report on her four patients. At the end of the shift, the charge nurse asked why there wasn't a taped report on the fifth assigned patient.

This came as a surprise, as the nurse had never seen the fifth patient. She quickly visited the patient and completed necessary assessments and care. Fortunately, the patient was stable, was scheduled to be discharged in the morning, and had not been scheduled to receive any medications or tests during that shift. He was not harmed.

The concern for this neglected patient and the potential for similar events in the future led to a root cause analysis. The underlying cause was determined to be the lack of confirmation of patient assignments by the accepting nurse. There were multiple contributing causes. On this unit and throughout the hospital, there were varying procedures for creating, checking, and distributing nursing assignment lists by different charge nurses and different, or sometimes no, methods for acknowledging assignments.

As a result, a rapid cycle improvement was conducted, and its recommendations were implemented on all inpatient units. First, nurses were to do an independent double-check of the nursing assignment list made by the charge nurse using consistent symbols with standardized meanings. Second, at shift change, oncoming nurses would be required to enter their own names next to the names of patients they had been assigned in the electronic patient tracking tool. This would acknowledge communication of assigned patients. Lastly, the charge nurse would compare the assignment list to the completed electronic sign-in tool and address any discrepancies.

Weighing In on Surgical Safety

Case & Commentary: Part 1

A 54-year-old man with diabetes mellitus, hypertension, and obstructive sleep apnea (OSA) was referred to an orthopedic surgeon after many years of left knee pain. Despite aggressive efforts

with physical therapy and medications to treat his pain, the patient continued to experience increasing functional limitations. Although he tried to lose weight many times, his body mass index remained 40 kg/m2 (normal is approximately 19-25). After having a total knee replacement recommended, he was referred to a preoperative clinic for evaluation.

Every day we are bombarded with newspaper, television, and radio headlines reminding us of the worldwide obesity epidemic. Obesity has become a major problem in both industrialized and developing countries. Today in the United States, more than two-thirds of the adult population is overweight (body mass index [BMI] > 25 kg/m2), and more than one-third is obese (BMI > 30 kg/m2). Significant obesity, often termed *morbid obesity* (BMI > 40 kg/m2), is associated with many medical comorbidities. This patient is typical, suffering from hypertension, type 2 diabetes mellitus, OSA, and osteoarthritis.

In order to reduce perioperative risks, medical comorbidities must be recognized, evaluated, and properly treated if necessary, prior to elective surgery. The presence and degree of obesity influence some of the technical aspects of anesthetic management (e.g., airway intubation, drug distribution and uptake, risk of pressure injury), but poorly controlled medical comorbidities are probably the most important factors increasing the overall risk of morbidity and mortality in this patient population. As a rule, general anesthesia and airway manipulation are best avoided in the extremely obese patient, and regional anesthetic techniques, although technically more challenging, are preferred if practical.

In patients like the one presented, hypertension must be adequately controlled and antihypertensive medications should be continued even on the day of surgery. The one exception is angiotensin-converting enzyme inhibitors, such as lisinopril, which should be stopped before surgery since they can cause marked hypotension on induction of anesthesia. Although the incidence of ischemic heart disease is increased in patients with obesity, a resting ECG is usually sufficient for baseline investigation if the patient has good exercise tolerance and no signs or symptoms of heart disease. The ability to easily climb stairs without dyspnea demonstrates reasonable cardiovascular reserve. However, most morbidly obese patients also have back and knee osteoarthritis, which severely limits physical activity and makes most forms of simple, clinical stress testing impossible. For patients with limited exercise tolerance or difficulty assessing this tolerance, additional evaluation by a cardiologist may be indicated.(1) Often the only clue that a patient suffers from cardiac dysfunction is the presence of orthopnea and fluid retention, usually presenting with pitting edema of the legs. Even modest degrees of ankle edema can suggest right heart failure and pulmonary hypertension in the obese patient.(2) These would all be important screening elements in the history and physical examination when conducting the preoperative evaluation in an obese patient.

Insulin and other diabetic medications should be continued until the day of surgery and then withheld. In diabetic patients, the operation should ideally be scheduled for the morning. Blood sugar should be monitored intraoperatively and throughout the postoperative period, and insulin

administered as required. There are existing practice guidelines that assist providers in managing perioperative glycemic control.

Our patient also has a history of OSA. The "STOP" questionnaire is a simple tool that asks about the presence of factors associated with OSA. *STOP* stands for loud *s*noring, *t*iredness during the daytime, *o*bserved apneas, and high blood *p*ressure.(3) A further refinement (the "STOP-BANG" questionnaire) includes questions about *B*MI, *a*ge, *n*eck circumference, and male *g*ender. The results of these questionnaires are suggestive but not diagnostic of OSA. A definitive diagnosis of OSA can only be made by polysomnography. However, since there is a very high association between OSA and morbid obesity, it is prudent to consider all such patients as having sleep apnea and to manage them accordingly. Mild to moderate OSA may be asymptomatic and of minor importance, but severe and long-term OSA is associated with chronic hypoxemia, pulmonary and systemic hypertension, and cardiac failure. Untreated chronic OSA can increase operative risk. Nocturnal continuous positive airway pressure (CPAP) therapy should be instituted 4-6 weeks before planned surgery. Patients on CPAP have reductions in both systemic and pulmonary hypertension and experience an improvement in functional capacity. Unfortunately, compliance may be a problem in some patients, and others may not wish to delay surgery. Likewise, weight loss prior to elective surgery is encouraged and may alleviate some comorbidities, but most morbidly obese patients are unable to lose significant weight without bariatric weight loss surgery.

In summary, with the proper preoperative risk reduction strategies, our patient would be a reasonable candidate for surgery, but risks remain because of the discussed comorbidities related to his obesity.

Case & Commentary: Part 2

The patient underwent a preoperative evaluation and, after a discussion about risks and benefits, he consented to a total knee replacement. The plan was to use general anesthesia supplemented by use of an epidural catheter for postoperative pain control. On the day of surgery and in the operating suite, the patient was placed in a supine position for induction of anesthesia. The patient soon experienced hemodynamic instability and hypoxia, and, despite many efforts, providers were unable to establish a functioning airway. The patient soon became pulseless, a code was called, and the patient expired after failed resuscitative attempts.

Normally, combining general and epidural anesthesia is an acceptable plan for any patient undergoing elective knee replacement surgery, although using only an epidural for both intra- and postoperative analgesia may have been a better choice for this morbidly obese patient. A regional anesthetic alone offers many advantages for the obese patient, including minimal need for airway manipulation, reduced use of potentially cardiopulmonary depressing anesthetic agents, and a lower incidence of postoperative nausea and vomiting.(4) An epidural can provide excellent postoperative pain control, thereby lowering opioid requirements, an important consideration for obese patients prone to pulmonary complications. Whichever anesthetic

technique is used, sedative premedication should be avoided whenever possible. Many, if not most, morbidly obese patients with OSA are extremely sensitive to the respiratory depressive effects of even small doses of sedatives and opioids.(5)

The combination of a large neck circumference (> 40 cm) and high Mallampati score (III-IV) is the best predictor of potential airway intubation difficulties.(6-7) The Mallampati score is used by anesthesiologists to try to predict difficulty with direct laryngoscopy. A Mallampati score of I or II is usually associated with an easy intubation, while scores of III and IV are more predictive of difficulty (Figure 1). For any high-risk patient (and many morbidly obese patients fit into this category), an awake fiberoptic-assisted intubation or use of a video-laryngoscope should be considered. However, for most morbidly obese patients, placement of a tracheal tube by direct laryngoscopy is usually no more problematic than for a normal-weight patient, provided that proper steps are taken to ensure success. An assistant experienced with airway management must always be immediately available should problems occur, since a second pair of hands may be necessary to help with bag-mask ventilation should intubation of the airway fail.

The error in this patient's care that resulted in the tragic outcome was the attempt to induce general anesthesia while he was supine—a known and very real danger in morbidly obese patients. Even when sitting or standing, extremely obese patients have markedly reduced functional residual capacity, and lung volume is further reduced when they lie flat.(8) The supine position causes significant increases in oxygen consumption, cardiac output, and pulmonary artery pressure. Simply lying down leads to a decrease in already poor chest wall compliance, greater perfusion mismatch, and a sudden shift of blood to an already hyperactive, borderline hypoxic heart. In patients with inadequate cardiac reserve, these acute changes can cause fatal cardio-respiratory decompensation, as was demonstrated more than 30 years ago in a report aptly titled "Obesity Supine Death Syndrome."(9) As this case tragically demonstrates, these observations are still not fully appreciated.

Proper positioning is essential. A head-up position facilitates mask ventilation, improves the laryngoscopist's view during direct laryngoscopy, and most importantly recruits lung volume and increases oxygen reserves.(10) The "head-elevated laryngoscopy position," in which the head and upper body are elevated so that an imaginary horizontal line can be drawn from the sternum to the ear, increases the success of direct laryngoscopy in morbidly obese patients (Figure 2).(11) Head-up positions also increase "safe apnea time" (i.e., the time between pre-oxygenation and muscle paralysis until oxyhemoglobin begins to significantly desaturate). The longer the safe apnea time, the more time available to secure the airway before the patient becomes hypoxemic. Maximum safe apnea time for morbidly obese patients can be achieved with the operating room table in the reverse Trendelenburg position.(12) Therefore, our practice at the start of every case with general anesthetic is to position the extremely obese patient in the head-elevated laryngoscopy position with the operating room table in the reverse Trendelenburg position (Figure 3).

After adequate pre-oxygenation, induction of general anesthesia is performed with intravenous propofol. Opinion is currently divided as to which muscle relaxant is best for tracheal intubation for obese patients—the choice is between the depolarizing relaxant succinylcholine and the non-depolarizing relaxant rocuronium. Although both have a rapid onset and both provide satisfactory conditions, succinylcholine allows for consistently better views during laryngoscopy. Succinylcholine has a short duration of action; should difficulties be encountered, paralysis will wear off within 8-10 minutes and the patient will resume spontaneous breathing. If rocuronium is used and difficulties occur (as in this case), its neuromuscular blocking effects must be reversed or the patient will remain paralyzed for a much longer period. Although the drug sugammadex does have the ability to reverse rocuronium immediately, it is not yet available in the United States. Until sugammadex becomes available, we recommend succinylcholine for tracheal intubation of obese patients.

If the trachea is not successfully intubated and mask ventilation becomes "impossible" (as occurred in this case), placement of a laryngeal mask airway and changing from the supine to reverse Trendelenburg position may be enough to allow adequate oxygenation. However, if the vocal cords have been traumatized from unsuccessful attempts at tracheal intubation, a surgical airway may be the only option. Unfortunately, cricothyroidotomy or tracheostomy in a morbidly obese patient with a large neck is not easily or rapidly achieved.

The obesity epidemic means that every anesthesia and surgical care provider will see more and more extremely obese patients in their daily practice. With proper preparation, monitoring, and an awareness of their unique needs and challenges, morbidly obese patients can safely undergo any surgical procedure. A completed plan, perhaps even a checklist, should be prepared prior to anesthetizing an extremely obese patient. To guide management, each case should begin with a list of each medical comorbidity and what steps have been taken to optimize that condition. An airway management decision tree should also be considered. Once the decision is made to access the airway, a list of what steps and what equipment should be available to maintain adequate ventilation (similar to the American Society of Anesthesiologists "Difficult Airway Algorithm") if the initial plans to intubate the trachea fail. For each patient, calculation of various weight formulas (BMI, lean body weight, and ideal body weight) prior to administering any drugs will avoid under- or overdosage since various agents are given based on these different weights.

Given the number of obese patients currently undergoing surgery, and the predicted increase in that number in the future, every anesthesia training program should place an emphasis on teaching the principles of management of these patients. The morbidly obese patient presents a complex clinical challenge, and continuous ongoing medical education and keeping current with the latest strategies for the care of the obese patient are necessary.(13) This case had a devastating outcome, one that probably could have been avoided if the anesthesia provider had been familiar with the management of the obese patient.

Acute Respiratory Arrest in Pregnancy

The Case

A 35-year-old woman was 38 weeks pregnant with twins (G3P2). When she developed acute onset of shortness of breath and hemoptysis (coughing up blood), her husband called 911. Shortly after paramedics arrived, the patient experienced a respiratory and cardiac arrest. CPR was administered, and she successfully regained a pulse. Upon hospital arrival, the patient was rushed to the operating room for emergency C-section. Two infants were delivered stillborn, with Apgar scores of 0 at 1, 5, and 10 minutes. The patient was transferred to the ICU with hypoxic encephalopathy; she eventually recovered.

Review of her medical records revealed that the patient had a history of chronic hypertension, which had worsened during her third trimester; it had been managed by increasing the dose of her chronic antihypertensive medication (labetalol). A few weeks prior to admission, after the patient complained of shortness of breath, her obstetrician prescribed her albuterol. Two days prior to admission, the patient presented to the obstetrics clinic with blood pressures (BPs) in the range of 170-210/100-125. Fetal non-stress testing was normal. At that visit, the nursing notes indicate some concern about preeclampsia. However, the physician did not order further evaluation, in part because "preeclampsia labs" had recently been performed and were found normal.

Tacit Handover, Overt Mishap

The Case

A 61-year-old man was admitted for management of an infected aortic stent, which had been placed 3 years earlier to treat an abdominal aortic aneurysm. In preparation for surgical removal of the infected stent and graft repair of the abdominal aorta, a spinal drain was placed by an anesthesiologist. The spinal drain, a small soft catheter, was inserted into the lower spinal cord to remove cerebrospinal fluid—these drains lower pressure in the spinal cord and thereby reduce the risk for post-surgery paralysis.

The patient underwent uncomplicated removal of the infected stent and graft repair of the aorta. Per protocol, the spinal drain remained in place for 48 hours after the procedure. At that time, the anesthesiologist attempted to remove the drain, but aggressive pulling resulted only in stretching of the catheter. Concerned about causing injury to the patient, he consulted a neurosurgeon who recommended that further attempts to remove the catheter be done under general anesthesia in the operating room (OR) in hopes that anesthesia would relax the back muscles. The patient was placed on the OR schedule for the following day. The anesthesiologist and neurosurgeon both clearly documented the plan of care in the chart.

The following morning, the five anesthesiologists on duty met to discuss all of the cases scheduled for the day, including the catheter removal, so all of them were aware of the plan. Unfortunately, because of prolonged surgeries, the case was pushed to the end of the day. By that

point, the anesthesiologist on call for the night had arrived, unaware of any of the treatment plans. She noticed that this case was labeled "Spinal Drain Removal" on the schedule. Confident that she knew how to manage these devices, she approached the head anesthesiologist for the day and asked if she could "take care of the spinal drain case." The head anesthesiologist knew that she had experience in the area and simply said "yes" without conveying any further information. The on-call anesthesiologist did not review the patient's chart or obtain any further information.

Unaware of the plan for general anesthesia, the on-call anesthesiologist proceeded to try to pull out the drain while the patient was awake in the preoperative area. Unfortunately, the catheter broke, leaving a portion inside the spinal canal. Consequently, the neurosurgeon had no choice but to surgically remove the catheter. Luckily, the patient suffered no major consequences, but was at risk for spinal cord injury and had to undergo a second surgical procedure.

Fatal Error in Neonate: Does "Just Culture" Provide an Answer?

The Case

An infant was born prematurely at 30 weeks weighing only 1.8 kg. In the neonatal intensive care unit, he was started on total parenteral nutrition (TPN) with Premasol amino acid solution at 3 g/kg/d and dextrose 12.5%, 5 mg/kg/min. After being maintained using those solutions for the first 2 days after delivery, the care team added lipids on day 3. This was ordered as lipid emulsion 20% at a rate of 0.19 mL/hr.

The neonatal intensive care unit had frequent orders for this treatment and kept a stock of lipid emulsion on site. This practice avoided the delay between ordering, sending the order to the pharmacy, and waiting for the pharmacy to dispense the new TPN solution.

Within 4 hours of beginning the lipid emulsion administration through the TPN line using a smart pump, the infant's condition worsened. He showed signs of respiratory distress, pulmonary hypertension, coagulopathy, and liver failure. Soon after, the infant suffered a cardiac arrest and died.

As the symptoms displayed by this premature infant suggested lipid overload, the dose and rate of administration of the lipid formulation were assessed. Assessment revealed that the pump was set to deliver 19.0 mL/hr. In the process of calculating the dose with the concentration of lipid emulsion available on the unit, the RN had erroneously set the pump to deliver 100 times the ordered dose of 0.19 mL/hr. Upon discovery of the error, the nurse involved was fired by the hospital and her license was revoked. The sequence of events and underlying reasons for the error were not investigated further.

Anticoagulation: Held Too Long

The Case

A 68-year-old woman with a history of mitral valve replacement with a mechanical valve was admitted with abdominal pain. Because of the mechanical valve, she was chronically on warfarin (a blood thinner). At the time of admission, her international normalized ratio (INR) was 1.3,

indicating that she was under-anticoagulated—her blood was not appropriately "thinned" to prevent possible clots from forming on her mechanical valve. She was treated with unfractionated heparin, a continuously delivered intravenous medication, which quickly thinned her blood appropriately.

Based on her abdominal complaints, a gastroenterology consultant wished to pursue esophagogastroduodenoscopy (EGD), a procedure in which a camera is inserted through the mouth and into the stomach. The gastroenterologist wanted the patient to be off all blood thinners to prevent bleeding complications and in case he needed to do biopsies.

The admitting team caring for the patient wrote an order to stop the heparin at 5:00 pm on the day before the EGD as well as an order to restart it 48 hours afterward. Unfortunately, the order to restart the heparin was missed, and the heparin was not restarted after the procedure. Four days after the EGD, the team noticed that the patient's partial thromboplastin time (PTT), a different marker of blood thinning (one that goes up in response to heparin), was normal and realized that the patient was not being anticoagulated appropriately by the heparin. The heparin was quickly restarted, and the patient was eventually discharged. She did not suffer any negative consequences, but her prolonged period off anticoagulants put her at high risk for acute stroke from blood clots on her mechanical valve.

Nosy Business
The Case

A 59-year-old man with a history of idiopathic thrombocytopenic purpura (ITP) presented to the emergency department (ED) with epistaxis (a "nose bleed"). He reported no previous history of epistaxis and stated that the symptoms began spontaneously a few hours prior to presentation. He was treated with "conservative" therapy after his platelet count was found to be normal and discharged home. He returned to the ED 24 hours later with recurrence of epistaxis and was once again discharged home after the bleeding stopped spontaneously. When he presented with epistaxis for the third time in 72 hours, he was noted to be tachycardic and pale. He had developed a new anemia, but his platelet count remained normal and his tachycardia resolved with intravenous fluids.

The ED providers initially placed nasal tampons bilaterally, but his brisk bleeding continued. Otolaryngology was consulted and, after removing the tampons, they identified the posterior nasopharynx as the site of bleeding under direct visualization. After attempted cautery and nasal packing, the bleeding recurred within an hour. The patient ultimately underwent a procedure to have his sphenopalatine artery embolized by interventional radiology. Because the patient's platelet count remained normal through the bleeding episodes, a hematology consultant felt that the patient's ITP had not contributed to the epistaxis. The patient's symptoms resolved, he received 4 units of packed red blood cells, and he was discharged home with no immediate recurrence.

Bad Writing, Wrong Medication
Case & Commentary: Part 1

A 73-year-old man with a long-standing cardiac arrhythmia came to the ambulatory clinic for a routine follow-up visit. After evaluation, he received a handwritten prescription for Rythmol (propafenone), 150 mg, which had been his usual antiarrhythmic medication for the past 3 years. The patient delivered the prescription to the clinic pharmacy, and it was filled. Shortly after starting to take the medication, the man began to feel "very, very bad," with nausea, sweating, and an irregular heartbeat. These symptoms persisted for 2 weeks, and the patient called his physician to schedule another appointment. The patient brought the medication to his physician, stating that the Rythmol tablets looked different from their usual appearance.

Both medication errors and adverse drug events (ADEs) are types of medication safety events. To provide a framework for discussion, it is useful to begin with a definition of each. The National Coordinating Council on Medication Error Reporting and Prevention defines a *medication error* as "any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer."(1) Such events may be related to any aspect of medication use. An *ADE* is defined as "an injury resulting from a medical intervention related to a drug."(2) The relationship between the two is illustrated in the Figure. Medication errors that cause harm become *preventable ADEs*; errors that do not cause harm are termed *potential ADEs*. Some ADEs are not due to errors and are not preventable.

Research that characterizes the epidemiology of medication errors and ADEs in the ambulatory setting is sparse, both due to the fragmented nature of most outpatient care and the limitations of the relevant data sources. Nonetheless, it is estimated that 21% of handwritten prescriptions contain at least one prescription-writing error.(3) Most research has focused on dispensing errors, and investigators estimate that between 1.7% and 24% of prescriptions are dispensed erroneously, and that 1.5% to 4% of these errors could cause harm.(4) Labeling errors and wrong-drug errors occur frequently.(4,5) Investigators estimate that between 11% and 38% of ADEs in the ambulatory setting are preventable (6-9), and one study found that preventable ADEs were more likely than nonpreventable ADEs to be serious, life-threatening, or fatal (54% versus 30%, respectively).(9) They further estimated the direct cost of a preventable ADE to be $1983 in older adults, and the estimated annual direct cost of preventable ADEs to the entire Medicare population to be $887 million (both 2000 $). These costs were attributed to inpatient stays (62%), emergency department visits (6%), outpatient care (28%), and medications (4%). These estimates do not include costs to the patient, productivity losses, or decrements in quality of life.(9)

Data from the 2006 National Ambulatory Medical Care Survey indicate that one or more drugs were provided or prescribed in 636.7 million of the 902 million office visits made to physicians in 2006.(10) With such high prescription volumes, adopting strategies to optimize medication

safety in the ambulatory setting is a crucial component of improving the quality and safety of patient care.

In this case, the patient's statement that the physical characteristics of the dispensed medication differed from those of his usual prescription, coupled with the temporal association between prescription filling and his symptoms of nausea, sweating and irregular heartbeat, send a clear signal that a dispensing error likely occurred.

Case & Commentary: Part 2

Based upon the altered appearance of the tablets, both the patient and the physician suspected that this might not be the correct drug. Upon investigation, the physician identified the patient's medication as Synthroid (levothyroxine), 150 mcg, not the intended Rythmol (propafenone), 150 mg. When the physician spoke with the pharmacist who had filled the prescription, it became apparent that a medication dispensing error had occurred due to unclear handwriting on the original prescription. The patient's symptoms of nausea, sweating, and irregular heartbeat were related to both inadvertent, abrupt discontinuation of Rythmol and the unnecessary use of Synthroid at a relatively high initial dosage. Synthroid was immediately discontinued, and the patient restarted Rythmol as originally prescribed.

In a *systems-based approach* to medical error prevention, we recognize that many errors stem from weaknesses in individual components of the health care system, that these weaknesses are best improved through multidisciplinary efforts, and that determining who was involved is less important than identifying and addressing the root causes of the problem.(11) The Institute for Safe Medication Practices (ISMP) actively promotes this approach and has conducted hundreds of root cause analyses (RCAs) after error occurrences. In all cases, the causes have been multifactorial and have involved many processes, more than one line of responsibility, and organization-wide systems.(11) ISMP has identified ten key system elements that influence medication safety: (i) access to patient-specific information; (ii) access to drug information; (iii) adequate communication; (iv) proper labeling, packaging, and nomenclature; (v) drug standardization, storage, and monitoring; (vi) medication delivery device use and monitoring; (vii) sufficient environmental support; (viii) staff competency and education; (ix) patient education; and (x) quality improvement and risk management programs.

Much is made of the roles of electronic medication records (EMRs), computerized provider order entry (CPOE) systems, and bar-coding technologies in reducing errors. The Institute of Medicine strongly supports greater use of information technology to improve medication safety.(12) CPOE systems, when correctly implemented, are associated with a reduction in errors—in some studies by more than 50%.(13,14) In a recent study that investigated the impact of a CPOE system on errors in the ambulatory clinic setting, the greatest reduction was seen in the odds of an error of illegibility (97% reduction), followed by use of inappropriate abbreviations (94%), and missing

information (85%).(14) The literature is silent on the impact of bar-coding in reducing medication errors in the community pharmacy setting.

Recent survey data from the National Center for Health Statistics indicate that approximately 17% of office-based physicians used a "basic" EMR in 2008 and 4% used a "fully functional" system.(15) As defined, a basic system included functionality for prescription ordering, while a fully functional system also allowed for electronic prescription transmittal. When prescriptions are electronically prescribed, they cannot always be transmitted directly to the pharmacy dispensing computer system, but may require that the prescription be sent via facsimile. Pharmacies can rescan these into the pharmacy system for documentation purposes, but they must still re-enter the prescription data into the pharmacy computer system to dispense the medication(s). Even when direct transmittal is successful, routed and delivered through an interchange used by the pharmacy benefit manager, the prescription often requires modification to ready it for dispensing. Finally, community pharmacy computer systems are seldom linked to EMRs and CPOE systems. At a minimum, pharmacy dispensing computer systems do contain a record of patient demographic information, allergies, and a list of prescriptions filled at that pharmacy. They provide alert checking for allergies, duplicate medications, and drug–drug interactions. Virtually all pharmacies have access to drug information with online information being more up-to-date than paper versions.

Pharmacists are accustomed to correctly interpreting handwritten prescriptions. When illegibility raises doubt in a pharmacist's mind, the pharmacist may seek clarification by viewing the EMR, checking with the patient, or telephoning the prescriber's office. Once clarified, bar-coding can be used to match each unique prescription to the drug product. Once a prescription is filled, the purchase transaction is often handled by a pharmacy assistant or technician. The Omnibus Budget Reconciliation Act of 1990 required states to establish standards governing patient counseling for prescriptions.(16) Most states require the *offer* of counseling, which is usually made by this same technician. If a patient accepts, face-to-face counseling by a pharmacist is required; in 64% of states for new prescriptions only, in the remainder for both new prescriptions and refills. This interchange provides the opportunity for a final check to prevent medication errors. Yet patients often refuse counseling, especially for medication refills. In one recent study, 43 of 100 trained shoppers received verbal counseling for a new prescription. In 16 of the cases, the shopper prompted counseling. All shoppers received written information covering an average of 90% of required topics.(17) In a similar study, 63% of trained shoppers received verbal counseling.(18) Characteristics associated with more frequent counseling were younger pharmacists, increased intensity of state counseling requirements, and less busy pharmacies.

Historically, the medication error described in this case might have been dismissed solely as a dispensing error caused by an illegible prescription. Conducting an RCA, using ISMP's ten key system elements as a framework, can shed light on the underlying causes of the error, and on improvements that could be made to mitigate chances of recurrence.(19) First, the pharmacist may have lacked adequate patient-specific information with which to confirm the correct

medication. It appears that the intended purpose was not written on the prescription. The ISMP advocates that the intended use be indicated on each prescription as an aid for pharmacists and for patients.(11) A CPOE system was not used to prescribe or to transmit the prescription. The pharmacy was associated with the clinic, but we do not know whether the clinic had an EMR in place, and whether the pharmacist could access it. Second, difficulties with interprofessional communication may have discouraged the pharmacist from calling to seek clarification. Third, the pharmacist may never have doubted that the prescription was for Synthroid. Drug names that look alike are easily confused, and a mix-up between Rythmol and Synthroid is plausible. Fourth, perhaps the physician and/or pharmacist felt rushed in their environments due to competing priorities, staffing challenges, or an impatient patient. Poor lighting, inefficient workflow, or interruptions may have contributed. Finally, we do not know if the patient was offered counseling for the "new" medication. If it was offered, he may have refused it, thinking that his prescription was for his usual refill. Rythmol 150-mg tablets are white, round, and scored; Synthroid 150-mcg tablets are light blue, round, partially scored, and smaller.(20) The two medications looked dissimilar, and the error could have been corrected sooner had the patient questioned the pharmacist at the time of dispensing or shortly thereafter.

In this case, the medication error, a preventable ADE, led to patient harm. Implementing the necessary system improvements could minimize recurrence of this type of error. Most importantly, implementation of a CPOE system would have eliminated prescription illegibility, the precipitating factor in this case. In addition, three indirect solutions could contribute to error avoidance: (i) pharmacist access to patient-specific information in an EMR, or at least the intended purpose listed on the prescription; (ii) patient counseling at the point of dispensing; and (iii) patient empowerment to question the change in prescription in a timely fashion. Finally, if communication or environmental issues were implicated, these should be addressed.

Health care systems are adopting systems approaches to improve patient safety. This, coupled with the incentives spurring adoption of EMRs and CPOE systems and promoting their interoperability among settings (21), should result in a marked reduction of this type of error over time.

Defensive Medicine: "Glowing" with Pain
The Case

A 31-year-old man presented to the emergency department (ED) complaining of abdominal pain and vomiting. The patient was well known to the ED staff (a "frequent flyer") as he had presented multiple times in the previous 2 years with similar complaints, always requesting intravenous hydromorphone (Dilaudid) for the pain. In fact, he had been seen in the ED 2 days earlier by the same physician who was on duty. At that time, the patient's examination was benign, and a computed tomography (CT) scan of his abdomen and pelvis was normal. He was discharged home with a prescription for hydrocodone/acetaminophen (Vicodin).

On this visit, the patient stated that his abdominal pain and vomiting had not significantly improved over the prior 2 days. His vital signs were normal, and his abdominal exam was unremarkable, with no tenderness, guarding, or masses. The ED physician ordered laboratory tests and a CT scan of the abdomen and pelvis, all of which were normal. Because of his persistent symptoms, the patient was admitted to the hospital. An evaluation by a gastroenterologist failed to reveal a clear cause for the symptoms, and the patient was discharged to home after 2 days in the hospital feeling somewhat better.

As part of a targeted review of intravenous hydromorphone use in the ED, the Medical Director came across this case. When she looked back over the prior 2 years, the patient had been seen in the ED 12 times for abdominal complaints and had received 12 CT scans of the abdomen and pelvis. All of them were completely normal. When she reviewed the clinical details for each of the 12 presentations to the ED, she felt strongly that most, if not all, of the CT scans were not clinically indicated. When she discussed the patient with the providers involved, many of the physicians expressed that the CT scans (and many other tests) were ordered out of "fear of getting sued"—as a safeguard against possible malpractice liability. The Medical Director was frustrated and wondered about the costs—to the health care system and to patients—of practicing this "defensive medicine."

Medication Reconciliation Pitfalls

The Case

A 90-year-old woman who lived alone suffered a mechanical fall with subsequent hip fracture and was brought to the emergency department (ED) by her daughter. The patient had a past medical history of hypothyroidism, osteoarthritis, and hypertension. The patient's medication bottles were given to the ED triage nurse and were used to generate a list of home medications. Among others, the list included "Toprol-XL 75 mg po daily." An orthopedic surgeon admitted the patient to the hospital and wrote orders to continue all of her home medications at their prior dosages. The surgeon also requested an internal medicine consultation for "preoperative clearance." The patient denied any history of arrhythmia, syncope, presyncope, dementia, or prior falls. Her medications were placed in an opaque, plastic personal-belongings bag along with her clothes, and she was moved to the orthopedic floor.

Several hours later, the consulting hospitalist performed an evaluation and confirmed the patient's home medications and their dosages. Other than her leg trauma and a mild hearing deficit, the patient's examination was normal. She did not inform the hospitalist that the medications were in her hospital bag; in fact, she may not have even realized that her daughter had left them there with her. The hospitalist noted a heart rate of 75 beats per minute with a systolic blood pressure of 170 mmHg. Blood pressure readings had been high since admission. An order was written to increase Toprol-XL from 75 mg to 100 mg daily.

While being prepped on the operating room table several hours later, the patient developed asystole, underwent successful resuscitation, and was transferred to the ICU. Upon transfer, an

ICU nurse handed the plastic bag of medications to the consulting cardiologist who noted that the patient's home dosage of Toprol-XL was 25 mg daily. The error was reported to the hospital pharmacy. Only by coincidence did the hospitalist who had increased the Toprol-XL dosage learn of the error. The hospitalist apologized to the patient and her family and assured them that the case would be carefully reviewed to ensure that a similar error wouldn't happen again.

The patient made a full recovery and had no recurrent vital sign instability. Myocardial infarction was ruled out, and an echocardiogram was normal. After observation in the ICU for several days, she underwent repair of her hip fracture and was discharged to home without further complications.

Adolescent Diabetes: A Routine Visit?
Case & Commentary: Part 1
A 15-year-old adolescent presented to her pediatrician for ongoing management of type 2 diabetes mellitus (T2DM). The girl had been overweight for most of her childhood and continued to gain weight in her early teen years. Her BMI of 29 placed her in the upper 99th percentile for her age and sex. She had presented to the clinic 18 months earlier with fatigue and polyuria. At the time, she had an elevated fasting blood sugar and hemoglobin A1c (HbA1c; a serum marker indicating elevated blood sugar levels for many months) and was diagnosed with type 2 diabetes. She was treated with long-acting insulin (glargine), short-acting insulin (aspart), and an oral agent (exenatide). This clinic visit was part of routine follow-up for her diabetes.

This patient presented with two chronic conditions of increasing prevalence among adolescents in the United States: obesity and T2DM. The Centers for Disease Control and Prevention (CDC) defines overweight and obesity in adults 19 years and older as body mass index (BMI) ≥25 and ≥30, respectively, and in youth aged 2-19 years as BMI ≥85th and ≥95th percentile, respectively, for age and sex.(1) According to the National Health and Nutrition Examination Surveys (NHANES), obesity among adolescents aged 12-19 years increased from 5.0% in 1976-1980 to 17.6% in 2003-2006.(2,3) While genetic susceptibility may increase the likelihood of obesity in an individual, population genetics have not changed rapidly enough over this period to explain the nearly fourfold rise among adolescents (nor the threefold rise among younger children).(2,3) Evidence suggests that these trends are explained primarily by behavioral and environmental changes resulting in higher caloric intake and lower physical activity.(4-8)

Adolescent obesity is associated with physical, emotional, and social adversity during adolescence and with premature disability and death during adulthood.(9) Of individuals with T2DM, 80% are overweight or obese, and the prevalence of T2DM in adolescents is also increasing. A 2002-2003 multicenter study of diabetes in US youth younger than 20 years found that T2DM accounted for 35% of new cases of diabetes diagnosed in adolescents 10-19 years compared to 2% in children younger than 10 years. The female-to-male relative risk was 1.6 for T2DM, compared to 1.0 for type 1 diabetes mellitus (T1DM). The estimated incidence rates (per 100,000 person-years) of T2DM among 15- to 19-year-old youth by race/ethnicity were as

follows: American Indian 49.4, Asian/Pacific Islander 22.7, African American 19.4, Hispanic 17.0, and non-Hispanic white 5.6.(10,11) A separate study of African American and Latino children younger than 17 years with newly diagnosed diabetes demonstrated more females (62% vs. 50%) and older age (13.1 years vs. 10.5 years) for T2DM than T1DM.(12)

Both T1DM and T2DM in children and adolescents usually present with symptoms of hyperglycemia (i.e., polyuria, polydipsia, weight loss, blurred vision) in the setting of glycosuria (glucose excretion in the urine). Factors associated with T2DM in children and adolescents include the following: non-white, non-European descent; age older than 10 years; Tanner stage ≥2; overweight or obesity; T2DM in a first- or second-degree relative; findings or conditions associated with insulin resistance (e.g., acanthosis nigricans, dyslipidemia, hypertension, polycystic ovary syndrome [PCOS], small-for-gestational-age birthweight); and absence of islet cell or glutamic acid decarboxylase antibodies. However, no single factor can be used to differentiate types 1 and 2. For example, 15%-25% of youth with new T1DM are overweight or obese.(13) Ketosis and ketoacidosis are more common in patients with T1DM but occur in more than 30% of youth with new T2DM.(13-15) C-peptide levels and islet cell autoimmunity eventually can help distinguish types 1 and 2, but levels in the two types may overlap for up to a year following diagnosis.(13,16)

Who should be tested for diabetes? The 2009 Standards of Medical Care in Diabetes published by the American Diabetes Association (ADA) recommends that asymptomatic children and adolescents who are overweight or obese and have at least two additional risk factors for T2DM be tested with a fasting glucose level every 3 years, beginning at age 10 years or pubertal onset.(17) Additional risk factors include family history of T2DM, findings or conditions associated with insulin resistance (see above), and maternal history of diabetes or gestational diabetes. Once ADA diagnostic criteria for diabetes are met, type 2 is presumed in the patient with obesity and at least two other risk factors.(17)

Although adolescents with T2DM are treated similarly to adults, there are a few key differences. Education about diet, exercise, and glucose monitoring should begin at diagnosis for all patients and may be the only therapy for those who are asymptomatic and able to achieve glycemic control (i.e., pre-prandial blood glucose 250 mg/dL, HbA1c >9%, or ketosis. When glycemic control is achieved, the insulin can be tapered off.(13,17,18) Although metformin and insulin are the only medications for T2DM approved in the United States for patients younger than 18 years (13), another oral hypoglycemic agent typically is prescribed before insulin for adolescents with inadequate glycemic control and without ketosis. It may be added to metformin or used alone if metformin is not tolerated.

The regimen prescribed for the patient in the case presentation is both unusual and unclear. First, although metformin is the preferred pharmacotherapy for this patient, no comment is made of past or current use. Second, while insulin glargine has demonstrated effectiveness in adults with T2DM, it is best used with metformin to boost insulin sensitivity.(13,19) Third, exenatide,

described as an oral agent in the case presentation, is available only for subcutaneous administration; is indicated for adjunctive therapy with metformin, a sulfonylurea, or a thiazolidinedione; is not approved for use in patients younger than 18 years; and is associated with gastrointestinal symptoms in up to 40% of adults.(20) Fatalities from acute, fulminant pancreatitis have been reported among patients using exenatide. It therefore should be discontinued immediately if pancreatitis or unexplained abdominal pain develops.

Case & Commentary: Part 2

The girl had often been a challenging historian, providing conflicting and sometimes vague answers to questions. On this visit, she complained of intermittent abdominal pain for a few days but could not be more specific. She also complained that her acne had worsened, and she requested treatment for it. As part of screening for polycystic ovarian disease, she stated that her periods were always regular and she had no new or excessive hair in a male pattern of distribution. However, she did mention that, 2 days earlier, she had accidentally "peed my pants" but did not know why. The rest of the review of systems was unremarkable.

On physical examination, she was a quiet and depressed morbidly obese girl in no distress. She had acanthosis nigricans on her neck, groin, and axilla and had severe acne on her face. The examination of her abdomen was limited by obesity, but she was non-tender and there were no masses or enlarged organs palpated. The rest of the examination was unremarkable. On her laboratory studies, her HbA1c remained elevated. She was prescribed a topical cream for her acne, and her insulin was increased slightly. She was told to watch her menstrual cycles closely and call back if they were noted to be irregular or if the abdominal pain worsened.

The following day, the pediatrician's office received a call from an obstetrician reporting that the patient had delivered a healthy baby girl by Caesarian section in the early hours of the morning. The gestational age was thought to be around 34 weeks. The pediatrician realized that the "abdominal pain" may have been contractions and that the incontinence may have been amniotic fluid ("water breaking"). On further history, the adolescent girl stated that she was raped 7 months earlier and was afraid to tell anyone. She and her family were provided appropriate counseling and resources.

The remarkable events that unfold in Part 2 quickly turn our attention away from T2DM. The patient description in the first sentence prepares us for, and may bias us toward, discounting the nonspecific complaints that follow. The challenge for all providers who care for adolescent patients is to consider prevalent issues of adolescence that may underlie the patient's demeanor. Reticence, conflicting information, and symptoms without apparent explanation suggest an adolescent who is unable or unwilling to discuss symptoms, ask questions, or describe events that are frightening, confusing, or embarrassing. Any concerning or unusual behavior during a visit may cue the clinician to explore those aspects of the adolescent history summarized by the mnemonic "HEADSS": *H*ome, *E*ducation (i.e., school), *A*ctivities (e.g., peers, work), *D*epressive or other symptoms, *S*exuality, and *S*ubstance use. On the first visit and periodically thereafter, the

clinician should discuss confidentiality with the patient and parent(s). Adolescents who are assured conditional confidentiality (i.e., confidentiality will be protected unless the risk of harm is high) are more likely to disclose personal information about sexuality, mental health, and substance use than those with whom it is not discussed.(21)

We are not told explicitly whether during this or prior visits the clinician had taken an appropriate sexual history. CDC practice guidelines call for a sexual history and testing for sexually transmitted infections and pregnancy in all adolescent females with unexplained abdominal pain and urinary symptoms.(22) Despite these recommendations, a 2009 review of emergency department visits by adolescents with urinary complaints revealed that 30% of records did not document a sexual history.(23) Even when physicians believe it is pertinent to the patient's presentation, 24% in one survey admitted they would not obtain a sexual history.(24)

A sensitive and thoughtful sexual history in a confidential setting may have revealed this patient's prior sexual assault and led to the pregnancy diagnosis. The following principles can help guide discussion of sexuality with an adolescent patient: confidentiality, within the limits of state law and patient safety; normalization of the topic as a routine component of health care; development of interview techniques that convey clinician comfort with the topic; respect for sexual diversity, including sexual orientation; avoidance of jargon or terms that may be misinterpreted (e.g., "sexual activity"); and knowledge about local resources related to adolescent sexual health. The clinician should be prepared to ask specific, usually open-ended questions pertaining to oral, vaginal, and anal intercourse; age of first intercourse and number of lifetime partners; use of condoms and other birth control; and sex by force or coercion, or in exchange for money, food, or shelter.

In addition to the unasked questions noted above, the case illustrates the disjunctions that may exist between clinician questions and adolescent answers or between past history and current findings on physical examination. An adolescent who has always had menstrual periods of varying interval and duration may perceive her cycles as regular. An adolescent with a family history of PCOS may not perceive her pattern or quantity of hair growth as different, excessive, or new. The BMI of 29 noted in Part 1 is below the threshold for adult obesity, yet the patient is described as "morbidly obese" on physical examination in Part 2. Although there is no firm definition of morbid obesity in children and adolescents, the term typically refers to BMI greater than 35. This discrepancy suggests that something besides adiposity is contributing to this patient's appearance.

Teen pregnancy and childbearing are prevalent and increasing in the United States. After a 30% decline between 1991 and 2005, the rates are again on the rise.(25-27) Pregnancy rates in 2007 per 1000 females aged 15-19 years varied nearly threefold by race/ethnicity (Hispanic 132.8, black 128, white 45.2).(27) As shown in the Table, the proportion of mothers with third-trimester or no prenatal care was 15.6% for mothers aged 10-14 years compared with 4.7% for those 20-24

years, and the proportions with preterm delivery were 22.2% and 12.7%, respectively.(27) This patient delivered prematurely at 34 weeks.

One may wonder if the adolescent in this case was aware of her pregnancy. Adolescents are less likely than adults to recognize or acknowledge pregnancy, even when seeking care for pregnancy-related symptoms. A study of pregnant adolescents younger than 16 years seen in the emergency department of a university-affiliated hospital revealed that 91% of those in whom pregnancy was diagnosed presented with abdominal or genitourinary symptoms, compared with 22% of those in whom pregnancy was missed. Of those adolescents in whom pregnancy was diagnosed, less than 10% had mentioned the possibility of pregnancy, and 10.5% denied history of sexual intercourse.(28)

Rates of sexual abuse in the United States peak during adolescence. In 2004-2006, there were 152.6 and 163.7 emergency department visits for sexual assault per 100,000 females aged 15-17 years and 18-19 years, respectively.(27) A 2009 meta-analysis of 21 studies revealed that a history of childhood sexual abuse increased the odds of teen pregnancy by 2.2-fold and estimated that 45% of pregnant teens have a history of sexual abuse.(29)

The issues with which this adolescent presents are disturbingly common yet often unrecognized. Remaining alert to population trends and individual cues may help us care for adolescents with greater sensitivity, efficiency, and effectiveness.

Round-Trip Service

The Case

A 70-year-old man with a long history of degenerative joint disease was experiencing increased symptoms in his left knee. He was referred by his primary care provider to an orthopedic surgeon who recommended a total knee replacement. The patient was eager for the surgery so he could return to his active lifestyle, but the elective procedure couldn't be scheduled for a couple of months. In addition to the delays with scheduling, the patient also became concerned about the costs associated with the surgery and his likely postoperative rehabilitation needs.

Based on a neighbor's recommendation, the patient explored alternate options and ultimately had his total knee replacement performed overseas. The surgery was scheduled within 2 weeks, at a fraction of the cost to the patient of domestic surgery, and provided a very satisfying experience overall. Approximately 2 weeks after the surgery, when the patient was back home, he developed acute pain and swelling in his surgically repaired knee. He contacted the US-based orthopedic surgeon who originally saw him, explained the circumstances, and was told he could not be seen because "we didn't perform the surgery, so you should contact your operating surgeon." The patient was ultimately seen in the emergency department and received appropriate treatment for uncomplicated postoperative swelling.

"Superficial" Report Leads to "Deep" Problem

The Case

A 35-year-old woman presented to the emergency department (ED) complaining of left foot and ankle pain for the past 7 days. The patient denied any recent trauma to her leg and had no fever or respiratory symptoms. She had no other medical history, and her only medication was an oral contraceptive. She reported smoking one pack of cigarettes daily and drinking alcohol occasionally, but denied illicit drug use. The patient's mother had a history of a "blood clot," but there was no other significant family history.

The physical examination was significant for moderate pitting edema, mild erythema, and tenderness of the left leg from the foot up to the mid-calf area. The left calf circumference was 4 cm greater than the right calf, but there were no dilated superficial veins or palpable venous cords. The patient was able to bear weight on the affected leg but had an antalgic gait (a limp adopted to avoid pain on weight-bearing structures, characterized by a very short stance phase).

The patient had a normal radiograph of her left foot and ankle. The emergency medicine resident evaluating the patient was concerned about the possibility of a deep venous thrombosis and ordered a Doppler ultrasound examination of the left lower extremity. The preliminary radiology interpretation faxed to the ED read, "thrombus left distal superficial femoral vein." The emergency medicine resident and attending physician caring for this patient interpreted this result as representing a superficial vein thrombus. Knowing that superficial venous thromboses can usually be treated safely without anticoagulation (because of their very low risk of causing pulmonary embolism), they diagnosed the patient with cellulitis complicated by a superficial thrombophlebitis and prescribed oral antibiotics along with elevation and warm compresses to the affected leg.

The final report of the patient's ultrasound, which returned many hours later, read, "deep vein thrombosis of the left distal superficial femoral vein." This final interpretation was not communicated to the patient's caregivers. The resident followed up 2 days later on the final reading of the study and recognized that the new information meant that the patient should have been anticoagulated. The patient was contacted and asked to return to the ED for initiation of treatment with low-molecular-weight heparin and warfarin. The patient returned promptly and was treated without any complications. She completed 3 months of therapy, and a follow-up ultrasound showed resolution of her deep vein thrombosis.

Standard Deviations

Case & Commentary: Part 1

A 45-year-old man with an active history of intravenous (IV) drug use was admitted to the medical service with fever and low back pain. He was noted to have a leukocytosis and an elevated erythrocyte sedimentation rate (ESR), and a subsequent MRI showed an epidural abscess with surrounding osteomyelitis. After having his abscess successfully drained, the patient

required a 6-week course of IV antibiotics for methicillin-resistant Staphylococcus aureus *(MRSA). Given that he was homeless, uninsured, and actively abusing IV drugs, there was no appropriate care setting where he could complete his required therapy. Therefore, he remained hospitalized while awaiting Medicaid enrollment. After the first 2 weeks, he became increasingly abusive to the nursing staff, was found smoking on the unit, and twice threatened to leave against medical advice (AMA). In efforts to make the best of the situation, the physicians caring for the patient elected to discharge him on an oral antibiotic regimen with follow-up in a free health clinic.*

This case highlights an unfortunately common problem with patients who are homeless and uninsured, and also have substance abuse problems, mental health conditions, or both: the diagnosis and desirable treatment may be clear, but actually carrying out the treatment can seem next to impossible.

The most important "error" in this case—a societal rather than a clinical one—occurred before the patient came to the hospital. The patient is uninsured. As a result, the hospital team had to care for him with the equivalent of one arm tied behind their backs. Had the patient been insured, it might have been possible to refer him to a setting other than the hospital that would have been more acceptable to him and would have allowed continuation of IV antibiotic therapy. A recent study suggested that as many as 45,000 deaths per year may be associated with lack of insurance.(1) This patient is at high risk for being part of that group.

Defining the *clinical standard* of care for a homeless IV drug user is complex. Anglo-American law requires us to comport ourselves with "due care" so as not to cause avoidable harm to others. Historically, physicians charged with negligence were judged by the standard of "customary practice"—how other physicians, locally or nationally, practiced. Over time, however, the *legal standard* shifted from actual practice patterns to "reasonable" practice patterns, to allow for the possibility that customary practice could be too slow in adopting evidence-based guidelines.(2)

Although the American Medical Association cautiously defines the *clinical standard* of care we owe to our patients as "competent care," presumably to protect physicians from being judged by overly high expectations, most health professionals (and patients) aspire to go beyond mere "competence" to an ideal of "excellence."(3) In this case, the hospital team provided excellent diagnosis and treatment planning. If physicians had failed to urge the patient to receive 6 weeks of IV antibiotics and explain the risks of not completing the course of treatment, they would not be meeting legal or clinical standards of care and would be vulnerable to a malpractice claim.

The first 2 weeks of treatment apparently went reasonably smoothly, but at that point a new clinical issue emerged—how best to deal with an abusive patient who threatens to leave against medical advice. This problem could have been anticipated and planned for at the point of admission. Discharges against medical advice (AMA) are not uncommon. A study of 3 million acute admissions showed a baseline AMA discharge rate of 1.44%.(4) But for patients with mental illness or substance abuse (or both), the rate is much higher, ranging up to an astounding

51%.(5) Among 1056 HIV-positive patients with a history of IV drug use, 25% signed out AMA.(6) Not surprisingly, patients discharged AMA do worse as a group. In one study, 21% were readmitted within 2 weeks compared to 3% in a matched control group.(7) Hospitals should develop strategies to prevent AMA discharges just as they develop strategies to prevent falls and hospital-acquired infections.

From the perspective of patient safety, this case emphasizes how important it is to focus on our competencies in dealing with culturally distinct patients and groups. A homeless IV drug user may be more "foreign" for hospital staff than an educated professional from Asia or Africa would be. Homeless IV drug users are a highly stigmatized group. It is common for clinicians to see a patient like the man in this case as an extreme "other." The staff wants to use IV medications to treat an illness. The patient uses IV "medications" to sustain an addiction. The staff wants the hospital to be a health-promoting environment. The patient smokes on the ward. The staff wants to treat patients with respect and empathy. The patient treats them with abuse. When differences like these create barriers to empathy and rapport, they also create risks to safety.

In its *ethical* meaning, "standard of care" refers to the treatment that *should* be provided. Over the past 40 years, the United States has come to a widely shared consensus that informed consent determines what *should* be provided. In this case, a 6-week course of IV antibiotics is clinically indicated, but if the patient is competent to decide whether to accept the recommendation and his physicians explained the risks of not following it in ways he understood, the ethical standard of care would require respect for his decision.

Decision-making capacity is defined by four criteria: (i) ability to communicate a choice, (ii) ability to understand the relevant information, (iii) ability to appreciate the situation and its consequences, and (iv) ability to reason about treatment options.(8) Although the case report does not suggest lack of competence, the significant potential harm from nonadherence to the recommended treatment, the frequency of psychotic disorders among the homeless (in one systematic review, the pooled prevalence of psychotic disorders was 12.7% [9]), and the potential for subtle cognitive deficits (10) call for an especially careful assessment of competence by a skilled clinician.

Research and clinical experience suggest that when homeless people reject services they do so "on the basis of a desire to be independent, a lack of active participation in services, poor therapeutic relationships, lack of provider cultural competence, and side effects from medication."(11) For a man accustomed to independent life on the streets, a hospital can be highly stressful. He is not accustomed to following orders and obeying rules in a socially appropriate manner. Outreach workers spend months trying to develop trusting relationships with homeless clients and even with that effort may not succeed. Once this patient begins to feel better, the personality factors that led to his homelessness and drug addiction are likely to reassert themselves.

In a case like this, it is as important to bring in a collaborator skilled in dealing with homeless IV drug users as it is to bring in an interpreter for patients who do not speak English. The collaborator could be a clinician, someone the patient knows and trusts (such as a shelter worker or priest), or even a homeless person he looks up to. In a case from Massachusetts involving a homeless man with alcoholism and advanced cancer, a priest became the crucial go-between for the hospital staff.(12) Sometimes adjustments in the hospital regimen can help, such as having a volunteer take him outside to smoke on a regular basis. The case report does not tell us how the patient's substance abuse condition was handled, but a Canadian hospital reported a 50% reduction in AMA departures when HIV-positive patients with a history of IV drug use were treated with methadone.(6)

The case report tells us that "the physicians caring for the patient elected to discharge him on an oral antibiotic regimen with follow-up in a free health clinic." An ethics consultation should be considered before making a decision like this, since the clinical consequences of less-than-optimal therapy might be high. A third party might be able to help the staff identify impediments to creating a better outcome. Abusive patients can elicit negative staff attitudes that could make the prospect of discharging the patient appealing. And financial concerns on the part of the hospital about a long hospital stay for an uninsured patient could also skew clinical judgment. Ethics consultants are typically skilled at dealing with thorny situations like this one and offer expertise and guidance to providers in managing such situations.

Case & Commentary: Part 2

The patient was readmitted to the same hospital 3 weeks later with a recurrent epidural abscess and worsened osteomyelitis. He reported taking "most of his antibiotics" but never made it to a clinic for scheduled follow-up care. He required a more extensive surgical debridement, and he also developed MRSA endocarditis. The patient became quite deconditioned postoperatively, but, after nearly 3 weeks of inpatient care, he threatened to leave AMA once again. Although he was ambulating at that point, he still required additional IV antibiotics and lacked any viable option for institutional nonhospital care. The providers "negotiated" with the patient to remain hospitalized, but he ultimately left AMA after an additional week. He was subsequently lost to follow-up.

Sadly, but not surprisingly, the patient's condition worsened. Ideally, the hospital would have learned from the first AMA departure as a sentinel event and would be better prepared to deal with the patient (and others like him) when he returned. It would be important to try to learn—from the patient's perspective—what makes it difficult to stay in the hospital and which of his values are satisfied by getting back on the street. This kind of conversation can be challenging for staff, for whom goals like "doing what I want and not what I'm told to do" or "getting a fix" may seem unworthy and hard to understand.(13) And hospitals that serve substantial numbers of homeless patients should build relationships with community agencies that serve the homeless population to provide partners for creating flexible responses to patients like this one. Finally, a system that flags patients' charts after they have left the hospital AMA may alert providers on

future admissions about opportunities for early intervention and the risk for a repeated occurrence.

It would be important to use ethics consultation, psychiatric consultation, or both, to ensure that any remediable impediments to adherence have been identified and that culturally appropriate approaches are identified. Are there previously unrecognized grounds for considering involuntary commitment? Have we understood the patient's real agenda? Are there people in the patient's life who can be brought into the treatment process? Are there ways in which the hospital and staff are unwittingly contributing to the patient's reluctance to stay?

Physicians and nurses may be confused and deeply troubled when clinical, ethical, and legal standards point in different directions, as they do in this case. Allowing the patient to interrupt his treatment and leave the hospital may feel like a violation of Hippocratic precepts. The hospital team is required to provide safe care, but the patient is not obliged to treat himself in a safe manner. The ethical standard of care requires that a competent patient's informed refusal should be honored even if the patient's choice does not meet clinical standards. If all that can reasonably be done to create a therapeutic alliance has been done, and if consultation confirms that the patient is competent to make the decision to leave the hospital AMA, the appropriate responses for the clinical team are sadness and determination to learn as much as possible from the case, not shame or guilt.

Who Nose Where the Airway Is?

The Case

A 70-year-old man with peripheral vascular disease was brought to the operating room to undergo vascular bypass surgery on his right upper extremity. Because the surgery was expected to involve only the arm, the case was started using local anesthesia. A certified registered nurse anesthetist (CRNA) was present to monitor the patient and to provide intravenous medications for anxiety, sedation, and pain control (monitored anesthesia care [MAC]). The CRNA was supervised by an attending anesthesiologist (a physician) but, because the surgery was a straightforward procedure performed under local anesthesia with MAC, the anesthesiologist was not physically present and knew very little about the case.

During the procedure, the patient complained of generalized discomfort and anxiety, requiring increased doses of opiates and benzodiazepines (an anti-anxiety medication). With these medications, the patient became sleepy but remained arousable. To maintain a patent airway, the CRNA placed a nasopharyngeal airway, a soft plastic tube inserted into the nose that extends into the posterior pharynx (Figures). Normally, the tip of this tube remains outside the nose, where it can be seen by clinicians. After this insertion, the patient did well with normal respirations and oxygen saturations.

After 2 hours of surgery, the vascular surgeon decided that they would need to use a vein from the patient's legs to replace a blood vessel in his upper extremity. Because this was expected to be a long and relatively complicated procedure, the decision was made to switch the patient to

generalized anesthesia, which would require endotracheal intubation (placement of a plastic tube through the mouth and down into the lungs) and mechanical ventilation. The CRNA contacted the supervising anesthesiologist to help convert the case to general anesthesia. Very little information was exchanged between the two clinicians, and the anesthesiologist intubated the patient without complication. The CRNA managed the anesthesia, and the remainder of the surgery was uneventful. The patient was successfully extubated and did well after the surgery.

The following day, the patient remained stable, and the physician team was planning on discharging him to home. Curiously, the patient complained to the team that although he was feeling well, when he tried to drink any liquid it would come right out of his nose. To overcome the skepticism of the surgical team, the patient took a gulp of his orange juice with the physicians present, and, sure enough, most of the juice flowed out of his nose onto his hospital gown. To the astonishment of the team, he repeated the scenario.

The surgeons decided to make the patient NPO (nothing by mouth) and gave him fluids intravenously. They consulted otolaryngology (ear, nose, and throat specialists) with concerns about a pharyngeal fistula or another anatomic abnormality—there were no obvious abnormalities seen extruding from the nose. The otolaryngologist discovered that the nasopharyngeal airway, which had been placed during the initial surgery, was still in his nose. It was not entirely clear how the tube had become lodged within the nasal cavity (so that its external portion was no longer extruding from the nose), but presumably this occurred when the patient was intubated by the anesthesiologist.

The plastic tube was removed, and the patient was discharged home later that day. He suffered no significant consequences from the event, but he did require an additional day in the hospital.

Danger in Disruption

The Case

A 23-month-old toddler was severely dehydrated after vomiting due to gastric outlet obstruction. She had metabolic alkalosis (pH = 7.58), and her last peripheral IV site had been lost. The nurse caring for her that day was expert, had worked on that unit for years, and had helped write unit and hospital pediatric policies. One of these policies limited the number of IV sticks in children, so the nurse requested that anesthesiology attempt femoral access.

When the anesthesiologist arrived with an assistant, they took the patient to a treatment room for sedation before attempting to establish a femoral IV site. The nurse informed them that hospital policy prohibited sedation in the unit without monitoring. When her comments were ignored, she went to alert the charge nurse and obtain a copy of the policy.

In the meantime, propofol was administered without monitoring. Upon her return, the nurse observed that the child was apneic and again requested monitoring. The anesthesiologist replied that it wasn't necessary, applied a painful stimulus, and noted that spontaneous respiration resumed. He proceeded to prepare for the femoral stick, but the nurse noticed that he did not use

sterile technique and he contaminated the needle. At this point, the nurse attempted to stop the procedure, and the verbal exchange became heated. The anesthesiologist threw the needle on the floor and walked toward the door. The nurse firmly requested that he stay and monitor the patient while she was still sedated.

The child was apneic briefly but recovered without incident. The anesthesiologist did eventually insert a peripheral IV and the re-hydration therapy resumed.

The situation was "saved" by the patient's nurse, who in the midst of a very difficult encounter with a physician, repeatedly made firm requests for adherence to policies designed for safety. Despite her many years of experience, this nurse was emotionally distressed by the event.

Difficult Encounters: A CMO and CNO Respond
The Case

An 89-year-old man was admitted to the orthopedic service after sustaining a hip fracture. The patient's family physician requested a cardiology evaluation. Surgery was delayed while the consultant evaluated the patient. The cardiologist identified severe aortic stenosis (echocardiogram showed an aortic valve area of 0.9 cm^2) and recommended that the patient not go to surgery. On the late afternoon following the cardiologist's report, the orthopedic resident called the operating room to schedule the patient for surgery later that evening. The nurse on the floor paged the orthopedic resident and read the cardiologist's conclusions and recommendations over the phone. The resident came to the floor, told the nurse that she was "stupid" and confidently explained that the case would be done under spinal anesthesia, so the cardiologist's concerns were nothing to worry about.

Spinal anesthesia can cause unexpected and sudden hypotension resulting in hypoperfusion of the coronary arteries and sudden death. At 7:00 PM, the nurse called the hospital's Chief Medical Officer (CMO), who was getting ready to leave for the day. The CMO promptly paged the orthopedic resident, who was meeting with the attending orthopedic surgeon to review x-rays of the case. The CMO went to the x-ray department and talked with two residents and the attending. The CMO patiently explained the risk of perioperative death associated with hypotension in the presence of severe aortic stenosis. The attending then called the operating room to cancel the case. The following day, the CMO reviewed the nurse's intervention with the Chief Nursing Officer (CNO).

Two days later, the patient suddenly arrested on the floor. Resuscitation efforts were unsuccessful.

Is the Admission Drug Dose Too Low?

A 72-year-old man with a long history of chronic obstructive pulmonary disease (COPD) was admitted to the hospital with increasing shortness of breath. His admitting diagnoses were COPD

exacerbation and pneumonia. Among his preadmission medications, the patient was taking Theo-Dur (extended-release theophylline), 300 mg three times daily. A theophylline blood level, drawn on admission, was 1.2 mg/L (therapeutic range: 10-20 mg/L). The admitting physician ordered Theo-Dur, 600 mg TID. A nurse questioned the order since this was double the patient's usual dosage, but the physician stated that he needed to get the patient's blood level up. The patient received Theo-Dur, 600 mg, at 12:00 AM, 5:56 AM, 11:43 AM, and 11:00 PM.

A theophylline blood level, drawn at 3:22 AM the following day, was 28.7 mg/L. The lab called the "critical result" to the floor at 6:55 AM. The night-shift nurse, a recent hire, had not checked to see if the blood level result was back before giving the patient his next dose of Theo-Dur at 6:05 AM. Later that day, the patient developed atrial flutter with a rapid ventricular response (heart rate in the range of 140 bpm), chest pain, and increased shortness of breath. A repeat theophylline blood level, drawn at 7:08 PM, was 38.1 mg/L, a very dangerous level. The patient was given oral activated charcoal, intravenous digoxin, and a continuous infusion of diltiazem. The patient's heart rate remained elevated for 3 days but ultimately returned to normal.

Hiding in Plain Sight

The Case

A 65-year-old woman presented to an emergency department (ED) with 48 hours of nontraumatic left lower back pain and general malaise. She was diagnosed with a musculoskeletal injury and discharged from the ED with muscle relaxants and antiinflammatory medications. She returned to the ED the following day with increased back pain described as shooting and burning in nature. Physical examination was reported as unremarkable, and basic laboratory tests and an abdominal computed tomography (CT) study came up normal as well. The patient was unable to ambulate due to pain and developed nausea related to her narcotic therapy. She was later admitted for observation and additional analgesics. The admitting hospitalist evaluated the patient and started her on intravenous analgesics. He did not document any evidence of neurologic deficits or an acute abdomen.

The next morning, the hospitalist assuming care for the patient readily noted a vesicular rash in the exact distribution of her pain symptoms and correctly diagnosed a herpes zoster infection (shingles). The patient was treated with prednisone and acyclovir and was discharged with improved symptoms. The patient initially reported the rash more than 24 hours prior to her hospitalization but didn't think it was related to her pain. She stated, "Nobody actually looked at my skin until the following morning." The patient had a full recovery but likely underwent unnecessary testing and delays to appropriate, disease-specific treatment.

Nurse Staffing Ratios: The Crucible of Money, Policy, Research, and Patient Care

Case & Commentary: Part 1

A 68-year-old man was admitted to the intensive care unit (ICU) with chronic obstructive pulmonary disease (COPD) exacerbation and atrial fibrillation with rapid ventricular response. He was markedly short of breath despite use of accessory muscles and was only able to speak in

short sentences. He was alert and oriented but frail, and providers were concerned that he might tire and ultimately require mechanical ventilation.

In the ICU that evening, two nurses scheduled to work had called in sick. There was only one patient care assistant scheduled on this weekend shift. Due to the short staffing and inability to locate a last-minute replacement, each existing nurse was assigned three patients rather than the usual two.

In this case, due to a shortage of nurses in the ICU, each nurse present had to take care of more patients than usual. Nurse researchers have long explored the relationship between registered nurse staffing, skill mix, and hospitalized patient outcomes (1-3), a line of inquiry that took on additional momentum with the publication of a 1996 Institute of Medicine (IOM) report on nurse staffing in hospitals.(4) Seminal studies then demonstrated that increases in the number of RNs caring for patients, as well as their education and experience, resulted in fewer complications, lower morbidity, fewer medication errors, and lower costs.(5-8)

Although some efforts to standardize nurse staffing ratios had begun prior to the 1996 IOM report, the increased evidence after 1996 linking ratios to outcomes created substantial momentum in the policy arena. In 1999, the American Nurses Association (ANA) introduced a nursing quality report card and the Principles for Nurse Staffing.(8,9) In 2003, another key IOM report prioritized increased nurse staffing as a key mechanism to decrease medical errors.(10) In 2004, building on the work of the California Nursing Outcomes Coalition (CalNOC), the National Database for Nursing Quality Indicators (NDNQI), and research reports, the National Quality Forum (NQF) introduced the 15 nursing-sensitive quality measures that included hours of nursing care and RN staff mix.(11) As of July 2009, 12 states (CA, CT, IL, ME, NV, NJ, OH, OR, RI, TX, VT, WA) and the District of Columbia have passed legislation or regulations to address nurse staffing, and 15 states (CA, CT, IL, MD, MN, MO, NH, NJ, NY, OR, PA, RI, TX, WA, WV) also restrict mandatory overtime.(12,13)

Although these laws and regulations create some external constraints, individual organizations retain considerable flexibility in their staffing strategies. Developing these hospital staffing plans requires a complex dance involving nurse leaders, staff nurses, physicians, hospital administrators, financial officers, regulators, patients, and families. This dance is guided by the ANA Principles of Safe Nurse Staffing.(12) Staffing plans are developed annually by nurse leaders and presented to hospital administrators to review, negotiate, and approve based on numerous indicators, including patient volume/acuity, regulatory standards, external and internal benchmarks, and nursing skill mix and experience.

Once the annual budget is approved, each nursing care unit develops monthly staffing and scheduling templates to ensure adequate nurse staffing. This monthly plan uses past experiences to estimate the number of nurses needed to fully staff each unit. Even after the plan is developed, it is reassessed frequently (sometimes every hour) based on the acuity of patients and the competency of nursing staff. Not only do patients have differing needs, but nurses have different

experiences, competencies, and organizational skills. Both the ANA and the American Organization of Nurse Executives (AONE) (12,14) support evidence-based nurse–patient ratios. Specifically, these organizations feel that staffing patterns should not be mandated or standardized, but determined, created, and monitored (i) with input from direct care RNs and based on (ii) number of patients and acuity; (iii) number of admissions, discharges, and transfers each shift; (iv) RN experience; (v) factors such as orientation to unit, support staff, physical design of unit, vacancy, and turnover; and (vi) RN ratios benchmarked with specialty and hospital organizations. The Labor Management Institute (15) and the National Database for Nursing Quality Indicators (16) are both recognized as valid and reliable sources for guiding staffing ratios. The standard rule of thumb is to have a nurse–patient ratio of 1:4-5 on medical–surgical units, 1:3-4 on intermediate units, and 1:2 in ICUs.

State nurse licensure boards, The Joint Commission, and Centers for Medicare & Medicaid Services (CMS) all have standards designed to help ensure adequate nurse staffing. Each of these regulatory bodies and appraisers works to ensure that hospital systems adhere to the ANA guidelines (12) and provide the necessary financial support to staff their units safely.

According to the 2003 IOM report "Keeping Patients Safe" (10), it is vital that we empower staff nurses to regulate their own unit work flow. In the case presented, RN shortages could have been addressed by closing the unit to new admissions or by considering the transfer of a more stable patient to an intermediate level of care unit. The decision not to take transfers and admissions must be made in collaboration with and supported by physician staff and must be based on predetermined admission/discharge /transfer triage guidelines. If it is deemed appropriate to hold all new admissions, alternative solutions must be offered to care for the new patients. These alternative solutions require clinician teamwork and strict adherence to handoff communication protocols. Many times, the patient awaiting admission or transfer remains in the original point of entry (such as the emergency department) and does not receive the level of care needed (e.g., in the ICU). In these situations, the ICU RN ratio is maintained at the expense of the ratio in the unit at the point of entry. This conundrum is commonplace and is best addressed with an internal resource pool that creates the capacity for nurses to "float" to units where they are needed.

In this specific case, it appears that the nursing staff members were not supported in making difficult decisions that would protect the patient and themselves. If "holes" in nurse staffing are allowed to remain unfilled at times like these, my guess is that such failures are a regular feature of this hospital, like many others. Ill calls and other unplanned absences are a regular feature of every hospital. Accordingly, nurse leaders and their designees must develop strategies to deal with these absences to ensure patient safety. It is the responsibility of the board of trustees and senior leaders to empower the Chief Nurse to design safe nurse staffing patterns and to provide the resources to carry out these plans.

To navigate this complex, dynamic system requires real-time, redundant decision-making processes. In this area, best practices include the following: First, a *centralized* staffing office

that assists the nurse leaders in adjusting the daily predicted budgeted staff vs. the actual, and maintains the data to justify staffing alterations. Second, a *Shift Coordinator* who has a hospital-wide perspective and can reallocate or adjust RN staffing in real time, minute to minute if necessary. It is important to mitigate the stressors of short staffing on a shift to shift basis. The practicing nurse needs to focus on the care of patients. The empowered Shift Coordinator is best placed to understand the overall hospital activity and hence is better able to problem-solve with physicians, patients, and other stakeholders in real time to maximize safety. Third, an internal *resource pool* of RNs available and incentivized to provide the ability to flex up or down to accommodate variations in acuity and/or volume.(12)

Internal resource pool budgets are based primarily on the expected nonproductive hours of nurses. For example, a nursing unit can estimate the expected number of hours of vacation, education, and unplanned absences for a year and plan the replacement hours needed to cover. Nonproductive hours expected for each unit can be averaged on a yearly basis, and resource pool nurses can be hired to replace these hours. Each unit's hours can then be tallied, and an internal pool leader can hire nurses to cover this time.

These strategies allow hospitals to customize staffing to meet both patient and nurse needs, decrease time spent by nurse leaders in managing unplanned events, instill trust in nurses that leadership supports safe patient care, improve nurse retention, and provide accountability for the efficient and effective use of valuable resources.

Case & Commentary: Part 2

The nurse assigned to the new admission reviewed and implemented the initial physician orders as the patient was stabilized on a diltiazem drip for his atrial fibrillation. His respiratory status also stabilized, and he avoided the need for noninvasive ventilatory support and intubation and began to transition to intermittent, rather than continuous, nebulizer treatments.

Within 30 minutes of his arrival in the ICU, a second patient was transferred from the overflowing emergency department with hemodynamic instability from a massive pulmonary embolism. Since the patient with COPD just admitted appeared to be improving rapidly, and the other nurses were caring for more critically ill patients, the same nurse "volunteered" to admit the new patient. While she was tending to the orders for the new admission and discussing the vasopressor medications being ordered with pharmacy, her patient with COPD began urgently asking for help to use the bathroom. Rather than using the bedpan, the patient insisted on getting up and going to the bathroom. The nurse quickly assisted the patient to the toilet and then called for a patient care assistant to transfer the patient back to his hospital bed when he was ready to

do so. The nurse then hurriedly returned to the bedside of the acutely ill patient with the pulmonary embolism.

Approximately 5 minutes later, the patient care assistant arrived at the COPD patient's bathroom and found him slumped on the floor, unresponsive and cyanotic with his oxygen detached from his face. A code blue was called but, despite extensive resuscitation attempts, the previously "stable" ICU patient was pronounced dead.

While we are not provided with details regarding the physiologic causes of this tragic outcome—it is possible that it was unrelated to the staffing—the case highlights the tensions involved in determining appropriate nurse staffing ratios and policies that exist or need to exist to ensure patient safety. The solutions are multifaceted, and all solutions begin with the nursing culture of the organization and the unit.

Commonly Used but Inadequate Options

The previous discussion focused on policies at the hospital level to ensure adequate staffing on each unit. But even in hospitals with such staffing policies, situations will arise in which nurses find themselves being stretched to the limits. How should nurses and the systems in which they operate respond?

The first option for this staff nurse was to discuss with the nurse manager or charge nurse his or her specific concerns about caring for three ICU patients and collaboratively establish a new plan of care for all patients during that shift. An appropriate leadership intervention would have been to validate the staff nurse's concerns and develop a solution. Solutions that are commonly used include: (i) reassigning a nurse from another comparable unit where acuity is lower, (ii) reprioritizing and readjusting the workload of all nurses on the shift, and (iii) having nursing management personnel extend their hours of work into the shift or come in early to help. In my view, while these actions appear to solve the problem at hand, these "fix-the-bridge-as-you-walk-on-it" solutions are not sustainable. When invoked routinely, they cause increased stress, emotional and physical fatigue, and compromised patient safety. Staff nurses who endure such shortages shift after shift do feel that care is unsafe.(9) A second option is to refuse transfers from the emergency department to the unit until a secondary plan can be created. Again, while this ameliorates the situation in the ICU, it often exacerbates staffing problems in the emergency department. Over time, if overcrowding in any venue of care persists, all care providers become overtaxed and anxious. Disrespect for one another begins to flourish, and patient care can become secondary to unit and caregiver needs. Other inadequate options are (i) mandatory or voluntary overtime and (ii) returning to work on an on-call basis but still working the next day. This translates to working 16-24 hours at one time. Robust research has demonstrated that these strategies are associated with poorer patient outcomes.(10)

Best Practice Options

The best approach to unplanned staffing deficits is to proactively define the action steps to take *prior to the crisis*. This action plan is defined by the approach articulated in Part 1. Nurse unit leaders must anticipate changing staffing needs and assess at least 4-8 hours prior to the next shift if staffing ratios and patient needs can be met. If unpredictable events occur, staff nurses must feel empowered to voice concerns and collaborate with nurse leaders, shift coordinators, and physicians to make decisions that protect patients *first*. This commentary has expressed both proactive and just-in-time approaches to making patients safe.

The budgeted staffing ratios must be planned with staff nurse input and support, and their decision making must be respected. Danger points for shortages of staff are weekend shifts and times of high emergency department census. Nursing leadership must proactively design incentives for nurses to work on weekends and plan for adjusting staffing levels when volume increases before the problem actually occurs.

Chief Nursing Officers (CNOs) must constantly balance the financial management of nurse staffing against the needs of patients. As budgets tighten, it is vital that nurse leaders maintain RN ratios when census is high and decrease RN staffing when census is low. The flexibility of a resource pool and keen daily budget management enable the CNO and other nurse leaders to follow budgeted staffing plans and instill trust and confidence in the staff nurses that patient care ratios will be protected. When RN ratios are adhered to, patients receive safe, quality care and nurses are recruited and retained. It is not rocket science.

Missing Trauma

The Case

A 54-year-old woman collapsed behind the counter of a small neighborhood market. She was discovered a few minutes later by a customer, who immediately called 911. On arrival, paramedics found the patient unresponsive, with poor respiratory effort and a barely palpable pulse. Initial treatment included fluid resuscitation and external pacing for a heart rate in the 40s. The patient was transported to the nearest emergency department (ED), where an initial chest x-ray suggested congestive heart failure. Rather acutely, the patient became pulseless, and CPR was initiated as the patient's cardiac rhythm went from bradycardia to ventricular fibrillation, and then asystole. The patient was pronounced dead after an hour of failed resuscitative efforts.

The transporting paramedics later returned to the ED, which, of note, was not a trauma center. The ED physician informed the paramedic team of the patient's death and reported that the patient had a tiny amount of blood on her left nipple, which he attributed to chest compressions. Together, the paramedics and the ED physician examined the patient's clothing and discovered a drop of blood inside her bra and a small hole in the bra itself. Further review of the admitting chest x-ray indicated the presence of a small caliber bullet in the area of the left ventricle, which was initially thought to be a cardiac monitoring electrode. The medical examiner was notified of the possible homicide, and an autopsy confirmed that a bullet likely lacerated the patient's left ventricle.

Vial Mistakes Involving Heparin

The Case

A 65-year-old man was admitted to the hospital for an elective left carotid endarterectomy. During the procedure, the surgeon requested 5000 units of intravenous (IV) heparin prior to clamping the carotid artery. The anesthesiologist administered 5 mL of heparin from what he believed was a 1000 units/mL concentration vial. After 3 minutes, an activated clotting time (ACT) was drawn while the surgeon clamped the carotid artery and proceeded with the surgery. When the ACT returned normal rather than prolonged (as it should have been after the heparin), the anesthesiologist repeated the ACT to confirm the result.

The anesthesiologist then re-dosed and administered what he thought was 7000 units of heparin as the surgeon grew concerned about the cross clamp time without adequate anticoagulation. When a repeat ACT once again returned normal, the anesthesiologist requested a new batch of heparin vials while reaching into the garbage and picking up the vial from which he had drawn. He quickly realized that the heparin vial from the garbage was a 10 units/mL concentration rather than a 1000 units/mL as intended. The two vials of heparin were designed to be color differentiated with different shades of yellow, and the anesthesiologist had chosen the wrong one from the cart. Another dose was administered from the correct vial, and the patient's ACT time rapidly became appropriately therapeutic. Luckily, the prolonged clamp time without anticoagulation led to no obvious clinical harm, making this a serious "near miss" event.

Delirium or Dementia?

Case & Commentary: Part 1

An 86-year-old woman, admitted with complaints of shortness of breath and cough, was found to have pneumonia. Her past medical history included cataract surgery, hypertension controlled with medications, and type 2 diabetes controlled by diet. She was ambulatory, lived alone, and at baseline completed all activities of daily living independently. According to her daughter, the patient was never disoriented. At admission, the patient appeared mildly dehydrated on physical examination. Her oxygen saturation was 94% on 2 liters oxygen by nasal cannula, and an arterial blood gas showed a normal pCO2 of 40 mmHg. Her daughter requested to spend the night at the bedside but was told she could not stay.

Overnight, the patient was noted to be disoriented by the nursing staff. She began pulling at her intravenous lines and attempting to get out of bed. The covering physician was called and ordered that the patient be placed in four-point restraints.

The following morning, the daughter returned to find her mother in restraints, speaking incoherently and severely short of breath. Upon finding her mother confused, the daughter asked the nurse what had happened and reiterated to the nurse that her mother had never been confused before.

Elderly hospitalized patients frequently develop altered mental status as a complication of their illness. Distinguishing delirium from dementia is a common problem for physicians, particularly

those who work in hospitals or long-term care facilities. Up to 25% of geriatric general ward patients and as many as 80% of intensive care unit patients experience delirium during hospitalization.(1) Upon presentation to the emergency department, 26% of geriatric patients meet diagnostic criteria for delirium.(2)

Given the frequency of delirium, all patients should be screened for cognitive functioning at the time of hospital admission. Screening serves two important purposes: to assess for delirium upon admission and to provide a baseline if delirium subsequently develops during the hospitalization.

Delirium in the Hospital

In the inpatient setting, any change in mental status should be considered delirium until proven otherwise. In fact, published guidelines preclude making the diagnosis of dementia in the setting of delirium (3); thus, diagnosis of dementia should be reserved for the outpatient setting. Although it is not mentioned whether formal cognitive screening was performed in this patient, the patient's excellent functional status and the corroborating information obtained from her daughter make it unlikely that the patient suffered from dementia at baseline.

Prediction rules for delirium have been validated in medical (4), and non-cardiac (5) and cardiac surgery (6) patients. While each patient population has unique attributes, there are several common, important factors. First, preexisting cognitive deficits are the strongest risk factor for delirium.(4-6) Patients with higher burden of illness, as measured by Acute Physiology, Age, and Chronic Health Evaluation (APACHE) scores (7,8), or comorbidities (5,6) are at higher risk of delirium. Those with laboratory abnormalities, such as a BUN/creatinine ratio ≥18 (a marker of dehydration), decreased albumin, or abnormal sodium, potassium, or glucose (4-6), are also predisposed to develop delirium. Additionally, patients with preexisting sensory deficits (visual or hearing) are at risk for delirium due to decreased cognitive input. For medical patients, cognitive impairment, acuity of illness, visual changes, and dehydration were combined into a validated prediction rule (Table).(4) This patient's pneumonia and dehydration placed her at moderate risk of delirium, even in the absence of preexisting cognitive or visual impairment.

Delirium poses several risks to the patient. First, a delay in diagnosis and assessment of underlying causative factors can cause the underlying condition to fester, resulting in worse physiological function when delirium is discovered. Patients with the hyperactive and mixed variants of delirium (see below for explanation) are at risk for overmedication (particularly sedation). Delirium amplifies the risks of hospitalization and bedrest in older patients, including malnutrition, deconditioning, dehydration, iatrogenic infection (such as catheter-associated urinary tract infection or aspiration pneumonia), pressure ulcers, falls, and iatrogenic events.(9-11) On a larger scale, delirious patients require more staff time (12), resulting in less staff time for other patients.

As a result of all of these factors, delirium is associated with severe consequences for patients. In fact, the diagnosis of delirium carries a mortality risk equivalent to that of sepsis or an in-hospital

acute myocardial infarction.(11) Patients who develop delirium have longer length of stay, increased hospital costs, and increased post-hospitalization costs.(13,14) In a recent analysis, patients who developed delirium accrued $16,000 to $64,000 in additional medical costs over the year following hospitalization compared to age-, gender-, and comorbidity-matched controls.(15)

There are three psychomotor variants of delirium: hyperactive (prevalence, 25%), hypoactive (prevalence, 50%), and mixed disorder, with features of both (prevalence, 25%).(16) This patient appeared to have the hyperactive form of delirium. As mentioned above, patients with the hyperactive and mixed disorders are more likely to be physically and chemically restrained. Indeed, this patient was placed in physical restraints when she became confused and hyperactive. The Joint Commission has published standards for restraint use. The key elements of the standards' implementation are "the device's intended use (such as physical restriction), its involuntary application, and/or the identified patient need that determines whether use of the device triggers the application of these standards."(17) As such, consideration should be given to the following questions prior to restraining a patient:

EMR Entry Error: Not So Benign

The Case

A 47-year-old man with advanced AIDS was admitted to an academic medical center with a chief complaint of shortness of breath. He was diagnosed with *Pneumocystis jiroveci* pneumonia (PCP) and started on appropriate antibiotic therapy. On physical examination, in addition to abnormal pulmonary findings, the patient had multiple flat purple skin lesions on his left thigh and several perianal lesions. Given his advanced AIDS, the medical team was concerned about Kaposi's sarcoma and human papillomavirus (HPV) infection, respectively. The dermatology service was consulted, and they performed biopsies of both lesions.

The patient continued to receive treatment for PCP and was slowly improving. Three days later, the intern on the team was reviewing the patient's clinical information in the hospital's electronic medical record (EMR). She looked up the biopsy results and discovered that the left thigh lesion was Kaposi's sarcoma and the perianal biopsy showed squamous cell carcinoma *in situ*. Interestingly, there was a third biopsy result in the electronic record, labeled "right neck" and reported as "basal cell carcinoma." The intern didn't recall any neck lesions (or discussion of a third biopsy), but questioned her memory as it had been a busy call night. She noted the results and went to see other patients.

The patient's primary care doctor (who was not directly caring for the patient in the hospital) visited the patient and looked at the medical record before seeing him. He noted the PCP diagnosis, a low CD4 count, and biopsy evidence of three separate cancers. Given the patient's end-stage AIDS and these new diagnoses, the primary care doctor met with the patient and recommended hospice care. He told the patient that, with "cancer in three places," his overall prognosis was poor.

That afternoon, the inpatient medical team recognized the error—the neck biopsy had been performed on another patient and accidentally entered into this patient's medical record. The team and the primary care doctor all met with the patient to disclose the mistake, but clearly the error had caused the patient tremendous pain and mental anguish.

On further investigation, it became clear that the dermatopathology department was unaware of the error. Their department used a standalone software program to track and report biopsy results, a system whose results were electronically "dumped" into the hospital's EMR. But the department physicians and staff didn't have access to the hospital's EMR. In fact, when called and asked if they had seen the error in X (the name of the EMR), the pathologist responded, "What is X?" Eventually, it was determined that the third, incorrect biopsy result had been entered into the pathology software under the wrong patient identifier and then uploaded into the hospital's EMR.

Eptifibatide Epilogue

The Case

A 62-year-old man was admitted at 11:00 PM on a Saturday night with the provisional diagnosis of acute coronary syndrome. Serial testing for markers of cardiac injury was begun, and he was treated with a beta-blocker, enoxaparin, and a statin. At 6:00 AM Sunday, the patient's troponin was elevated and the diagnosis was upgraded to NSTEMI (non-ST segment elevation myocardial infarction). The intern entered an order for intravenous eptifibatide (a powerful anticlotting agent given by intravenous drip) into the computerized order entry system in anticipation of expedited coronary intervention on Monday morning. The intern entered the correct weight-based dosage of eptifibatide (a loading dose, followed by a maintenance infusion of 2 µg/kg/min) into the order template. Because of a forcing function in the template, he also had to enter a maintenance infusion rate in milliliters per hour (mL/hr). He was unsure of the proper infusion rate, so he arbitrarily chose 0.5 mL/hr. He expected the pharmacist on duty to make adjustments to the order as needed.

The eptifibatide order was electronically transferred to the pharmacy for processing. The pharmacist processed the order as entered, and eptifibatide was sent to the floor for administration. The nurse on duty was harried because he was caring for six patients instead of the usual four. He correctly administered the loading dose and ran the maintenance infusion at 0.5 mL/hr, under-dosing the patient by a factor of 40. The night shift nurse continued the infusion at this rate, as did the nurse on the following day shift. The day shift nurse was curious about the low dose and queried the intern, but the nurse was distracted by her additional charge nurse duties. The patient was taken to the percutaneous cardiac intervention (PCI) lab at 2:00 PM on Monday, by which time his troponin values had peaked and were trending down. In the PCI lab, the eptifibatide infusion error was immediately noted. The patient subsequently underwent coronary angioplasty with stenting. It is impossible to say whether the underdose of the blood thinner led to more cardiac damage.

Breakage of a PICC Line

The Case

Born at 27 weeks' gestation, a premature infant had a standard, silastic, 1.9 F percutaneously inserted central venous catheter (PICC) placed on day two of life for parenteral nutrition. The PICC was inserted under sterile conditions with placement verified by X-ray. Initially, the infant was on ventilator support and NPO due to feeding intolerance and necrotizing enterocolitis surveillance. Several attempts were made to introduce feeds; however, the infant continued to have large residuals and increased abdominal girth.

After 40 days of parenteral therapy, the antecubital site and the upper arm became red, swollen, and tender to the touch. The neonatologist opted to remove the catheter. When the RN started to remove the PICC, it broke, leaving approximately 7 cm in the patient.

After several attempts to retrieve the remainder of the line, with X-rays to check placement, the infant was sent for surgical removal of the catheter. Cultures taken via blood and PICC reported moderate growth of *Staphylococcus*. The infant required an increased level of care that included ventilator support, infusion of blood products, and antibiotic treatment.

Double Dosing, by the Rules

A 65-year-old woman with rheumatoid arthritis and chronic obstructive pulmonary disease (COPD) was admitted to a medical unit during the night with worsening shortness of breath. Orders were written at 2:00 AM for prednisone 60 mg daily and for continued administration of her daily methadone dose of 80 mg. The medications were administered by the night-shift nurse when they arrived on the unit at 6:00 AM, in accordance with a new policy that specified that all newly ordered medications be administered to patients within 4 hours.

The nurse assigned to this patient for the day shift also administered the two medications at 9:00 AM to comply with another policy regulating daily medication administration. When the day-shift nurse documented his administration of the two medications, he realized that the same medications had been administered 3 hours earlier. He immediately notified the physician, and continuous pulse oximetry and hourly vital sign checks were conducted to watch for oversedation from the methadone overdose. Fortunately, the patient was able to tolerate the extra doses of prednisone and methadone with no lasting effects.

This incident illustrates how multiple reasonable system policies can produce an unreasonable result. The policy mandating that all new medications be given within 4 hours of being ordered had just been implemented a few days before the incident, while the policy of administering all daily medications between 8:00 and 10:00 AM had been rigorously enforced for many years. Both were policies designed to enhance effectiveness and safety but, applied together, introduced a threat to patient safety.

Medication Reconciliation Victory After an Avoidable Error

The Case

A 91-year-old woman, previously active and independent, recently developed weight loss, confusion, and falls without injury. She lived alone. Late one night, her family visited and found her on the floor of her home. She was lethargic and incontinent, and her speech was slurred. She did not appear to recognize her family members. She was taken to the hospital and admitted for altered mental status and dehydration. Upon arrival to the ward, the admitting nurse attempted to reconcile her home medications with those ordered on admission. However, the patient was unable to tell the nurse which medications she was taking. A family member was asked to return to the patient's home, gather all of her medications, and bring them to the hospital so that medication reconciliation could be performed. In all, seven prescription medications were returned, including Flexeril 10 mg TID, glipizide 10 mg daily, Neurontin 200 mg TID, lisinopril 10 mg daily, gabapentin 200 mg TID, cyclobenzaprine 10 mg TID, and Lortab 5 mg as needed for pain. Some medications had been filled at a local pharmacy, while others were filled by a mail-order pharmacy. The admitting physician recognized that several of the medications were duplicates (Flexeril is the brand name of cyclobenzaprine; Neurontin the brand name of gabapentin), and he adjusted the medication regimen accordingly.

The day after admission, the patient was more alert and responsive to questions. Her medications were reviewed, and she reported that she was taking all of the medications, as prescribed, from the bottles that were retrieved from her home. Unaware that any of the medications were duplicates, she thought she was taking exactly what her physician had intended.

All in the History

Case & Commentary: Part 1

A fatigued emergency department (ED) physician was coming to the end of his long shift when he was told there was a patient referral from an area nursing home. When he picked up the phone, the nursing home physician on the line started to explain, "I'm sending you a 68-year-old man with a history of interstitial lung disease who has been having some shortness of breath." At that moment, the call was interrupted as a senior nurse grabbed the ED physician and said, "We need you in code room one now!" The paramedics had just arrived in the ED with a critically ill patient.

The physician entered the room and found an elderly gentleman with no pulse, no blood pressure, and very low oxygen saturation. He began advanced life support—the patient was intubated and placed on mechanical ventilation, and given intravenous fluids, epinephrine, and atropine to treat his pulseless arrest. With this treatment, the patient regained a pulse and blood pressure after a few minutes but remained critically ill. Once the patient was somewhat stabilized, the ED physician searched for further information about the patient. The paramedics who had delivered the patient had left without speaking with him and did not leave any paperwork or documentation. The physician managed to find some papers with the patient that identified him as a 68-year-old nursing home resident with shortness of breath and included

scant notes about medications, but no further information on past medical history. Only many hours later did the ED physician realize that this patient was the 68-year-old man that the nursing home physician had tried to sign out initially. Because of the interrupted signout and the inadequate handoff from the paramedics, the ED physician had no choice but to proceed with the evaluation and treatment of this patient despite minimal information.

The scenario faced by this emergency physician is all too common—because of lapses in communication, he was forced to make crucial medical decisions with little information. In this case, communication failures occurred between the nursing home and the ED as well as between emergency medical services (EMS) personnel and the ED. This case provides an opportunity to explore these critical transitions in care.

Although the majority of patients seen in EDs present directly or are brought by ambulance, many are referred from outside facilities such as other EDs, nursing homes, or local clinics (at our institution, this may be as high as 10% on a given day). These patients are frequently quite ill (which is often why they are referred in the first place) and may have already received significant medical evaluation or treatment prior to transfer. The Emergency Medical Treatment and Active Labor Act (EMTALA), enacted in 1986, was created to regulate some aspects of this referral process. EMTALA outlines specific expectations for both referring and receiving facilities to provide for safe transfer and to prevent the "dumping" of medically indigent patients who cannot afford to pay for their care (Table 1).(1,2) Unfortunately, EMTALA only applies to the transfer of patients to the ED from another ED, hospital, or medical center. The law does not apply to the referral of patients from non-acute care facilities such as nursing homes or clinics, and these transfers are not regulated in any systematic fashion. Thus, while it is a professional courtesy to contact EDs ahead of time about unstable (or stable) nursing facility patients, there is no legal requirement to do so.

Furthermore, there is no standardized protocol for this communication between providers (when it does occur). Two prior AHRQ WebM&M commentaries (3,4) highlight the frequency and hazards of signouts between medical providers for admitted patients in U.S. teaching hospitals (estimated at 1.6 million per year at UCSF alone).(5) The issues around the "signout" of patients referred to the ED are no different and should be subject to the same degree of oversight and standardization. The 2008 Joint Commission Patient Safety Goal 2E requires all health care providers to "implement a standardized approach to handoff communications" (6) and states that the organization's process for effective handoff communication ought to include (7):

- Interactive communication allowing opportunities for questions between the giver and receiver of patient information.
- Up-to-date information regarding patient condition, care, treatment, medications, services, and recent or anticipated changes.
- Methods to verify received information, including repeat-back or read-back techniques.
- Opportunities for the receiver to review relevant patient historical data, which may include previous care, treatment, or services.

- Limited interruptions to minimize the possibility that information fails to be conveyed or is forgotten.

In a perfect world, referrals such as the one in this case would be communicated according to the Joint Commission guidelines. To start, the referral should occur prior to the patient's arrival to give the receiving ED physician an opportunity to ask questions. In reality, the referring provider is often consumed with providing emergent care (the reason for the transfer) and may not be free to discuss the transfer until EMS is en route to the ED, as in this case. Furthermore, the ED provider may be overwhelmed with multitasking (patient care or other administrative responsibilities) and thus may be unable to discuss the referral in adequate detail. Three simple interventions may ameliorate these inherent impediments. First, checklists (whether on paper or as part of an electronic medical record) can help the receiving facility and provider obtain crucial patient information. Examples of such checklists include an inpatient signout template highlighted in a previous AHRQ WebM&M commentary (4) or the UCSF ED referral template (Figure). Second, if coverage allows, dedicating an ED physician to manage administrative tasks, such as fielding referral calls, can allow an opportunity for more thorough exchange of information. Third, tasking administrative personnel with recording demographic data and referring provider information (most importantly, a call back number) might reduce the time required of the ED provider, who can then concentrate primarily on the essential medical information.

Another weak communication link in the ED highlighted by this case can occur at the transfer of care between EMS and the ED. Many health care systems require EMS providers to radio the receiving ED prior to arrival. These "ring downs" are necessarily brief, do not include identifying information (beyond patient age and gender, due to the insecure nature of radio communication), and are often complicated by poor reception. Thus, a formal face-to-face report is preferred. EMS providers must transfer care to a provider with a higher scope of practice, most often a registered nurse. In the case of an unstable patient, as determined by the EMS providers or by the triage nurse, EMS providers often report directly to the ED physician. This official report, whether to the nurse or the physician, generally includes the patient's chief complaint and history, pertinent physical examination findings including vitals, and any response to prehospital treatment. But note that there is no national standard for this process. Moreover, in practicality, this direct verbal communication can be challenging. In the case of an unstable patient, there may be a cacophony created by multiple providers in the resuscitation room (physicians; nurses; respiratory therapy; radiology technicians; pharmacy, laboratory, and blood bank personnel, etc.), all of whom have crucial roles to play. Ideally, the room should be quiet with the exception of the reporting EMS provider and receiving physician, with all other personnel diligently performing their preestablished tasks. However, anyone who has been present during resuscitations knows that this is the exception.

EMS "runsheets" (EMS provider documentation of the patient encounter) are designed to include these data in a succinct written format (whether paper or electronic). However, EMS documentation is often incomplete upon arrival due to patient acuity and time constraints. A recent report from a suburban academic ED revealed that EMS personnel verbally relayed only

44% of pertinent data contained on their runsheets.(8) Some systems require the ED nurse or physician to sign the EMS runsheet acknowledging the transfer of care. Although forcing a signature may not improve the timely completion of the runsheet or ensure direct communication, it may force the accepting providers to review the information (even if later), and hospitals should consider making this a standard policy. Simply leaving the patient on an ED gurney does not constitute an appropriate transfer of care and may be considered patient abandonment.

Case & Commentary: Part 2

A stat chest radiograph revealed infiltrates in the left lung. Based on the minimal information at hand (the history of shortness of breath, the low oxygen levels, the cardiac arrest, and the chest x-ray), the ED physician made a presumed diagnosis of aspiration pneumonia with respiratory arrest and septic shock. The patient was given intravenous antibiotics, fluids, and vasopressors for blood pressure support. The ED physician contacted the intensive care unit (ICU) team who would be managing the patient in the ICU. He remained busy with this patient (and others in the ED) and could only give a brief signout: "He is a 68-year-old man with a possible history of lung disease with probable aspiration pneumonia. He's intubated, on pressors, and has already received antibiotics. He needs to get up to the ICU." At that moment, another patient was crashing and the physician had to hang up.

The admitting ICU team evaluated the patient and agreed with the initial assessment (although they were concerned by the limited information available). The patient was taken to the ICU. Three hours later, the patient had another arrest, becoming pulseless without a blood pressure. After being treated with aggressive fluids and three vasopressor medications, his blood pressure remained low.

At this point, the puzzled admitting team contacted the nursing home physician. Further history revealed that the patient's shortness of breath had been very acute in onset and had been associated with chest pain, and the patient had stated at the time that he "felt faint and like he was going to die." Based on this vital piece of information, the team became concerned that a pulmonary embolism (blood clot to the lungs) was the cause for his critical illness. The patient was treated with thrombolytics (clot-busters) for presumed massive pulmonary embolism 5 hours after he arrived at the hospital.

The patient immediately responded to treatment, with improvements in his oxygen level and blood pressure. He continued to improve and, after a prolonged hospitalization, ultimately returned to the nursing home.

The transition in care (handoff) between the ED and the inpatient providers creates an opportunity for communication breakdown and medical errors. As with all transfers of care, this should be done in accordance with the 2008 Patient Safety Goal 2E guidelines.(6) Based on clinical experience, most providers feel that the ED physician's presentation to the admitting team should be brief but thorough and include the items listed in Table 2. Contact information

for referring providers, if available, should be conveyed. This process should last no longer than a few minutes and normally takes place in the form of a brief phone conversation, though a face-to-face conversation is preferable. In the case of critically ill patients, this process is best accomplished in person at the patient's bedside.

In a recent survey of emergency and internal medicine providers from a large academic medical center, 29% of respondents reported that a patient of theirs had experienced an adverse event or near miss after ED to inpatient transfer.(9) The most common etiologies for these events were errors in diagnosis, treatment, and disposition. Respondents identified numerous contributing factors including inaccurate or incomplete information (particularly vital signs); ED crowding; high workload; difficulty in accessing key information such as vital signs, pending data, ED notes, ED orders, and identity of responsible physician; nonlinear patient flow; "boarding" in the ED; and ambiguous responsibility for signout or follow-up.(9) Potential solutions include improved electronic access to key information (such as vital signs, ED notes and orders, laboratory and radiology studies, and pending studies), and signout checklists (Table 2). Although the ED physician in this case was not aware of the key aspects of the history from the nursing home, a more standardized, clear, and pertinent signout could have improved the care of the patient.

One additional contributor is particularly noteworthy: cultural differences and misunderstandings, especially around roles in determining the final diagnosis. Emergency department diagnoses are often uncertain at best (due to patient acuity, limited interaction, incomplete laboratory/radiographic data, and limited time to assess response to therapies). This uncertainty may not be appreciated by admitting teams and may be related to ED physicians overstating confidence in their diagnoses (a need to "prove" that the patient requires admission [9]), or because of clinical inertia (failure of health care providers to initiate or intensify therapy when indicated) or cognitive biases (the tendency to make errors in judgment based on cognitive factors). A colleague of mine has said that ED physicians are "sensitive," while admitting teams aim to be "specific" (i.e., the emergency physician's role is to stabilize the patient and determine appropriate disposition, not definitively diagnose or manage their care). This cultural chasm can contribute to admitting teams' mistrust of ED ability, judgment, or professionalism, thus creating further barriers to effective communication.

A consequence of admitting teams not fully appreciating the ED approach to establishing the diagnosis is *premature closure*. Premature closure is the tendency to stop considering other possible diagnoses after a diagnosis is reached.(10) The ED physician can help to avoid this phenomenon by acknowledging diagnostic uncertainty and simply referring to the patient's complaints as the final ED diagnosis and suggesting a differential diagnosis (e.g., "respiratory failure of unclear etiology, possible aspiration vs. community-acquired pneumonia vs. pulmonary embolism, etc.") rather than labeling the patient with a definitive diagnosis (e.g., aspiration pneumonia). The internist, on the other hand, can avoid this cognitive trap by making a conscious effort not to accept a diagnosis as definitive after reaching (or being given) one, but to

ask "What alternatives should be considered?" This should be done initially and intermittently as the clinical case evolves. Diagnoses may seem obvious initially, but time is often our best diagnostic tool, and this simple mental back-up mechanism can help to avoid errors. In this case, the admitting team may have initially "anchored" on the diagnosis provided by the ED, which potentially delayed receipt of the definitive appropriate therapy.

This case illustrates many potential pitfalls in signouts, whether they be from a nursing facility to an ED, EMS to ED, or ED to admitting team. Playing "telephone" is great fun as a child, but when lives are at stake, it is anything but humorous.

Hospital Admission Due to High-Dose Methotrexate Drug Interaction

The Case

A 40-year-old woman with osteosarcoma in her left leg received neoadjuvant high-dose methotrexate, doxorubicin, and cisplatin (MAP) prior to left leg resection and reconstruction. She continued to receive MAP in the outpatient oncology center after surgery. Four months after leg reconstruction, the patient developed left lower extremity erythema and was admitted to the plastic surgery service for presumed cellulitis. The wound was debrided, and the patient received antibiotic therapy. Four days after admission, she was discharged home to complete a 14-day course of intravenous vancomycin and oral ciprofloxacin.

On the 10th day of antibiotics, she went to the outpatient oncology center for high-dose methotrexate in accordance with the MAP cycle. She returned the following day to the oncology center for routine leucovorin "rescue" and IV hydration. She reported extreme fatigue and was found to have transaminitis (aspartate aminotransferase [AST] 668 IU/L, alanine aminotransferase [ALT] 822 IU/L) in the presence of an elevated methotrexate blood level. After her readmission to the hospital for leucovorin rescue and aggressive hydration, she received a diagnosis of methotrexate toxicity due to a presumed interaction with ciprofloxacin.

Are Two Insulin Pumps Better Than One?

The Case

A 62-year-old man with type 1 diabetes mellitus was admitted to the hospital for coronary artery bypass graft surgery. His diabetes had been managed with an insulin pump while he was an outpatient. During his preparation for surgery, the patient asked the staff to leave his insulin pump in place and running at a basal rate. After surgery, he was transferred to the coronary care unit where orders were written to start him on a standard intravenous insulin infusion protocol. After he was extubated, the patient asked the nurse for his hourly finger stick blood glucose results. Unbeknownst to the nurse, the patient would then adjust his insulin pump in response to the glucose readings. At the same time, the nurse adjusted the intravenous insulin infusion rate based on the standardized protocol. The patient's blood glucose levels fluctuated, and he experienced hypoglycemia (with blood glucose levels in the range of 50-60 mg/dL) on several occasions. When the nurse mentioned the insulin pump at case management rounds, the medical director inquired further and, after discussion with the patient, the double dosing was discovered.

The patient then agreed to turn off his insulin pump while he was receiving the intravenous insulin infusion.

To Transfer or Not to Transfer

The Case

A 74-year-old man had a long history of coronary artery disease requiring coronary artery bypass grafting as well as placement of an automated internal cardioverter-defibrillator (AICD) for ventricular arrhythmias. His AICD was almost 10 years old, and his cardiologist had found minor lead displacement (one of the wires to his heart had moved over time). Admitted to Hospital X (less than 1 mile from his house), he underwent the placement of a new AICD—a minor surgical procedure, which was uncomplicated. The patient was discharged 2 days later.

Within hours after arriving home from the hospital, the patient's newly placed AICD began "firing"—shocking his heart with large amounts of energy and causing considerable pain. As the AICD fired more than 15 times in the course of minutes, his wife called 911.

Emergency medical services (EMS) arrived and found him lying on the couch, awake and alert, but in discomfort. His heart rate and blood pressure were normal. Because of repeated AICD firings and concern for a heart attack, he was taken in the ambulance.

The patient told paramedics that he had received all of his care at Hospital X and had just been discharged from there. However, they took him to Hospital Y, a few miles away.

In the emergency department (ED) of Hospital Y, the patient's AICD continued to fire shocks. The defibrillation stopped after the patient was treated with amiodarone and supportive care. He was then admitted to cardiology at Hospital Y for ongoing management. The next day, when the patient was clinically stable, the cardiologist considered transferring him back to Hospital X but decided to keep him at Hospital Y.

Unfortunately, the patient continued to have more ventricular arrhythmias and firings of his AICD even with medical treatment. Despite maximal efforts, the patient eventually died from a cardiac arrest.

It was unclear whether the patient's death could have been prevented had he been taken to Hospital X. However, one could argue that he may have received better informed care had he been admitted to his original hospital.

Sick and Pregnant

The Case

A 35-year-old woman with chronic asthma presented to the emergency department (ED) with difficulty breathing. The patient informed the staff that she was 17 weeks pregnant and had an obstetrician on staff at another hospital. A urine pregnancy test was ordered and was positive. The test result was documented in the electronic medical record. The patient was treated with inhaled bronchodilators, but her respiratory distress persisted. The ED physician contacted the

on-call internist to admit the patient for continued therapy. The internist agreed to admit the patient, but he was not told that the patient was pregnant. The admitting nurse received a report from the ED nurse, but again, the patient's pregnancy status was not mentioned.

On admission, the patient was ordered to receive intravenous corticosteroids, nebulized bronchodilators, and intravenous levofloxacin (a pregnancy category C antibiotic [see Table]). In the morning, the internist saw the patient. She informed him that she was pregnant. The physician reviewed the patient's medication administration record and determined that she received one dose of levofloxacin. He discontinued levofloxacin and ordered an alternate antibiotic that was pregnancy category B. A maternal-fetal specialist was consulted and reported that one dose of levofloxacin should have no adverse effects on the fetus.

A Mid-Summer Fog

The Case

A 33-year-old woman with type I diabetes mellitus was admitted for symptoms of left flank pain, dysuria, and emesis, concerning for pyelonephritis. The patient was taking 40 units of Lantus daily and 10 units of NovoLog with meals and reported good glycemic control on this regimen. On exam, she was febrile but with otherwise normal vital signs, and her laboratory studies were notable for a leukocytosis and glucose of 275. A computed tomography (CT) study confirmed pyelonephritis but also showed marked left-sided hydroureter and hydronephrosis. Urology recommended that the patient be kept NPO overnight in case a procedure was required the following morning. The patient was started on ceftriaxone and intravenous fluids while the new intern, working on his first call night in July at a new hospital, thumbed through the different insulin order forms.

The intern came from a hospital system (as a medical student) that relied entirely on paper orders. This particular hospital used different insulin order forms depending on whether the patient was insulin-dependent, eating, or NPO. The confused intern chose the wrong form, causing the patient to receive insulin in doses that failed to account for her NPO status. At 6:00 the following morning, the intern was called when the patient became unresponsive with a glucose level of 32. The patient responded quickly to treatment with D50 and had a full recovery once the error in insulin order forms was discovered around the hypoglycemic event.

Dangerous Shift

The Case

A 3-month-old infant was admitted with a respiratory syncytial virus (RSV) infection to a pediatric medical unit. Although she was initially stable (without oxygen requirements), her breathing soon became labored, with an increased respiratory rate and subcostal retractions. Providers determined that she would benefit from a higher level of care and initiated the transfer process. This transfer happened to coincide with a shift change for both the nursing staff and the physicians involved.

The off-going nurse assumed that the transfer would take place immediately and signed out her patients to the next nurse before the patient was physically moved. The outgoing physician sent a text page to his incoming colleague with similar sign-out. Approximately 45 minutes later, the unit clerk called the infant's bedside nurse to report that the infant's parents believed their child was in significant distress. The nurse was surprised that the patient had not yet been transferred and, after an initial evaluation, immediately called the rapid response team. The evening physician was also contacted and was equally surprised by the series of events. She had been told that the patient was being transferred "non-emergently" to a unit for closer observation. The patient was transferred to the intensive care unit (ICU), where she made a full recovery, after a prolonged hospitalization.

The hospital performance improvement committee reviewed the case and determined that improper delegation and lack of communication between staff members contributed to the delay in treatment, and that improved policies should be required for shift changes.

Mistaken Identity

The Case

An 85-year-old Cantonese-speaking woman was admitted to the medical service with altered mental status and a reported fall. After finding tenderness in her left hip, the physicians obtained plain films, which confirmed a nondisplaced femoral neck fracture. The orthopedic surgery team was consulted and, after evaluating the patient, decided that the patient's age, comorbidities, and minimal pain and tenderness on exam made her a candidate for conservative, nonsurgical treatment. These recommendations were documented in her electronic health record, where the team specifically noted: "We're reassured to see the patient is able to weight-bear without pain, even though we wouldn't suggest it in the short-term."

The following day, one of the medical interns read the orthopedic surgeon's note and found these comments about the patient ambulating odd. The patient had strict bed-rest orders and was in significant pain, making it hard to believe that she had been observed walking. After further investigation, the intern realized that the orthopedic team had evaluated the wrong patient—the patient's roommate, who also happened to be a Cantonese-speaking elderly woman. The orthopedic surgery team was consulted again and, after some embarrassment about their mistake, offered surgical repair of the correct patient's fractured hip.

Coming Up Short

The Case

A 12-year-old Hispanic female was seen for a well-child check. The child was delivered 2 months prematurely (likely due to domestic violence) in Puerto Rico. She had an intracerebral hemorrhage and was in the neonatal intensive care unit (NICU) for 6 months. The child moved to the United States with her family 5 years ago. The child is currently 22.7 kg and 107 cm (very small according to the growth chart [Figure] for her age), with a normal-sized head. The patient's mother, who speaks only Spanish, says the child developed and grew normally until age 7, when

she stopped growing and began to lose ground developmentally. A few years ago, a school evaluation found that she was mentally retarded.

At the time of the present evaluation, the mother stated that the child had been seen twice in a family practice office for "well checks" over the past few years but had not had blood tests or a thorough evaluation for her growth and developmental problems. On this visit, the family physician ordered routine labs and referred her to pediatric endocrinology. The thyroid-stimulating hormone (TSH) test result was 834 (a near record high), and she was diagnosed as likely having Hashimoto's disease. Thyroglobulin antibodies of 701 and anti-thyroid peroxidase (TPO) antibodies of 576 confirmed this diagnosis. The patient has since begun thyroid replacement therapy and is likely to grow and develop with thyroid replacement. However, according to the endocrinologist, the child's mental function is unlikely to recover.

Recurrent Hypoglycemia: A Care Transition Failure?
Case & Commentary: Part 1
A 70-year-old man with type II diabetes and chronic kidney disease was admitted to the hospital after being found unresponsive at home with a blood glucose level of 23. Two days previously, he had been seen at another emergency department (ED) due to symptomatic hypoglycemia. At that time, he was treated and released with instructions to stop his antidiabetic medications. On this admission, he was resuscitated with IV dextrose and recovered quickly without neurologic complications. The patient did not speak English. After he became alert, the medical team questioned him via an interpreter and learned that the patient did not understand that he was supposed to check his blood sugars at home and did not know the symptoms of hypoglycemia.

The challenge of health literacy immediately presents itself at this point in the case. For a patient in this demographic, poor health literacy is a significant risk factor for his future mortality.(1) Although there are limitations in what individual clinicians can do to solve the overarching problem, it is vital that doctors, nurses, and pharmacists work to mitigate their individual patients' risk. In fact, the case of a patient who does not speak English and is elderly provides an excellent illustration of how health information technology, implemented with a patient-centered focus, can help.

Case & Commentary: Part 2
On further history, the medical team learned that the patient had also received multiple samples of oral hypoglycemic (i.e., antidiabetic) medications from his primary care physician and was taking them indiscriminately. He was discharged home in good condition and was strictly instructed not to take any antidiabetic medications.

The case report does not mention whether the patient's primary care physician received communication about the care and postdischarge plan.

Even in 2008, most practices in the United States continue to use paper-based discharge communication systems. Such a system would require that a member of the patient's primary care team manually update the patient's primary care record after an ED visit or a hospitalization. This is a significant point of failure. The likelihood of failure here is further exacerbated by the variability of the discharge process across different health care institutions—primary care physicians may encounter a unique discharge form and process for every hospital in their community. Errors are likely to be reduced when hospitals use electronic medical record (EMR) systems, because the patient's primary care team can receive a legible printed medication list. However, even when there is an EMR-generated medication list, the documentation generated by the hospital is probably unique to its own vendor's system, since vendors (and most provider organizations) have not standardized the printed output coming from their systems. Such lack of standardization also impedes efforts to move information in electronic form from hospital to primary care practice, a point I will explore further below.

Case & Commentary: Part 3

Eight days later, the patient was readmitted after again being found unresponsive, this time with a blood sugar of 11. In the interim, he had seen his primary physician, who had restarted a sulfonylurea (a common type of antidiabetic drug) despite the patient's relatively advanced chronic kidney disease. The patient recovered after a 3-day hospitalization.

The Promise of the Electronic Health Record

An electronic health record (EHR) has been defined as "an electronic record of health-related information on an individual that conforms to nationally recognized interoperability standards and that can be created, managed, and consulted by authorized clinicians and staff across more than one health care organization."(2) This definition distinguishes the EHR from a simple EMR, since the latter need not span multiple health systems. Using this definition, I don't believe that a true EHR exists in the United States at this time. However, patients who receive care in self-contained integrated delivery systems may have an experience that closely approximates that which a true EHR would offer.

There are a number of ways in which information technology could have been used to avoid this patient's multiple ED visits and two preventable hospitalizations. For one, even an EMR localized to one organization might have prevented this patient's hospital admission, by providing point-of-care decision support to the patient's primary care physician regarding the use of oral hypoglycemics in the presence of chronic kidney disease. Moreover, an EMR-generated after-visit summary, given to the patient after an ED visit or primary care encounter, would provide additional safety. Given that 40%–80% of medical information provided by health care practitioners is forgotten immediately and almost half of the information that is remembered is incorrect, an after-visit summary might support better adherence to a care plan.(3) It is now possible for health systems to purchase acute-care instructions in multiple languages that can be

integrated into an after-visit summary, accompanied by customized instructions from the discharge team.

Even better, the presence of a true EHR would have markedly facilitated the transition of care from the ED to the outpatient setting. In the most advanced integrated systems in use today, medication reconciliation activity can be performed electronically in the ED and is reflected instantly in the patient's outpatient record. The result is that an updated record of the patient's care plan is available to the primary care team from the moment he is discharged from the ED. This record can be used to facilitate safe care whether the patient calls the primary care office on the phone or comes in for a visit. In the presented case, this information might have been available to the primary care physician prior to the second preventable admission. With access to the information about the change in medication regimen and associated discharge information, the physician might well have modified the patient's care plan, particularly in light of his chronic kidney disease and his health literacy issues.

Moving the Locus of Control Toward Patient, Family, and Community

Even as we discuss the holy grail of an interoperable EHR, it is worth noting that the description above is of a system designed largely to support a practitioner-centric, rather than a patient-centric, health system. These are inadequate solutions because they present information to, and about, patients at discrete points in time, typically during the acute phase of illness, and allow limited to no interaction with the patient's personal health information when it is needed most. Such systems also do not encourage practitioner behavior to support collaboration with patients. I believe that changing the locus of control from provider and health care organizations to patients themselves will prove to be the most powerful impact of health information technology.

Personal health records, which give patients online access to their health information, are health records viewable, managed, and shared by patients. Personal health records that include interactive messaging offer patients continuous engagement with their health and health care providers, and protection against errors. Features that support patient involvement include the ability for patients to review after-visit instructions, perform searches against information in their medical record, confirm medication regimens, and ask questions of their health care teams when it is convenient for them.(4)

Personal health records will also change practitioner behavior whether or not individual patients or their families access the information. For example, in the case of prescriptions, even if a physician does not tell the patient the name of a medication being prescribed (which happens up to 26% of the time according to one study [5]), a computer-generated summary will prompt questions, which will in turn change prescribing behavior. In the hospital, a family member who has access to the patient's medication administration record may become aware of a missed antibiotic dose. The family member might then call the nurse or doctor, prompting a bedside discussion of the patient's regimen instead of the more common, non–patient-centered conference room or nursing station rounds.(6) Patients with online access may develop enhanced

expectations for timely and accurate delivery of information, which will stimulate reexamination of information-constrained care processes. It will no longer be acceptable to tell a patient, "If it's normal, you won't hear anything from us"—every intervention will generate information for patients about the result, even one that is expected, along with an opportunity to ask further questions.

Although legitimate concerns have been raised about lack of computer and Internet access for medically underserved populations, such access has been expanding rapidly. Presently, 73% of the American population reports using the Internet or e-mail. For adults older than 65, the figure is 35%. For Spanish-dominant Hispanic adults, the figure is 32%.(7) While Spanish-dominant Latino adults get health information from the Internet only 17% of the time, they get health information from family or friends 56% of the time, and 55% of English-speaking Hispanic adults have Internet access.(8) Obviously, continued promotion of widespread Internet access will be increasingly important as more health information and communication become electronic.

In addition, there are innovative uses of patient-centered health information technology that could help patients such as the one described in this case. One such system, used by Queens Health Network in New York City, utilizes smartcards that allow patients to exchange personal health information with local care providers and EDs.(9) In Sonoma County, California, a system called MiVIA connects migrant and farm workers to the health system through a personal health record and identification system supported by health *promotores* (health promoters who specifically work with the migrant/farm community).(10) In both examples, the patient manages privacy and security, either through the use of a physical device or via permissions embedded in a web-based system.

The presented case does not indicate if the patient's support system (family, friends, community) was assessed for their ability to be informed about and assist in management of this patient's care. Family involvement, and the ability to support it through the use of personal health technology, is a key aspect of preventing errors. Many health care systems recognize this and provide proxy access for authorized family members, such as parents of children or adult children of aging parents. For a hospitalized patient, a family's online access to the hospital course could make a significant difference in terms of identifying potential errors and supporting the postdischarge care plan.

Toward an Interoperable Personal Health Network

The latest efforts of companies like Microsoft and Google are furthering these innovative efforts to promote patients' access to their personal health information. Both companies are regularly interacting with multiple stakeholders in the health care arena (patients, providers, employers, health plans, and community organizations) to learn about health care while leveraging their expertise in serving people online. Both are keeping abreast of the latest connectivity standards in health care while regularly using standards used in other industries.(11) The Certification

Commission for Health Information Technology will begin certifying personal health records in 2009, with a focus on privacy, security, and interoperability.(12) It is likely that every patient or health care organization will soon be able to choose a personal health record service or product with confidence—some offered by their own health care provider or system, and others offered by outside vendors. Data clearly show that they want this access, whether they are insured or uninsured (13), and this demand, coupled with growing national experience with personal health records, will stimulate further innovation.

Toward a World of Technology-Facilitated Patient and Family Involvement

Within the care environment, an EHR can provide guidance at critical times and transmit a record of decisions made between care providers. This is a first layer of protection. The more potent layer is the involvement of people who know the patient best—patients themselves and those who support them. A system where the information can only be provided to patients and families at discrete times, often while the patient is in distress or alone, is unsettling to many who provide health care, and potentially devastating to those who receive it. When health information technology is implemented with the patient in mind, the cumulative impact of everyone on the team doing their best—including the patient, their family, and their community—is much greater than what can be achieved by an inpatient team or a primary care team working in isolation.

Finally, it is important to state that participation should extend to the design and implementation of systems. Developing effective information technology systems will require the involvement of not only patient advisors, but allied health leaders, nursing leaders, and physician leaders. The care experience extends far beyond the patient–physician encounter; all who are involved in supporting the care should participate in designing its future.

Where's the Feeding Tube?

The Case

A 13-year-old boy was involved in a motor vehicle collision and experienced a traumatic brain injury. Because of the injuries, he was unable to swallow and had to receive nutrition through a nasojejunal feeding tube. After many weeks in the intensive care unit (ICU), he was transferred to a rehabilitation unit with improved mental status. A routine chest radiograph performed to check for resolution of a pneumothorax (punctured lung) revealed that the nasojejunal tube had migrated, and the tip was now in the gastric area (serving as a nasogastric feeding tube). The medical team felt that this placement was adequate, and the boy continued to receive enteral feedings.

Two days later, the boy developed tachycardia (increased heart rate), tachypnea (increased respiratory rate), and decreased oxygen levels that required supplemental oxygen. A portable chest radiograph revealed evidence of pneumonia. In addition, the chest radiograph showed the nasogastric tube had moved again, and the tip was now in the esophagus. Given the more proximal location of the nasogastric tube, physicians felt that the pneumonia was most likely from an aspiration event (inhalation of the liquid food into the lungs).

Because of decreasing oxygen levels and worsening mental status, the patient required transfer back to the ICU. He was treated with antibiotics and supportive care and slowly improved. He returned to the rehabilitation center 3 days later, but unfortunately his mental status and physical state had declined since before the aspiration event. His recovery was delayed, and the aspiration event caused significant emotional distress for his family.

Failure to Latch

The Case

The patient is a full-term, 8.5-pound, healthy infant whose parents were strongly committed to breastfeeding exclusively for 6 months. However, early breastfeeding did not go smoothly. The newborn suckled frequently and strongly but did not appear to be receiving adequate intake. The infant had marginal output characterized by decreased urinary output, and the mother experienced painful bleeding nipples. While not specifically trained to assist with breastfeeding, nurses in the postpartum unit offered assistance but ultimately suggested formula supplementation, which the parents refused. Mother and infant were discharged 48 hours after delivery.

Because of the low output and rising bilirubin, the infant was seen by a pediatrician three times in the next 6 days and experienced a 15% weight loss. The infant's output continued to be marginal. The infant was nursing frequently for 30–45 minutes at a time, was quite fussy, and tended to fall asleep at the breast. The mother reported that her breasts were tender and the nipples were painful but no longer bleeding. The pediatrician evaluated the infant for hyperbilirubinemia (bilirubin increased to 16 mg/L) but did not observe the infant feeding. The pediatrician suggested that the parents give the infant formula supplementation before every feeding.

The worried and exhausted parents, bewildered by conflicting advice, eventually sought telephone advice from a lactation consultant, who recommended a plan of pumping, nursing, and formula supplementation after feeding. Following this regimen, the infant gained 4 ounces in 4 days and the total serum bilirubin decreased to 11. Breastfeeding continued to be difficult, and the parents scheduled a face-to-face visit with the lactation consultant. The consultant observed a feeding and performed a physical examination, after which she identified the infant as having ankyloglossia (tongue-tie).

Empiric Steroids: the Good, the Bad, and the Ugly

Case A: Part 1

A 55-year-old male immigrant with no significant past medical history came to the emergency department for evaluation of a 3-day history of dyspnea, nonproductive cough, and fever. The physical examination revealed tachypnea, bibasilar crepitations, and diffuse, end expiratory

wheezes. The patient was started empirically on a cephalosporin and a macrolide for community-acquired pneumonia (CAP). Given the diffuse wheezing on exam, he was also treated with intravenous corticosteroids.

Comment: The diagnosis of CAP in patients hospitalized for severe symptoms is often made without evidence for a causative agent. Antibiotic coverage is initiated, and, because many of these patients have chronic obstructive pulmonary disease (COPD), glucocorticoids are often added. In a prospective, randomized study of giving 40 mg prednisolone intravenously for 3 days in addition to antibiotics to one cohort of moderate–severe CAP patients, and antibiotics alone to a second cohort, the glucocorticoids were reported to promote resolution of symptoms and reduce the duration of intravenous antibiotic therapy.(1) Similarly, a retrospective, observational study of 546 patients with CAP found that mortality decreased in the patients with severe CAP who were given both systemic steroids and antibiotics.(2) Other rationales for glucocorticoid therapy in severely ill patients with pneumonia are that many of them have "critical illness–related corticosteroid insufficiency," and *in vitro* studies indicate that alveolar cell apoptosis and activation of proteases induced by *Legionella pneumophila* are inhibited by methylprednisolone.(3)

Among the many questions raised by this brief case report is a crucial one: How aggressively should physicians search for a specific etiologic agent in presumed CAP before instituting therapy? One point to support a search is that there are more and more relatively specific therapies for parasitic diseases often found in immigrant populations, in addition to tuberculosis. *Strongyloides stercoralis*, for example, responds to treatment with thiabendazole and ivermectin, and various studies indicate that glucocorticoid therapy is not helpful in pulmonary *S. stercoralis*. Another answer is that when there are risk factors for "atypical" causes, such as the patient being an immigrant, a closer look is indicated. In patients such as this one, the use of sustained glucocorticoids for "expiratory wheezing" is questionable without a better sense of the causative agent.

Case A: Part 2

Over the subsequent days, the patient deteriorated, developing respiratory failure and requiring transfer to the intensive care unit. The diffuse wheezing persisted. Subsequent chest radiographs and computed tomography (CT) scans revealed progressive bilateral diffuse granular opacities. A more extensive work-up pursued to evaluate for atypical and fungal pneumonia revealed no culprit organism. Bronchoscopy revealed thick yellow mucus, and cultures were sent. Ultimately, bronchial washings demonstrated the larvae of S. stercoralis.

Let us hope that the proper therapeutic regimen (including antiinfectives and discontinuing the glucocorticoids) helped this man. The principal message for this and other cases is that glucocorticoids (don't use the term "corticosteroids" because that word includes the sex hormones) should be thought of as being essentially for *acute* use in whatever dose is needed,

with plans to taper or replace with other medications. The exceptions must be diseases that are chronic and prolonged for which there are no more therapeutic options.

Whenever you are initiating glucocorticoid therapy empirically, and you aren't completely certain of the underlying illness, ask yourself, "Are there any conditions remaining on the differential diagnosis that could get much worse on glucocorticoids?" If the answer is yes, consider withholding the steroids, empirically treating the other condition, or pursuing more aggressive diagnostic testing to rule out the condition.

Case B: Part 1

A 49-year-old woman had the onset over 3 weeks of morning stiffness, pain, and swelling bilaterally in her proximal interphalangeal (PIP) joints, metacarpophalangeal (MCP) joints, wrists, and knees. She is postmenopausal, has an unremarkable past medical history and no allergies, and her only medications are a statin drug for high low-density lipoprotein (LDL) and gabapentin for sleep. She has not left her home for the past 6 months. She is fatigued and finds that she cries more easily. She sees you, her primary care physician, 3.5 weeks after symptoms began.

Examination reveals bilateral tenderness and soft tissue swelling in the finger joints, except for the distal interphalangeal (DIP) joints and the palmar aspect of the wrists. Both knees are swollen, with a particularly large effusion on the right. A right popliteal cyst is present, and full extension lacks 20 degrees. MCP joints 1–3 are tender on the right foot. Full extension of the left elbow is limited. No subcutaneous nodules or skin rash is found. Eye exam is normal, as is examination of the cardiorespiratory system.

While you await the results of laboratory tests, would it be appropriate to begin treatment with 15 mg prednisone each morning because of concern about the right knee?

Comment: All aspects of this case suggest a diagnosis of early rheumatoid arthritis (RA). The morning stiffness is a *sine qua non* for joint inflammation. The reasons for the bilaterality of RA are not definitively clear, but the leading hypothesis links this to inflammatory neuropeptides. Her joint distribution is typical: DIP joints are rarely affected in RA.

While awaiting lab tests and arriving at a definitive diagnosis, it is *inappropriate* to start therapy with prednisone, 15 mg daily. The initiation of this low-dose therapy is likely to lead to an improvement in the patient's symptoms but may lead to a conflict later: the relatively low dose is "forgotten" by the physician, but the patient cannot bear stopping it. Since the 1950s, when cortisone was first used to treat RA, there has been a tendency among many physicians, once the diagnosis of RA is definite, to use oral, daily glucocorticoids. This is now recognized as inappropriate, especially since the efficacy of methotrexate, with or without biologic agents, has clearly been demonstrated. If the daily dose were to be continued for more than a month, this postmenopausal woman would be at a high risk for glucocorticoid-induced osteoporosis.(4)

Early intervention could include nonsteroidal antiinflammatory drugs, education about joint protection, and consideration of medical treatment for reactive depression. In addition, tetracycline derivatives (e.g., minocycline and doxycycline) have been found to have small but definite efficacy in early RA.(5)

Although oral daily glucocorticoids are contraindicated at this point, it would be appropriate to aspirate as much fluid as possible from the patient's right knee and inject 40 mg triamcinolone (an injectable glucocorticoid) or an equivalent. This route of administration is approximately twice as effective as intramuscular injection of similar doses (6), and the aspiration of fluid itself alleviates symptoms. The fluid should be sent for cell count and culture.

Case B: Part 2

Let's assume that glucocorticoids were not initiated. The joint fluid contained 23,000 polymorphonuclear leukocytes (PMNs)/mm^3 and culture was negative. The patient's hemoglobin was 10.2 g/dL, plasma white blood cell (WBC) count was 9500/µL with 3% eosinophils and 80% PMNs. Urinalysis and a comprehensive serum screen were normal. The C-reactive protein was 6.8 mg/dL, and both rheumatoid factor and anticitrullinated antibody (highly specific for RA) were present in serum. Now, almost 5 weeks after symptoms began, the patient is not improved and probably is worse.

Should oral glucocorticoids be used empirically now to suppress the presumed RA?

While it is appropriate to make a diagnosis of RA in this woman, it is not appropriate to begin oral glucocorticoids unless there is a definitive plan to discontinue them relatively soon. Such a plan, used by many rheumatologists, has received credence from the BeSt study, a randomized trial designed to compare targeted treatment strategies.(7) The results—reaching a low disease activity score—were obtained with two protocols: (a) initial combination therapy with methotrexate, sulfasalazine, and rapidly tapered high-dose prednisone therapy, and (b) initial combination therapy with methotrexate and infliximab (a monoclonal antibody directed against tumor necrosis factor [TNF] alpha). Patients on either of these two regimens were more likely to achieve a clinical remission of disease and to have significantly less joint damage progression after 2 years than those on either sequential monotherapy or step-up to combination therapy. Those on the protocol that included initial prednisone did not have more toxicity than those who were not given prednisone.(7)

In my judgment, the empiric use of glucocorticoids in RA should be limited to one of three scenarios:

- Administration of a single high dose of intramuscular glucocorticoids very early in the disease process before other therapies are given (i.e., for acute symptom relief).
- Use of intraarticular glucocorticoids at 2- to 3-month intervals (i.e., to relieve a single painful, inflamed joint).

- Use of oral glucocorticoids in protocols in which they are tapered to zero dose within a month (i.e., as in the first protocol above, where the glucocorticoid is combined with other disease-modifying agents such as methotrexate).

Case C: Part 1

A 43-year-old man developed a skin eruption believed to be an allergy to a diuretic (his only medication) that he was taking for hypertension. Within several weeks, he became profoundly tired, had spiking fevers during the day, and began to lose weight. He noted stiffness in knees and hands, especially in the morning. His wife noted that he seemed "pale."

On examination, he appeared ill and was mildly tachypneic. Oral temperature was 39.4°C. Blood pressure was 117/75, pulse was 112 (regular). He had a faint serpiginous skin eruption on his trunk. Cardiac examination showed tachycardia and prominent heart sounds. Both his liver and spleen were palpable, the latter extending 6 cm below the left costal margin. Mild pitting edema of the lower extremities was found, but he had no joint effusions. Neurologic examination was reported as "nonfocal." Stool was negative for occult blood.

Initial laboratory tests revealed a WBC count of 2100/μL with 40% band forms and 10% lymphocytes; platelets were low. Smear exam showed multiple fragmented red blood cells (RBCs). Hemoglobin was 8.3 g/dL. Urinalysis showed numerous WBCs. The erythrocyte sedimentation rate (ESR) was 120 mm/h. The C-reactive protein was 28.8 mg/dL.

Further laboratory tests showed: blood urea nitrogen (BUN) was 56 mg/dL; bilirubin was 4.2 mg/dL; aspartate aminotransferase (AST) and gamma-glutamyltransferase (GGT) were both elevated; blood glucose was normal; creatine kinase showed slight elevation; electrolyte tests showed a sodium level of 132 mEq/L and a potassium level of 5.4 mEq/L. Protein results were albumin of 2.8 g/dL and globulin of 2.4 g/dL. Tests for tick-borne diseases were negative.

While awaiting other tests, would it be appropriate to begin 80 mg prednisone/day in divided doses?

Comment: The physicians should consider but then reject this course until most possibilities of infection have been ruled out. If blood and urine cultures are negative, systemic vasculitis or malignancy is high on the list of differential diagnoses. The patient is very ill with a systemic process that could be generating an excess inflammatory cytokine release, so-called cytokine storm.

If infection seems unlikely, malignancy (most often lymphoma) and systemic vasculitis are the most probable diagnoses. In a patient such as this, who is continuing to worsen, empiric steroids, 80–100 mg prednisolone/day, intravenously, are appropriate therapy while the work-up continues. However, steroids should not be administered unless infection has been excluded by appropriate studies.

Case C: Part 2

The blood smear showing fragmented RBCs led to other tests: fibrinogen was low; fibrin degradation products were high; and serum ferritin was 1120 µg/L.

As the patient was stabilized, but not improved, with glucocorticoid administration 3 days later, a subsequent bone marrow examination revealed phagocytosis of hematopoietic cells by invasive macrophages. A protocol for treatment of aggressive lymphoma was added to the prednisolone, and the patient improved.

The extremely high ferritin levels, in association with fever, splenomegaly, cytopenias, and hypofibrinogenemia suggest a diagnosis of hemophagocytic lymphohistiocytosis.(8)

The lesson about empiric glucocorticoid therapy from this case is "don't use steroids unless you can't help it!" Although the diagnosis was not clear, the patient was worsening and most causes of infection (with exception of miliary tuberculosis) had been ruled out. Severe multisystem disease without a clear diagnosis is more often caused by infection, malignancy, or systemic vasculitis. Indeed, in the absence of infection, it often is appropriate to test the hypothesis that the problem is a "steroid-responsive disease." The drug can be stopped if the patient does not improve, or if a cause for which there are specific therapies (e.g., the *Strongyloides* in case A) emerges.

The cases presented above demonstrate important concepts about when to use and when to avoid use of empiric steroids. In addition to RA, other forms of arthritis that have partial or greater response to glucocorticoids, usually given intraarticularly, include acute gouty arthritis, juvenile arthritis, osteoarthritis, pseudogout, psoriatic arthritis, and rheumatic fever. Glucocorticoids are often used in oral doses for systemic vasculitis and other connective tissue diseases, including dermatomyositis/polymyositis, mixed connective tissue disease, polymyalgia rheumatica, and systemic lupus erythematosus.

For fear of exacerbating the underlying disease processes, certain comorbidities should preclude the use of glucocorticoids unless specifically indicated. Physicians should be very cautious about prescribing glucocorticoids for periods longer than several weeks to patients with the following disorders:

- Infection—all forms. The exception to this rule is when high doses of glucocorticoids are indicated to diminish severe inflammatory manifestations of the infections (e.g., *Pneumocystis carinii* lung disease and tuberculous pneumonia).
- Diabetes mellitus.
- Poorly controlled hypertension.
- Postmenopausal women, especially those with other risk factors for osteoporosis.

What Was in Those Platelets?

The Case

A 47-year-old woman was admitted to the hospital for complex spinal surgery. The surgery went well without complications, and postoperatively she was transferred to a general surgical ward.

Shortly thereafter, she spiked a fever, became tachycardic, hypotensive, and hypoxic, and developed a red rash across her chest. She was reintubated (placed back on the mechanical ventilator), given an infusion of dopamine to maintain adequate blood pressure, and transferred to the intensive care unit (ICU). She was found to have severe septic shock and developed multiorgan system failure. On initial evaluation, the clinicians were puzzled and confused because there was no clear cause for her septic shock.

On the same day, a 76-year-old man with coronary artery disease and a prosthetic aortic valve was admitted for spinal surgery. The procedure went well, and he was stable and transferred to a general surgical ward postoperatively. Later that evening, he developed tachycardia, hypotension, and hypoxia, requiring reintubation and transfer to the ICU. He was found to have sepsis and, despite extensive diagnostic testing, the clinical team could not identify a clear cause for his decompensation.

Given the similarity in clinical course, the hospital investigated the two cases. Upon detailed review, the blood bank discovered that both patients had received intraoperative platelet transfusions from the same batch of platelets. With further testing, it was determined that the entire batch of platelets was contaminated with *Staphylococcus aureus*, a virulent and aggressive bacteria often found in hospitals.

The 47-year-old woman remained critically ill for many days and had *Staphylococcus aureus* in her bloodstream for more than a week despite antibiotic therapy. She had a long and complicated hospitalization, but she was ultimately discharged in stable condition. The bacterium was never cultured from the blood of the 76-year-old man, but he remained febrile in the ICU for many days. Given his prosthetic valve, an echocardiogram was obtained that showed possible bacterial endocarditis (infection of his heart valve with the bacteria). In addition to a prolonged hospitalization, he required 6 weeks of intravenous antibiotics as a result of the contaminated platelet transfusion.

Wrong Route for Nutrients

The Case

An 82-year-old man living in a skilled nursing facility (SNF) had not been eating or drinking well for about 6 months. He had lost weight and developed several decubitus ulcers on his coccyx and hips that were not healing. He was diagnosed with failure to thrive and was fed using a percutaneous enterostomy tube. This treatment did not bring about improvement in his condition. To provide more nutrition, the physician placed a central venous line and prescribed intravenous (IV) total parenteral nutrition (TPN) administration.

In the SNF, licensed practical nurses (LPNs) administer most medications. The LPN on the night shift mistakenly hooked up the total nutrient fluid prepared for the central line (i.e., to be delivered as IV TPN) to the enterostomy tube. The patient's daughter was in the room and

observed this error. She questioned the LPN about this procedure, and the LPN told her that this was what had been ordered. But just to be sure, the LPN checked with the registered nurse (RN) in charge and learned that the daughter's concern was well founded—indeed this total nutrient fluid was to be administered through the central line, not through the enterostomy tube.

Recognizing the mistake, the LPN returned to the patient's bedside to correct the error, disconnected the total nutrient line from the enterostomy tube, and prepared to connect it to the central line catheter. Fortunately, both the daughter (a retired RN) and the RN in charge were present and stopped the LPN from contaminating the central line with this line that had been directly communicating with the patient's bowel. The total nutrient solution was discarded, and the physician was notified. The next total nutrient fluid preparation did not arrive until the following evening. Therefore, the patient did not receive this supplemental nutrition for 24 hours.

Dependence vs. Pain
Case & Commentary: Part 1

A 56-year-old man with a long history of heroin use presented to the hospital with abdominal pain, nausea, and vomiting. He said he had been using less heroin than usual because of the gastrointestinal complaints and felt that his symptoms were probably from heroin withdrawal. On initial evaluation, he was dehydrated, but his vital signs were unremarkable and his abdominal examination was benign. His complete blood count, liver function tests, amylase, and lipase were all normal, and an upright KUB radiograph showed no clear cause for his abdominal pain. He was admitted to the hospital for treatment of dehydration and opiate withdrawal and was given intravenous fluids, methadone, and low doses of morphine intravenously for the abdominal pain.

Later in the evening of admission, he complained of increasing diffuse abdominal pain. He also complained of excessive yawning and increased lacrimation. On physical examination, he was tachycardic, tachypneic, and generally restless, but had a nontender abdominal examination. He was given increased methadone to treat presumed worsening opiate withdrawal.

Opioid dependence is a treatable chronic medical illness that afflicts as many as 6 million persons in the United States. Unfortunately, many providers are uncomfortable caring for patients with opiate dependence, unwilling to do so, or simply uninformed about appropriate treatment strategies. This case provides an opportunity to discuss the basics of opiate dependence and opiate withdrawal.

The medical disorder *opioid dependence* is defined as a maladaptive pattern of use of illicit or prescription opioids leading to clinically significant impairment or distress as manifested by three or more diagnostic criteria in the past 12 months.(1) These diagnostic criteria include physical dependence, tolerance, taking opioids in larger amounts or for longer periods than intended, desiring to cut down or control use, dedicating a large amount of time to procuring

opioids or recovering from their effects, giving up important activities because of their use, and using opioids despite knowledge of harm. Unfortunately, the terminology for this disorder is confusing. Physical dependence on an opioid is just one of the seven criteria for the diagnosis of opioid dependence, and patients who are not physically dependent on opioids can still have opioid dependence if they meet three other criteria. A common illicit opioid is heroin, but any opioid pain medication can be "diverted" to illicit use, including hydrocodone and long-acting oxycodone.

Opioid dependence is not a trivial problem. More than 3 million Americans have used heroin in their lifetime.(2) According to the Office of National Drug Control Policy, there were an estimated 810,000 to 1,000,000 individuals addicted to heroin in the United States in the year 2000, representing the highest number of heroin-addicted persons in this country since the late 1970s.(3) Furthermore, the National Institute on Drug Abuse (NIDA) Monitoring the Future Survey reported that as many as 10.5% of 12th graders reported using hydrocodone within the last year.(4) Several factors contribute to this increased use. First, in the late 1990s, the purity of heroin increased—heroin purity now may be as high as 80%–90% in large urban areas. The increase in purity has increased use of heroin by noninjection routes of administration, including snorting and smoking. Indeed, one survey found that only one third of new users of heroin actually inject it.(3) Not only are illicit opioids available and pure, they are cheap: it is not unusual to be able to buy a supply of heroin (for one "hit") for less than $10. Interestingly, this "street price" is much cheaper than that of diverted prescription opioid medications.

Another reason for the increase in opioid dependence is the dramatic increase of drug diversion (use of a drug outside the scope of its intended purpose). In 2000, 2 million people used prescription pain relievers for nonmedical reasons for the first time (5), and from 1999 to 2000, the Drug Abuse Warning Network (DAWN) reported a 68% increase in illicit use of oxycodone products.(6) Furthermore, according to the DAWN Mortality Data Report, hydrocodone ranked among the 10 most common drugs related to deaths in 18 cities. Also, persons who misuse prescription opioid medications are more likely to eventually use illicit and illegal opioids that include heroin.

This increase in opioid addiction has exacted tremendous medical and societal costs. Illicit opioid use—either heroin use or prescription opioid misuse—is associated with significant harm to individuals and burdens limited health care resources. Major medical and psychiatric illnesses often coexist with opiate addiction. For example, depression, hepatitis infection (primarily hepatitis C), and HIV are all common in patients who have opioid dependence. Violence and crime are also associated with opioid dependence.

We are told that the patient in this case has a long history of heroin use and likely suffers from the disorder of opioid dependence. The patient's symptoms as described are consistent with classic opioid withdrawal. Opioid withdrawal is defined diagnostically as three or more symptoms that include dysphoric (negative) mood, nausea or vomiting, muscle aches, runny nose

or watery eyes, dilated pupils, goose bumps or sweating, diarrhea, yawning, fever, and insomnia. In my clinical experience, patients sometimes complain of abdominal cramping or bony pain ("Doc, it's in my bones"), but overt abdominal pain (as seen in this case) is less common. The withdrawal symptoms cause significant distress to the individual and often impair functioning in activities of daily living. Opioid withdrawal symptoms may be so severe and aversive that many opioid-dependent individuals continue to use the drugs only to avoid withdrawal. The nature and severity of the opioid withdrawal syndrome depend on the individual, the opioid pharmacology (short- vs. long-acting), and the standard dose used. Research has recently shown benefit for monitoring opioid withdrawal using objective measures such as the Clinical Opioid Withdrawal Scale (COWS).(7) An objective measure was not used in this case, but given the constellation of symptoms, a presumptive diagnosis of opioid withdrawal was made.

How should this patient's opiate withdrawal be treated? Because opioid withdrawal syndrome, while aversive, is not deadly, many insurers will not pay for a hospitalization for only treatment of opioid withdrawal. Partly for this reason, opiate withdrawal is generally managed in the outpatient setting in methadone treatment facilities (or in licensed opioid agonist therapy [OAT] programs). Occasionally, patients like this one are admitted to a nonmethadone facility (e.g., hospital) for another illness, and opioid dependence treatment using opioids is necessary to help treat the primary illness (e.g., an acute myocardial infarction in a patient with heroin withdrawal). Management of opioid withdrawal in these patients can be difficult. The primary concern should be managing the acute medical illness and stabilizing the patient undergoing opioid withdrawal. In the case of a patient with an acute illness and opioid withdrawal (like the patient who presented in our case) who does not want long-term treatment for their opioid dependence, a short, tapering "detoxification" course of opioids is often used. In both outpatient and inpatient settings, both methadone and buprenorphine can be used to treat opioid withdrawal as well as to provide longer term maintenance treatment for opiate dependence.

Emerging evidence suggests that a short, decreasing dose course of either methadone or buprenorphine can ameliorate the symptoms of withdrawal while acute medical issues are addressed. Doses used depend on several factors including the patient's level of physical opioid dependence, the type of opioids illicitly used, and the nature of the acute medical illness. Typically, detoxification treatment lasts less than 2 weeks, and there are several protocols available and studied.(8) Emerging research has also outlined detoxification protocols using buprenorphine and its potential preferential benefits as a first-line pharmacologic agent.(9-17)

If long-term treatment of opioid dependence is a goal for patients needing detoxification for an acute medical illness, patients should be offered maintenance OAT during their hospitalization. It is well established that maintenance OAT is preferred over detoxification to reduce the morbidity and mortality of the disease of opioid dependence.(18) Most providers are aware that methadone is the mainstay of pharmacologic treatment of opioid dependence, but methadone can only be prescribed for opioid dependence treatment within OAT programs or when patients with opiate dependence are admitted to an acute care hospital for other medical issues. Buprenorphine is

another effective medical treatment of opioid dependence (e.g., maintenance OAT) and can also be used as a pharmacologic treatment of opioid withdrawal syndrome. In 2002, Congress amended the Drug Abuse Treatment Act (DATA 2000), allowing credentialed and Drug Enforcement Administration (DEA)-waivered physicians to prescribe buprenorphine and buprenorphine/naloxone (both Schedule III medications) for OAT in office-based practices.(19) Like methadone OAT for use in licensed methadone OAT programs, buprenorphine administered in office-based practices is effective at reducing illicit opioid use, drawing patients into treatment, and reducing harm associated with comorbid medical and psychiatric illnesses.(20-26) Clinical studies suggest that patients maintained on buprenorphine for a period of time do better than patients who are merely "detoxified" using buprenorphine.(18)

In this case, the provider's original working diagnosis was opioid withdrawal syndrome. Even when this diagnosis is strongly suspected, a full and complete history and physical examination as well as appropriate laboratory studies should be performed. Other medical disorders, such as pain syndromes, can mimic opioid withdrawal syndrome. In addition, many patients with opiate dependence present with comorbid conditions of HIV, hepatitis C, or skin infections—all consequences of intravenous injection of illicit opioids. These disorders may require specific treatment or may influence the treatment of other illnesses.

In the patient in this case, the overt abdominal pain would lead me to consider other diagnoses. The patient's yawning, lacrimation, tachycardia, tachypnea, and general restlessness are consistent with opioid withdrawal. His nontender abdominal examination also would be consistent with this diagnosis. However, prescribing intravenous morphine would generally not be my initial treatment of choice for opioid withdrawal if that was the only medical condition needing attention. Detoxification using buprenorphine (or potentially methadone) would better assist in transitioning care from a detoxification treatment to longer term maintenance therapy using buprenorphine or methadone. Although that would represent my usual practice, in this case, because the patient has abdominal pain of unclear etiology, intravenous morphine may be a good option. As a short-acting treatment, I would be able to monitor the acuity of abdominal pain to determine whether it was due to atypical opioid withdrawal. In addition, introduction of buprenorphine in this patient, who may need surgical management of his acute condition, may complicate his perioperative pain management. Buprenorphine is a partial opioid agonist, and as a result of its high receptor affinity, traditional doses of perioperative pain medications may not readily displace buprenorphine from the opioid receptor and thus may not have the necessary analgesic effect.(27)

The bottom line is that, at this point, it would be appropriate to evaluate the patient for other causes of his abdominal pain and worsening condition.

Case & Commentary: Part 2

Despite increasing the methadone, the patient's abdominal pain persisted and worsened. A covering physician was contacted overnight about the abdominal pain. The nurse told the

physician that the patient had asked for something stronger for the pain. Because the daytime physician had earlier described the patient as a "strung out shooter," the covering physician believed that the patient was either drug seeking through his complaints of pain or not receiving enough methadone. Instead of reevaluating or reexamining the patient, the covering physician ordered another increase in the dose of methadone. Overnight, the patient continued to have diffuse abdominal pain and tachycardia.

In the morning, the patient's abdominal pain became severe, his tachycardia worsened, and his blood pressure decreased, indicating a possible infection (septic shock). He was given aggressive intravenous fluids, and his abdominal computed tomography scan (CT) revealed a perforated colon, likely from diverticulitis. The patient then underwent successful colonic resection and was discharged from the hospital 2 weeks later.

The patient's worsening condition in the face of opioid agonist therapy should have given the covering physician pause, and another diagnosis should have been strongly entertained. Unfortunately, the stigma associated with having an alcohol or drug use problem can contribute to misdiagnosis or delays in diagnosis. There is general consensus that physicians and other health care providers have negative perceptions about patients with alcohol and other drug disorders (28-30)—attitudes that may result in worse health outcomes. For example, 23% of HIV-infected patients had physicians with negative attitudes toward patients who were injection drug users. Injection drug users who were cared for by physicians with negative attitudes had a significantly lower adjusted rate of treatment with highly active antiretroviral therapy than non–injection drug users who were cared for by such physicians or injection drug users who were cared for by physicians with positive attitudes.(28) Although not stated explicitly in the case presentation, the covering provider may have been biased by the description of the patient as a "strung-out shooter" and treated him differently.

Physicians also have lower satisfaction in treating patients with alcohol and other drug disorders than in treating those with other medical illnesses.(31) This is somewhat surprising. Comparing alcohol and drug disorder diseases with other chronic care diseases, relapse rates to unhealthy behavior (e.g., alcohol use in an alcohol-dependent patient; poor diet control in a patient with diabetes) are comparable.(32) Fewer than 40% of patients adhere to their antihypertensive regimens, fewer than 30% of patients adhere to the recommended diet or behavioral changes, and 50%–70% of hypertensive patients experience a relapse of their disease annually. These rates are comparable to a relapse rate between 40%–60% for alcohol and other drug use disorders.(32-34)

Considering the effects of alcohol and other drug use disorders on patients and their environment, and the effective evidence-based treatments that are available for these disorders, it is unfortunate that health care providers may not appropriately screen, identify, and treat them. How do clinicians ensure that patients with alcohol and other drug use receive equal, high-quality care? In my experience, the first step is to recognize that alcohol and other drug disorders are chronic medical illnesses that are never quickly fixed. Improved education in substance abuse

disorders for trainees and practicing clinicians may also improve the quality of care. Hospitals and health care systems should consider structured mechanisms to ensure appropriate treatment of opioid dependence and opioid withdrawal.

Is It Safe to Be Direct?
The Case

A 92-year-old man with hypertension and heart failure (HF) was evaluated by his primary care physician (PCP) for progressive shortness of breath and lower extremity edema. An electrocardiogram (EKG) in the office showed no acute evidence of ischemia, and the patient's vital signs were normal, including pulse oximetry. Given a suspected HF exacerbation, the PCP arranged for a direct admission to the hospital and contacted the hospitalist on call to report the clinical history. The patient was sent to the admitting office to await an available bed, thus avoiding a prolonged emergency department (ED) stay.

Three hours later, a bed opened and the patient was taken to the floor. His vital signs now demonstrated significant instability, with a heart rate of 144 beats per minute, respiratory rate of 30, and pulse oximetry of 90% on room air. The admitting hospitalist was notified, the rapid response team was activated, and the patient received treatment for tachyarrhythmia and hypoxia. The patient's condition rapidly stabilized, and, after 3 days of treatment for his fluid overload and adjustments to his diuretic regimen, he returned home safely. The case prompted the hospital to consider the safety of admitting patients directly from outpatient clinics.

The Inside of a Time Out
The Case
A 65-year-old man was scheduled for an elective endovascular repair of an abdominal aortic aneurysm. The patient had an allergy to "IV contrast dye" that was noted during his preoperative clinic visit with an anesthesiologist. The surgical physician assistant (PA) documented in a preoperative note that hydrocortisone should be used before surgery, but no such order was written. On the day of surgery, a different anesthesiologist expressed concern about the reported allergy and planned to discuss with the surgeon—mostly to understand the nature and severity of the allergy. Fighting time pressures, driven at least in part by a new policy that tracks and reports delays into the operating room (OR), the anesthesiologist and his resident induced general anesthesia, and the resident remained in the room as the attending left the OR to address an issue regarding another patient.

In the OR, the patient was surrounded by an attending surgeon, two surgical residents (but not the PA), two medical students, nursing staff, and a surgical device sales representative. A "time out" was conducted, during which a nurse raised concern about the alleged allergy. Everyone else in the room looked to the anesthesia resident for input. The resident, probably intimidated by the situation he found himself in, haltingly began to discuss the allergy, but the surgeons in attendance quickly came to a "consensus" to administer hydrocortisone and proceed. The

anesthesiology attending returned to the room, upset not to be included in the time out. He felt that his resident didn't speak up to adequately address the allergy concern, in part because of the atmosphere in the OR. While the patient did well during the surgery, with no evident allergic reaction, the experience raised concerns about whether time out procedures were serving their intended role.

Diagnosing HIV-It Doesn't Take a Brain Surgeon
Case & Commentary: Part 1

A 41-year-old healthy man was admitted after 1 week of new-onset headaches, followed by a witnessed generalized seizure. On examination, he was neurologically intact with stable vital signs and had an otherwise unremarkable exam. Laboratory studies were notable for a mild leukopenia and anemia, and imaging of his head revealed a 3-cm left-sided brain mass with surrounding edema. The radiologist reported the findings to be concerning for a malignant rather than infectious process. The patient was single, with no children, and had emigrated from Mexico 8 years earlier. He was started on steroids and transferred to a referral facility for neurosurgical biopsy and possible excision. Upon arrival to the referral facility, the patient remained neurologically stable and underwent left-sided craniotomy and brain biopsy. Unexpectedly, pathology revealed toxoplasma cysts, confirming a diagnosis of cerebral toxoplasmosis, for which therapy was initiated. This diagnosis prompted a HIV test that returned positive.

The case highlights the importance of recognizing HIV infection, particularly in the setting of signs, symptoms, or laboratory or radiographic studies consistent with HIV-related illnesses. HIV infection is estimated to affect more than one million persons in the United States. The number of new HIV infections has remained steady since 1998, at around 40,000 cases annually.(1,2) About one quarter of infected persons are thought to be unaware of their HIV-positive status, as likely occurred in this case.(3) The rate of unrecognized HIV infection is especially high in young (aged 18 to 24 years) men who have sex with men (79%).(4) Statistical modeling suggests that approximately one half of HIV-infected persons in the United States acquired their infection by age 25, and one quarter by age 22. Compared with non-Hispanic whites, rates of HIV infection are approximately eight times higher in non-Hispanic blacks and three times higher in Hispanics.(1) Particularly large increases in HIV infection incidence have been observed among young minority women infected heterosexually.

More than 500,000 cumulative deaths in the United States have occurred in persons with the acquired immunodeficiency syndrome (AIDS). The primary mechanism through which chronic HIV infection causes immune deficiency is by a decrease in the level and functioning of CD4+ T lymphocytes. Although the median time from HIV seroconversion to the development of AIDS is between 8 and 11 years without treatment (5), many persons with HIV infection have low CD4 counts at diagnosis or are not diagnosed until after they present with an opportunistic infection, such as toxoplasmosis or pneumocystis. About one quarter of patients are simultaneously

diagnosed with HIV and AIDS, and about 40% of those newly diagnosed with HIV infection meet criteria for AIDS within 1 year.(6,7)

From a clinical standpoint, providers must take a complete and targeted history to fully understand a patient's risk factors for HIV infection. Risk factor assessment is critical in the screening process, as a substantial proportion of Americans report behaviors that could put them at risk for HIV infection.(1) In men, the most commonly identified risk factors are male-to-male sexual contact (60%), injection drug use (16%), and heterosexual contact with a person known to have or be at high risk for HIV (17%). In women, high-risk heterosexual contact is the most common risk factor (76%), followed by injection drug use (21%). A significant proportion of HIV-infected persons report no risk factors (8), though estimates vary depending on how risk factors are defined and assessed. Unlike risk assessments used to estimate the likelihood of other clinical entities (e.g., pulmonary embolism or myocardial infarction), history taking for HIV infection requires tremendous sensitivity given the nature of questions involved. Failure to do so may result in poor or inaccurate histories, and ultimately the lack of a trigger to order an HIV test.(9,10) Risk factor assessment is particularly important because the clinical diagnosis of acute HIV infection is challenging as symptoms are short-lived, nonspecific, and often atypical (11), and following resolution of acute HIV infection, patients often experience a prolonged, relatively asymptomatic phase until they become severely immunocompromised.

Case & Commentary: Part 2

The patient's clinical status deteriorated steadily following surgery. He developed worsening neurological status, required mechanical ventilation for airway protection, and developed a number of infectious complications that ultimately led to his death after a 5-week hospitalization.

It is difficult to know from the case whether identifying the HIV infection at the time of this hospitalization would have led to a change in the overall outcome. However, early knowledge of HIV infection during the hospitalization with the described imaging findings could have led to immediate toxoplasmosis antibody testing, which may have prevented an unnecessary brain biopsy. In addition to reminding us of the importance of considering HIV infection in patients with compatible clinical presentations, the case also raises questions regarding the role of universal HIV screening to identify infected persons before they present with a serious opportunistic infection.

HIV screening could result in detection of infected persons at earlier stages of disease.(12) Earlier detection could in turn result in reduced morbidity and mortality, if patients who meet CD4 cell count or viral load criteria for highly active antiretroviral therapy or opportunistic infection prophylaxis are started on appropriate treatments before presenting with a serious infection. Although antiretroviral therapy is effective at all stages of HIV disease, it is more effective when initiated before patients develop very advanced immunodeficiency.(13) An important potential benefit of earlier identification of HIV infection is also reduced secondary

transmission, as persons aware of their HIV-positive serostatus may engage in fewer risky behaviors than those unaware of their status.(14,15)

A challenge in evaluating potential benefits associated with routine HIV screening is that decreases in HIV-related morbidity and mortality are primarily associated with the benefits observed using highly active antiretroviral therapy in patients with more advanced disease.(16) Direct clinical evidence that identifying, monitoring, and treating HIV infection in the early stages of disease are associated with improved clinical outcomes is currently lacking. In addition, studies describing reduced risky behaviors following HIV diagnosis are difficult to interpret due to low participation rates, high loss to follow-up, and reliance on self-reported behavioral changes, which could be biased toward reporting of socially desirable responses. There is also evidence that knowledge of HIV serostatus does not necessarily result in decreased risky behaviors, as some studies report persistent high-risk behaviors or increased rates of HIV infections and other sexually transmitted diseases in HIV-infected persons and high-risk populations with high rates of testing.(17-19)

In the absence of direct clinical data showing benefits of routine screening, several studies have evaluated the cost-effectiveness of routine HIV screening. In general, when potential benefits from reduced secondary transmission are factored in, these analyses found routine screening to be cost effective (20-22) Without secondary transmission benefits, routine screening is not cost effective (>$50,000/QALY) in low-prevalence settings but remains cost effective in higher-prevalence (>1%) settings.(20,21)

In 2006, the Centers for Disease Control and Prevention (CDC) issued new guidelines recommending routine HIV screening for all persons aged 13–64 years, unless the prevalence of HIV infection in the particular health care setting is documented to be 23) The CDC also recommends streamlined counseling using an "opt-out" approach, meaning that patients should be informed that HIV testing will be performed unless they decline (opt out of) testing, without requiring specific signed consent for HIV testing. This opt-out approach is similar to recommendations for routine screening in the prenatal setting. Requirements for specific signed consent for HIV testing were originally put into place when there were profound stigma and other consequences associated with HIV testing, and no effective treatments.(24) By streamlining the consent process and eliminating the need for risk assessment, the CDC recommendation is theoretically less burdensome on clinicians and easier to put into practice, and helps normalize testing for HIV in an era with effective treatments. However, studies assessing implementation of routine opt-out testing in low-risk, low-prevalence settings are not yet available, though even in higher-prevalence settings, a substantial proportion of patients decline testing.(25) Other important challenges to implementing the 2006 CDC recommendations include the need to ensure that testing remains truly voluntary and informed, the need to maintain confidentiality of testing, higher proportions of false-positives in low-prevalence settings, continued stigmatization of persons with HIV infection, and current laws or

policies in a number of states mandating specific informed consent or extensive pretest counseling.

A recent U.S. Preventive Services Task Force (USPSTF) recommendation leaves more discretion to clinicians than the CDC guidelines for screening in low-risk, low-prevalence settings.(26) Because the Task Force found that potential benefits of routine screening appear small relative to potential burdens and harms (including labeling, anxiety, and false-positives), it does not recommend for or against routine screening. Although screening asymptomatic adults and adolescents with no identifiable risk factors would detect additional persons with HIV, the overall number of new infections identified would be limited, and benefits of early identification on morbidity or mortality and transmission rates are unproven.(27) The Task Force strongly recommends screening in persons reporting high-risk behaviors and in high-prevalence settings, as the yield of screening would be much greater.

For the patient in this case, it is not clear that immediate HIV testing and timelier administration of antibiotics during the current admission would have changed the ultimate outcome given the seriousness of his presenting opportunistic illness. However, toxoplasmosis typically only occurs after the CD4 count has dropped below 100 cells/mm3, suggesting that there is a good chance that the patient had been infected with HIV for a decade or more. Although he is described as previously healthy, the patient probably had at least some encounters with the health care system following seroconversion.(9,28) Clinicians should view every health care encounter as a potential opportunity to inquire about HIV risk factors and to test those reporting them, given the high yield of testing in such persons.(29) About 40% of persons reporting an HIV risk factor have never been tested.(30) Even in settings with good access to health care, high-risk behaviors often remain undetected or fail to lead to testing despite identification.(9,10) Another high-yield strategy is to routinely test persons evaluated in higher-prevalence settings.(29) However, prevalence-based testing is often unfeasible because many clinicians do not have access to local prevalence data. In addition, although previous recommendations cite a testing prevalence threshold of 1% (31), a lower threshold is probably appropriate based on recent cost-effectiveness analyses, but there is no consensus on what that threshold should be.(20-22)

HIV screening can take place during any health care encounter, including primary care, urgent or emergency care, and inpatient visits. However, it's not enough to just test. Two studies of routine testing in urgent care centers found that up to a quarter of positive patients did not receive test results.(32,33) Forty to sixty percent of HIV-infected persons do not regularly see a provider outside of the emergency department.(34) To realize maximum potential benefits of any HIV screening program, patients must be informed of test results and linked to appropriate follow-up care.(35) Rapid HIV tests enhance the proportion of patients notified of initial test results and may be particularly useful in non–primary care settings where locating patients to notify them of results can be difficult. However, positive rapid test results still require confirmatory testing, an issue of particular importance in lower-prevalence populations where the proportion of false-positives is higher.(36) In many urgent care, emergency department, and hospital settings,

routine screening is warranted because of a relatively high prevalence of undiagnosed HIV infection. In the inpatient setting, protocols for routinely identifying previous HIV test results upon admission, assessing for presence of HIV risk factors, notifying patients of confirmatory test results, and linking infected persons to care should be developed and implemented.(37) In patients with a previous negative test, the yield of repeat HIV testing is dependent on the incidence of HIV infection.(38) In those reporting high-risk behaviors or in particularly high-prevalence settings, repeat testing may be warranted annually.(20,22) In low-risk persons evaluated in low-prevalence hospitals, repeat screening at any interval may not be cost effective.(20)

The Wrongful Resuscitation
The Case

An 80-year-old man with diabetes, peripheral vascular disease, bilateral below-the-knee amputations, and poor quality of life had previously been resuscitated from sudden death. After his recovery, he completed a DNR (do not resuscitate) form signifying his desire to avoid such treatment in the future.

The patient presented to the emergency department (ED) in extreme pain and was found to have a ruptured abdominal aortic aneurysm (AAA). Although his DNR form was with him, neither the ED staff nor the consulting surgeon looked at it. The patient was rushed to the operating room (OR), where his AAA was repaired. Postoperatively, an internist came upon the DNR form in the patient's chart and discussed resuscitation preferences with the patient and the family. The patient reconfirmed his desire to avoid resuscitation and heroic procedures, expressing anger that he had been taken to the OR for the AAA repair. The family agreed with the patient's choice. The internist wrote a DNR order in the chart, but the surgeon—having just completed major surgery on this patient—was furious, changing the code status back to "full code." Ultimately, the internist consulted with the hospital ethicist, who convinced the surgeon to honor the patient's and family's wishes. The DNR order was reinstated, and the patient later died of a cardiac arrest during the hospitalization.

The Forgotten Drip
The Case
A 45-year-old man was brought to the emergency department by his friends because of a 1-day history of a severe headache and "bizarre behavior." A computed tomography (CT) scan of his brain revealed acute intracranial hemorrhage with cerebral edema, evidence of midline shift, and increased intracranial pressure (Figure). The patient was admitted to the intensive care unit (ICU).

Multiple therapies were initiated to reduce the intracranial pressure and swelling, including intubation and mechanical ventilation, intravenous steroids, and an infusion of mannitol. In addition, intravenous fluids were withheld, to prevent worsening of the cerebral edema. Over the

next 24 hours, the patient showed minimal improvement and remained unresponsive and comatose. Repeat CT scanning showed a stable hemorrhage but persistent cerebral edema.

On hospital day 2, another CT scan showed that the hemorrhage was unchanged, but there was significant improvement in the cerebral edema. Based on these results, the physicians expected the patient's mental status to be improved; however, he remained in a coma. A review of that day's laboratory data revealed that the patient had developed severe hypernatremia (high enough to explain his continued altered mental status) and new acute renal failure since admission. Nephrology was consulted to help determine the etiology of the hypernatremia and renal failure and to make recommendations about management.

In reviewing the records, consultants realized that the mannitol infusion had been continued for more than 24 hours at a very high dose. The mannitol, as expected, had induced a profound osmotic diuresis. Because the patient had not received any additional intravenous or enteral fluids, he had become severely dehydrated. Although the hemorrhage and cerebral edema were improved, the patient remained unresponsive and comatose because of the hypernatremia and acute renal failure. He had a prolonged hospitalization and ultimately died from complications related to renal failure.

Antibiotics for URI/Sinusitis—A Simple Decision Gone Bad
Case & Commentary: Part 1
A healthy 53-year-old woman presented to her primary care physician with upper respiratory symptoms and possible sinusitis. She was prescribed Augmentin (amoxicillin-clavulanate). Despite this therapy, her symptoms persisted. She was then prescribed azithromycin.

Upper respiratory tract infection (URI) symptoms are among the most common presenting complaints to primary care physicians, with 83.1 million visits occurring in 2002 (1) , of which 3.1 million were ultimately ascribed to acute sinusitis in adults.(2) Sinusitis occurs after or in conjunction with a viral URI. Inflammation of the respiratory epithelium lining the paranasal sinuses (most commonly the maxillary sinuses) leads to obstruction of the sinus ostia and accumulation of mucus within the sinuses. The adjacent nasal mucosa is invariably inflamed as well. This process leads to the typical sinus symptoms of headache, nasal congestion and discharge, and facial pain or pressure, sometimes accompanied by sneezing, toothache, or fever.

Most cases of acute sinusitis are caused by viruses, and only 0.5%–2% of cases of viral sinusitis develop into a bacterial infection.(3) However, distinguishing viral from bacterial sinusitis on clinical grounds is difficult, as no single symptom or physical examination finding has been found to be predictive of bacterial sinusitis. The typical symptoms of sinusitis—headache and nasal congestion—do not reliably predict bacterial infection, and imaging studies (such as CT scan or plain radiographs of the sinuses) are frequently abnormal in both viral and bacterial sinusitis. In 2001, the Centers for Disease Control and Prevention (CDC) recommended that acute bacterial rhinosinusitis be diagnosed only when a patient has three clinical criteria (4):

• Maxillary pain or tenderness in the face or teeth.

• Mucopurulent nasal discharge.

• Symptoms have lasted for 7 days or more.

In addition, worsening of symptoms after initial improvement appeared to be moderately predictive of bacterial infection in some studies. A 2007 practice guideline by the American Academy of Otolaryngology—Head and Neck Surgery generally corroborated the CDC guidelines.(5) Both guidelines recommend amoxicillin as the preferred initial antibiotic when antibiotics are warranted, as most cases of bacterial sinusitis are caused by *Streptococcus pneumoniae*, *Haemophilus influenzae*, or *Moraxella catarrhalis*.

Despite these guidelines, overtreatment of acute sinusitis with antibiotics is common. A 2007 study found that antibiotics were prescribed in 82.7% of outpatient visits due to acute sinusitis.(2) Many of these prescriptions are unnecessary, as the vast majority of cases of sinusitis are viral in origin—especially when symptoms have lasted for less than 1 week.

In this case, the primary care physician should have asked the patient about the duration of symptoms, character of nasal discharge, and presence of toothache, and examined her for evidence of tenderness over the maxillary sinuses. Antibiotic treatment with amoxicillin would have been justified if the three clinical criteria above were present. If antibiotics were not warranted, management should have focused on symptomatic therapy, including decongestants and antiinflammatory agents.

The patient was prescribed Augmentin (amoxicillin-clavulanate) as initial therapy. While this agent is the second most common antibiotic prescribed for acute sinusitis (behind amoxicillin) (2) , its choice in this scenario illustrates another facet of inappropriate antibiotic use: prescribing of broad-spectrum agents when narrow-spectrum antibiotics are indicated. The use of broad-spectrum antibiotics rose significantly during the 1990s. For sinusitis, prescribing of broad-spectrum agents increased from less than 20% (of cases where antibiotics were prescribed) in 1991 to more than 40% in 1999.(6) Both amoxicillin-clavulanate and azithromycin are considered broad-spectrum antibiotics, and neither has been demonstrated to be significantly more effective at curing sinusitis compared with amoxicillin. Even if antibiotics had been warranted in this case—which is unlikely—treatment should have consisted of amoxicillin along with symptomatic therapies. A second antibiotic course could be justified only if infection with a resistant organism was suspected, which would be unlikely in a previously healthy patient with no recent history of antibiotic use.

Case & Commentary: Part 2

Shortly after starting her second course of antibiotics, the patient began feeling unwell. A few days later, she was found down in her home by her daughter. The patient was brought to the emergency department for evaluation. Her work up revealed profound anemia due to brisk

autoimmune hemolysis. This was thought to be due to the amoxicillin-clavulanate she had received. She was started on high-dose immunosuppressive therapy with steroids.

Although antibiotics have yielded undeniable benefits for patients since their introduction into medical practice, inappropriate use of these agents results in adverse effects for both individuals and the population at large. Beta-lactam antibiotics such as amoxicillin are generally quite safe, but prescribers and patients must be aware of a wide range of potential adverse effects, ranging from common problems like antibiotic-associated diarrhea (which can occur in up to 34% of patients receiving a typical course of amoxicillin-clavulanate), to rare but dangerous reactions such as *Clostridium difficile* colitis, anaphylaxis, or this patient's problem: autoimmune hemolysis. Many antibiotics may cause drug-induced autoimmune hemolytic anemia; in the case of penicillins, the mechanism is generally via formation of drug-specific IgG antibodies in the patient's serum, resulting in a direct antiglobulin (Coombs') positive hemolytic anemia.(7) Amoxicillin was first recognized as a cause of autoimmune hemolytic anemia more than 2 decades ago.(8) Although mild cases may be managed by withdrawal of the antibiotic, cases of severe symptomatic anemia require treatment with high-dose glucocorticoids, as in this patient.

The chief population-level effect of antibiotic overuse is the widespread and growing problem of antimicrobial resistance (AMR). AMR is a worsening problem among many bacteria, including *Staphylococcus aureus*, *Streptococcus pneumoniae*, and *Escherichia coli*—organisms that cause common clinical syndromes such as cellulitis, community-acquired pneumonia, and urinary tract infection. Once confined to hospitals, these drug-resistant pathogens are becoming increasingly prevalent in the community setting, and some data indicate that prior treatment with antibiotics may increase an individual patient's likelihood of contracting an infection with a drug-resistant bacteria.(9) AMR exerts significant societal costs, as infections with drug-resistant bacteria are associated with increased morbidity, mortality, and health care expenditures.

Antibiotic use leads to AMR by two mechanisms: creation of a susceptible host by eliminating an individual's normal bacterial flora and selective pressure promoting survival of bacterial strains with genetic mutations that confer antibiotic resistance.(10) Due to this close link between antibiotic prescribing and development of AMR, extensive national and international efforts (11) have focused on reducing antibiotic prescribing for conditions in which antibiotics are not usually indicated. The CDC's "Get Smart" campaign is a prominent example.(12) A major focus of these efforts is reducing antibiotic prescribing for acute respiratory infections (ARIs), including sinusitis, as these infections are rarely bacterial in origin.

Case & Commentary: Part 3

The patient's hospital course was marked by multiorgan failure, septic shock, and spontaneous bowel perforation requiring hemicolectomy. Examination of the bowel showed Aspergillus, *leading to a diagnosis of disseminated aspergillosis. Despite aggressive antifungal therapy, the patient ultimately succumbed to overwhelming infection and died.*

This patient suffered a tragic outcome likely related to inappropriate prescribing of antibiotics. While the complications and ultimate outcome of this case are exceedingly rare, unfortunately, the problem of inappropriate antibiotic prescribing remains common. Over the past decade, antibiotic prescribing for ARIs has decreased in response to publicity and education regarding antimicrobial resistance. However, prescribing rates for viral infections remain high: in 2002, nearly half of adults with nonspecific ARIs were still prescribed antibiotics.(13) Limited success in reducing overall antibiotic prescribing may be counteracted by a marked increase in prescribing of broad-spectrum antibiotics, the use of which doubled during the 1990s.(6)

A clinician's decision to prescribe antibiotics is the result of several factors, including patient factors (patients often expect to be prescribed antibiotics to treat respiratory infections), physician factors (physicians often use heuristics to judge if antibiotics are warranted, rather than relying on evidence-based criteria), and health care system factors (requiring prior approval for acute appointments may result in fewer visits for respiratory symptoms, and correspondingly fewer antibiotic prescriptions).(10) Quality improvement (QI) efforts to reduce inappropriate antibiotic prescribing have used various methods to educate patients and clinicians on indications for antibiotic prescribing. Providing targeted feedback to clinicians on their prescribing practices has also been used. Community-wide campaigns, using mass media communications and other strategies to simultaneously target patients and clinicians, are underway in several European countries and US states.

Reviews of published QI efforts show them to be moderately effective in reducing inappropriate prescribing and reducing unnecessary broad-spectrum antibiotic use.(10, 14) While no single strategy appears uniquely effective, promising strategies include mass media campaigns in combination with targeted clinician education and use of explicit clinical decision support algorithms to indicate when antibiotic prescribing is appropriate. A decision support system could have been very useful in this case. In such a system, the clinician would have been prompted to enter the patient's presenting symptoms and signs, and the system would provide patient-specific treatment recommendations. A recent cluster-randomized trial using a handheld computer–based decision support system for prescribing in respiratory infections accomplished significant community-wide reductions in antibiotic use in communities in Utah and Idaho.(1)

Antibiotic prescribing for respiratory symptoms is frequently driven by a physician's desire to respond to a patient's explicit (or implied) request for antibiotics.(16) However, research has shown that even patients who explicitly request antibiotics are satisfied if clinicians directly address their concerns by explaining the rationale for not prescribing antibiotics and offer symptomatic therapy instead.(17) QI efforts to reduce antibiotic prescribing have not caused increased dissatisfaction with care.(10)

The tragic clinical outcome of this case is undoubtedly rare, but if inappropriate antibiotic prescribing continues unchecked, the societal costs may be equally dramatic. The marked rise in infections caused by methicillin-resistant *Staphylococcus aureus* (MRSA) (18) is but one

example of the clinical implications of drug-resistant bacteria—a problem that will undoubtedly worsen if indiscriminate antibiotic use continues. Despite some successes, inappropriate antibiotic prescribing remains widespread, and clinicians must take responsibility for improving their prescribing practices. Although on the surface this case may appear to be an example of "cascade iatrogenesis" (19) rather than a true medical error, failure to adhere to evidence-based treatment guidelines is increasingly being treated as an error.(20) The burden of responsibility lies on clinicians to practice judicious antibiotic prescribing in order to avoid considerable health implications for their patients in the future.

Overdose on Oxygen?

The Case

An 84-year-old woman with a history of chronic obstructive pulmonary disease (COPD) on home oxygen (1–2 L/min) presented to the emergency department with cough, chills, and shortness of breath. On physical examination, she was afebrile and tachypneic, and her oxygen saturation was 94% on 2 L of oxygen. Her pulmonary examination was unremarkable. The chest radiograph revealed bilateral lower lobe infiltrates. The patient was admitted with a diagnosis of community-acquired pneumonia and a COPD exacerbation. She was given appropriate therapies and, with her mild illness, was expected to be discharged the following day.

On the morning following admission, she was found to be somnolent and minimally arousable. She remained afebrile with a normal blood pressure and pulse, and the remainder of the physical examination was unchanged. The physician on duty noted that her oxygen saturation was 98% and she was receiving oxygen by nasal cannula at a rate of 4 L/min. An arterial blood gas was performed, which showed a pH of 7.21 (normal, 7.35–7.45) with a partial pressure of CO2 (PaCO2) of 101 mm Hg (normal, 35–45 mm Hg) and an oxygen of 85 mm Hg. The hypercarbia (increased CO2) was felt to be due to excessive oxygen administration and likely explained her change in mental status.

She was immediately transferred to the intensive care unit (ICU) where she failed noninvasive positive pressure ventilation (NIPPV) and required endotracheal intubation. Her oxygen "dose" was lowered, in an effort to keep her saturation in the 90%–94% range. With that (and treatment of her infection and COPD), her hypercarbia promptly resolved. She was extubated the following day, had an uncomplicated subsequent hospital course, and was discharged home 3 days later.

Hold That Order

The Case

A 25-year-old woman with a history of a pituitary tumor was admitted with hypernatremia. Because of her previous pituitary resection and radiation, the patient had a long history of central diabetes insipidus and difficult to manage sodium homeostasis. At home, she balanced administration of DDAVP (desmopressin acetate) and free-water boluses given by percutaneous endoscopic gastrostomy (PEG) tube to maintain a normal sodium level. Due to PEG tube dysfunction, the patient was unable to give herself free-water boluses for the 2 days prior to

admission and became progressively lethargic. On admission, her serum sodium level was 159 mEq/L.

During the patient's hospitalization, the house staff team struggled with her sodium management, trying to balance the DDAVP and the free water by PEG tube. On hospital day 3, although the patient was clinically stable, she had a serum sodium level of 131 mEq/L in the afternoon. Based on this result, the intern did not want her to get additional DDAVP that day, as it would lower the sodium level further. The intern wrote the following order: "Hold DDAVP tonight."

At this academic center, a medical center policy stated that all orders to "hold" medications are interpreted as "discontinue" orders. Thus, the medication was discontinued in the medication administration record (MAR) and in the pharmacy records. The intern was not notified of the discontinuation of the DDAVP.

The next day, the patient's sodium level slowly rose to 144 mEq/L in the afternoon, and the team wanted the patient to receive her evening DDAVP. The intern assumed that the patient would receive the evening dose of medication because her order had stated to hold it for only 1 day.

The patient was not given the DDAVP, and the following morning her sodium level was 154 mEq/L. She was slightly lethargic and less interactive than usual and was given an urgent dose of DDAVP. Her sodium level was closely monitored for the next 24 hours. She did not experience any serious or long-term consequences.

Back Again

Case & Commentary: Part 1

A 34-year-old man came to the emergency department for evaluation of back pain. He stated that the pain had been present for about 1 week. His review of systems was unremarkable except for an isolated episode of fever, which resolved with acetaminophen. His past medical history was significant for use of heroin and cocaine until 1 year earlier. His medications included methadone and ibuprofen. He had no allergies. Physical examination revealed tachycardia and tenderness in the lumbosacral region. Straight leg raising test was negative. X-ray of the lumbar spine was normal. The patient was discharged home on ibuprofen and advised to follow up with his primary physician the next day.

This case presents a common problem, low back pain (LBP), which is typically benign and self-limited. However, it is occasionally the presenting symptom of serious systemic disease, such as cancer or infection, or a surgical emergency, such as with cauda equina compression.(1) The major challenge is to distinguish the vast majority of patients who have benign musculoskeletal pain from the small minority with a serious, specific disease process requiring timely intervention. Table 1 summarizes the major causes of LBP.

Identifying Back Pain Associated with Systemic Disease

The initial task is to assess the likelihood of a serious underlying systemic disease without over-testing those with benign musculoskeletal pain. History is usually the key to early detection of serious causes of LBP.(2) Suspicion should be particularly high in patients whose pain is unrelieved in any position.(3-5)

Cancer

The classic "red flags" for malignancy include age older than 50, previous history of cancer, unexplained weight loss (greater than 4.5 kg over 6 months), failure to improve after 1 month of therapy, and no relief with bedrest.(6) Malignancy accounts for less than 1% of cases seeking care for LBP.(7) The only finding specific enough to significantly increase the odds of malignancy is a previous history of cancer (Table 2 summarizes test characteristics for red flags in evaluating LBP). The other red flags, when present, only modestly raise the odds.(2) Pain worse at night or with recumbency, particularly when patients sleep in a chair to avoid pain, is very worrisome for malignancy or infection, though the precise sensitivity and specificity are unknown.(4,8) The most sensitive red flag is no relief with bedrest; when this is absent (i.e., pain is relieved with lying down), it significantly reduces the odds of malignancy. However, this finding is rather nonspecific; most patients who report a lack of relief with recumbency/rest will still have benign backache.(2)

In patients with none of the red flags, the probability of malignancy approaches zero.(2) LBP patients with one or more "red flags" have a pretest probability of serious systemic disease of between 1%–10%.(9) The physical examination is less helpful than the history for identifying malignancy. The majority of spinal malignancies are metastatic from breast, lung, or prostate, so these areas should be carefully evaluated when malignancy is suspected.(10) Focal bony tenderness in the midline is a moderately reliable finding for malignancy and should be explored as well.(11)

Infection

Intravenous drug use, urinary tract infection, indwelling urinary catheters, and skin infections raise the likelihood of infective spondylitis.(6) Fever strongly suggests infection but remains an insensitive marker.(4,10) Thus, while the presence of fever should raise strong concern for infective spondylitis, the absence of fever does not significantly lower the odds of infection.(4) This is particularly true when patients are taking acetaminophen or nonsteroidal anti-inflammatories for pain, as these can mask fever.

Compression Fracture

With an aging population and better treatment options for osteoporosis, compression fractures as a cause of LBP are becoming more important to recognize.(1) Compression fractures make up about 4% of LBP cases.(3) Being less than 50 years of age significantly lowers the odds of

compression fracture, while being over 70 increases the odds of compression fracture.(2) A history of trauma is not particularly useful, and it does not markedly alter the odds of compression fracture.(2) Corticosteroid use is a fairly specific risk factor for compression fractures; compression fracture needs to be strongly considered in any patient using corticosteroids who presents with LBP.(2)

Spinal Cord Compression Syndromes

Cauda equina and spinal cord compression syndromes are the most important neurological entities in the differential diagnosis of LBP as they represent surgical emergencies. Cord compression can occur in the setting of spinal tumors or epidural abscesses or with massive midline intervertebral disc herniation (IDH). Fortunately, this entity is quite rare, accounting for an estimated 0.04% of LBP cases. Unilateral or bilateral leg pain, numbness, and/or weakness are common, each occurring in over 80% of cases.(10) Urinary retention is fairly sensitive and specific, with a high positive likelihood ratio and low negative likelihood ratio.(10)

In this case, the patient is young with few or no concerning features for malignancy, although we are not told enough about the features of his pain to know if it was mechanical or not. The report of fever is worrisome, and the lack of elevated temperature on examination should not be reassuring, particularly with his report of taking acetaminophen. The frequent lack of objective physical and imaging findings in patients with mechanical back pain complicates the evaluation. In this case, a significant red flag is the history of probable injection drug use (which might be misinterpreted as a red flag for "drug-seeking behavior" rather than as a clue to serious systemic illness).

Case & Commentary: Part 2

The patient did not see his primary physician the next day. Instead, the day after that, he went to another emergency department with complaints of back pain. He was again advised to use ibuprofen and follow up with his primary physician. The patient returned to the hospital again after 4 days with complaints of worsening back pain and new shortness of breath. Examination revealed the presence of bilateral rales, a systolic murmur in the mitral area, and track marks over flexor aspects of both upper extremities.

Standard recommendations for the work-up of patients with "red flags" include a complete blood count, erythrocyte sedimentation rate (ESR), urinalysis, and plain radiography of the spine.(6,9) Plain radiographs of the spine have high specificity for malignancy but are relatively insensitive.(2) Infective spondylitis can be difficult to diagnose with plain radiography (2), particularly early on in the course of disease. Bone scanning has good sensitivity for infection but modest specificity.(2) Magnetic resonance imaging (MRI) has excellent sensitivity and specificity and is the test of choice in patients with a high clinical suspicion for infective spondylitis.

A detailed cost effectiveness analysis of different diagnostic strategies recommended advanced imaging (MRI or bone scan followed by MRI if the bone scan is abnormal) in patients with one or more red flags if they have either a worrisome radiograph (lytic or blastic lesion seen) or an ESR greater than 50. This strategy found 88% of all the findable cases at a cost of $40 per patient, $9525 per case found, and with only 1.6 false positives per 1000 patients.(12) The notable exception was patients with a personal history of cancer: because their pretest probability is relatively high at 10%–15%, and cord compression is a major concern, moving directly to MRI is probably warranted, even without a worrisome radiograph or an elevated ESR.

Case & Commentary: Part 3

Shortly after admission, the patient developed acute respiratory failure requiring intubation. He became hypotensive, and laboratory results were significant for the presence of bandemia, thrombocytopenia, coagulopathy, acute renal insufficiency, and micro- and macrohematuria. He was treated with fluid resuscitation, antibiotics, fresh frozen plasma, and platelets. Despite these efforts, he developed bleeding from his venipuncture sites, his oral cavity, and his rectum, along with refractory hypotension. Aggressive resuscitation efforts, including red cell transfusion and vasopressor therapy, were initiated without success. The patient died of overwhelming shock.

The patient's cultures subsequently grew methicillin-resistant Staphylococcus aureus. *Autopsy revealed a 2x1 inch tricuspid valve vegetation, bilateral patchy pneumonias, and multiple bilateral cortical infarcts in the kidneys. The final cause of death was "complications of infective endocarditis."*

The incidence of infective endocarditis among intravenous drug users is estimated at 1%–5% per year with *Staphylococcus aureus* being the most common organism.(13) Clinical data described as helpful in identifying infective endocarditis include fever, anorexia, weight loss, and back pain.(14) Back pain is present (but may not be the chief complaint or a prominent symptom) in up to 43% of cases of endocarditis—in one case series of *Staphylococcus aureus* endocarditis, back pain was the chief presenting complaint in almost 10%.(15,16)

The pathogenesis of back pain with infective endocarditis is often not known but can include septic embolization, renal or splenic infarction, myalgias/arthralgias related to the inflammatory response, or infective spondylitis with or without epidural abscess.(15,17) While frank infective spondylitis has been reported to be rare in endocarditis (17), in one recent series it was present in 15% of cases.(15) In this case, the patient rapidly progressed to severe systemic infection, which may or may not have started as infective spondylitis.

The major risk factor contributing to this patient's serious systemic illness may have contributed to the missed diagnosis—his injection drug use. Care of patients with substance abuse is challenging. These patients may be regarded as "sociopaths, a burden to society, manipulative, and not intelligent enough to make a choice or decision."(18) As a result, health care teams may assign little priority to the evaluation and treatment of pain in these patients.(18) Effective principles for engaging drug users in health care relationships include a respectful approach to

substance users, understanding the medical and behavioral sequelae of addiction, use of multidisciplinary teams, and refraining from moralistic judgments.(19) More careful attention to the patient's history of fever and injection drug use at the first two visits might well have led to a more timely diagnosis.

Maintaining proper vigilance for potentially "dangerous" causes of back pain without performing unnecessary diagnostic work-ups in the large numbers of patients seeking health care for simple back pain is a difficult task. The Clinical Practice Guideline published by the then Agency for Health Care Policy and Research on "Acute Low Back Problems in Adults" (6) continues to be a helpful and important resource with simple algorithms that remain highly relevant aids for physicians faced with decisions of diagnostic triage in the acute setting.

Chemotherapy Extravasation

The Case

A 73-year-old woman with no past medical history was diagnosed with stage IIIA breast cancer. She and her oncologist decided to begin systemic chemotherapy that would involve 6 cycles of treatment, all administered at the outpatient chemotherapy center located at the local hospital.

The patient arrived for her first day of treatment. A nurse who was relatively new to the job had difficulty placing a peripheral IV catheter but was ultimately able to achieve venous access in the left arm. Despite meeting some resistance when infusing saline, the nurse proceeded to infuse the first medication, doxorubicin, a highly toxic chemotherapeutic agent. The patient immediately began complaining of pain at the infusion site. Upon closer examination, the nurse noted that the chemotherapy had infused outside of the vein (extravasated) into the skin.

The nurse removed the IV catheter and placed an ice pack on the site. She had not been given any information about how to manage extravasations nor had she been informed of the location of the "extravasation kit," so she did not know what else needed to be done. Eventually, the IV site was bandaged and the patient was sent home to return later in the week. The patient suffered pain at the site with some mild redness and blistering but had no long-term side effects.

Contaminated or Not? Guidelines for Interpretation of Positive Blood Cultures

The Case

A 62-year-old man with type 2 diabetes mellitus, chronic kidney disease, and a history of ventricular tachycardia with an automated implantable cardiac defibrillator (AICD) came to his primary care physician (PCP) with symptoms of shaking, weakness, and vomiting. He denied fevers. The physical examination was unremarkable except for the presence of chronic peripheral neuropathy. The physician ordered routine blood tests and 2 peripheral blood cultures, diagnosed the patient with a nonspecific viral syndrome, and sent him home.

The routine laboratory tests done that day revealed only a normocytic anemia. However, 5 days later, the PCP was notified that both sets of blood cultures were growing *Corynebacterium* spp. Uncertain of how to interpret the result (as this bacteria may represent contaminated blood

cultures rather than a true cause of disease), the PCP contacted an infectious disease specialist, who recommended hospitalization. The patient was hospitalized, seen by a different infectious disease specialist, and started on IV antibiotics. The patient's subsequent evaluation revealed no evidence of infection, including an unremarkable abdominal CT scan and a normal transthoracic echocardiogram (TTE). Repeat blood cultures (drawn before antibiotics were begun) remained negative. The patient was clinically stable, so the antibiotics were stopped and the patient was discharged to home. The physicians assumed that the *Corynebacterium* was a contaminant from the skin.

One month later, the patient presented to the emergency department (ED) with nausea and vomiting. His physical examination and laboratory test results were unremarkable. His symptoms improved with IV fluids, and he was discharged after an 18-hour stay.

Two days later, 2 out of 2 blood cultures drawn at that ED visit started growing *Corynebacterium* spp. That evening, the results were reported to a covering physician who was unfamiliar with the patient or previous culture results. The physician assumed that the blood cultures were contaminated from the skin and took no action.

Three weeks later, the patient was readmitted after being shocked by his defibrillator (AICD). A transesophageal echocardiogram (TEE) revealed a tricuspid vegetation and blood cultures again showed *Corynebacterium* spp. (the final speciation was never determined). Diagnosed with subacute bacterial endocarditis and treated with IV vancomycin, the patient made a full recovery.

How Do Providers Recover From Errors?
Case & Commentary: Part 1

An 81-year-old man with chronic obstructive pulmonary disease and end-stage congestive heart failure was admitted to the hospital with complaints of increasing shortness of breath. A chest radiograph revealed a moderate sized right-sided pleural effusion. He was treated with diuresis and bronchodilators. However, after 2 days and a net output of more than 2.7 liters, he continued to be dyspneic, requiring more supplemental oxygen than baseline. The primary team decided to perform a therapeutic thoracentesis. The resident on the primary team had not performed the requisite number of thoracenteses and therefore could not perform this procedure without supervision. A resident from another team who had performed the required number of thoracenteses offered to perform the procedure, and the primary team's resident accepted this offer. Consent was obtained from the patient and his wife. The resident performed the thoracentesis but was unable to draw any fluid, aspirating only a small amount of blood and air. The resident then realized that the effusion was on the contralateral side, not the left side she had just tapped. One hour after the procedure, the patient developed hemoptysis, and a chest radiograph revealed a pneumothorax on the left and a persistent unchanged pleural effusion on the right.

This case unfortunately represents an all-too-common occurrence in modern medical practice. The proportion of hospitalized patients affected by medical errors has been estimated to be 5% to

10%, although it has approached 50% in some studies.(1) The majority of reports on medical error rates have focused on patient-specific rates. Less commonly addressed but also of interest is the proportion of physicians who commit errors. Essentially the entire literature on this subject concerns resident physicians; data on fully trained practitioners are scarce.(2)

Among residents, several studies have addressed this question. In an early report, Mizrahi (3) found that 47% of internal medicine residents reported making serious errors during their training. Subsequently, Wu and colleagues (4) found a similar proportion (45%). More recently, Jagsi and colleagues (5) surveyed residents across multiple specialties and found that 18% reported an adverse event under their care in the previous week, with one-third of these events classified as mistakes. In a sample limited to internal medicine residents, another study (1) found that 34% reported at least one major medical error during their training. This figure represented an underestimate of the true proportion, since it included residents completing less than the full 3 years of categorical residency training at the time of the report.

Each of these studies relied on self-report; very little is known about actual error rates, although most care providers would probably recognize that it is essentially impossible to complete training without making at least one major error. This suggests that self-reported error rates may actually represent a lower bound on the true incidence of medical errors. It seems clear that such errors are common, but better tracking is needed before these rates can be more accurately described.

Committing errors can have a significant impact on clinicians, who have been termed the "second victims" of medical errors.(6) In one study of internal medicine residents, committing an error led to a 3-fold increase in depression, accompanied by a clinically meaningful increase in burnout and decrease in overall quality of life.(1) This is particularly notable given the high baseline rates of physician distress in modern medicine. Waterman and colleagues have also reported high rates of anxiety, loss of confidence, sleeping difficulties, and reduced job satisfaction following errors.(7) Thus, feelings of distress, guilt, shame, and depression are common (1,7,8) and may be long-lasting. Some physicians may even feel "permanently wounded" as a result.(9) These feelings appear to occur regardless of stage of training.(10)

Predicting the impact of an error is difficult, although 2 factors related to the error itself have been proposed. One is the patient outcome resulting from the error, and the other is the degree of personal responsibility felt for the error. As might be expected, errors for which the provider feels directly and fully responsible, and those that result in patient death or severe morbidity, have the greatest impact.(10)

Given the significant impact that errors can have on providers, how can these errors be processed to minimize the damage they can cause? Certainly, prevention is one key: an error avoided is a recovery process that never needs to begin. However, once an error has occurred, the literature suggests several important steps.(11)

First, it is important to avoid counterproductive responses to errors. For example, maladaptive behaviors such as emotional repression, patient avoidance, and defensive medical practice are unlikely to benefit patients or providers.(10,12,13)

Second, among more positive steps toward successfully processing errors, accepting responsibility is crucial, as is the logical follow-up to this, pursuing additional training to better understand and correct mistakes.(14) It is particularly important for physicians to understand that the need for support after an error is normal, not a sign of weakness. A common but by no means universal (15) coping mechanism is discussion with colleagues and family members.(10,16) Sources of support may come informally from within a clinician's professional and social network but may also include error disclosure to patients and family members.

Historically, disclosure of errors to patients has been controversial, although the importance of disclosure to the physician-patient relationship is clear. There are few quantitative data on the impact of disclosure to patients on physician distress after errors, but in one study, physicians dissatisfied with error disclosure to patients had markedly higher rates of distress.(7) Additional qualitative data suggest that error disclosure (and apology when appropriate) to patients represents an important and positive step toward resolution for both patients and care providers after a medical error.(8,12,17,18) This remains an area requiring further research.

Case & Commentary: Part 2

The resident provided full disclosure to the wife immediately following the procedure. The patient continued to deteriorate and died approximately 4 hours after the thoracentesis. The resident was devastated by the error. One week after the patient passed away, the wife called the hospital where the event occurred and asked for the resident. The wife wanted to thank her for her honesty and to check to see if the resident was doing okay after the event.

As discussed, this resident's emotional response to the error is typical, especially given the resident's direct causative role and the patient's poor outcome. While some legal experts may highlight the perceived risk of full error disclosure (as described in this case) (19), such disclosure is clearly the appropriate action once an error has taken place. Interestingly, while it is not appropriate to burden patients and their families with care providers' own distress about errors, it is quite common for families to reach out to trusted physicians in these situations when they see integrity, honesty, and genuine hurt. Because this cannot be relied upon as the sole source of support, however, a key question is what other means of support are available for providers after errors occur?

Given what is known about the impact of medical errors on physicians, it is perhaps surprising that there are relatively few formal support programs available for providers after errors occur.(6) As described previously, providers often rely on informal support structures such as family, friends, and colleagues. More formalized structures are poorly defined in the literature and have not been subjected to rigorous scientific scrutiny.

Suggested forums for processing errors include case reviews, which may occur informally in small groups or formally in conferences such as the traditional morbidity and mortality (M&M) conferences at many institutions.(10,14,20,21) These conferences historically have been extensions of the culture of medicine in which errors are regarded as lapses resulting from unacceptable personal fallibility and therefore may place providers at risk for public humiliation and shame.(11,14,22) However, if discussions are framed differently, such conferences can represent a powerful opportunity for professional role modeling of error acknowledgment and open discussion.(10,21) On a more individual level, emotional support may be provided by institutional "confessor" figures with whom physicians can discuss errors confidentially.(14) It is important, however, that such figures not be part of the clinician's performance evaluation team.

Clearly, additional steps are necessary to standardize support for physicians after medical errors. Specifically, institutional efforts to put medical error teaching programs in place throughout medical training would be helpful. These programs should help providers understand that errors are a part of any human endeavor, and while we strive for perfection in medicine, perfection is simply not possible. Programs should then also help providers understand the coping strategies that others find helpful, as well as caution against maladaptive strategies. Finally, these programs should promote open discussion of errors in a manner designed to foster personal and institutional growth rather than humiliate and assign blame. One potential role model for such efforts is the Brigham and Women's Hospital Peer Support Team.(23) In this program, a multidisciplinary team provides one-on-one peer support for any physician requesting it, and group sessions are used in situations involving major events. By publicly supporting such measures, teaching faculty, medical school and residency leadership, and institutional administration may better address the impact of medical errors on caregivers at all stages of medical training and practice.

Too Hot For Comfort

The Case

A 4-month-old infant admitted to rule out sepsis was receiving maintenance intravenous (IV) fluid and IV antibiotics via a peripheral line in the left antecubital region. During shift report, nurses noted that the extremity was taut and the infant was irritable. The nurses further assessed the site and removed the IV. Prior to ending her shift, the nurse placed a warm compress on the infiltrate site and notified the resident physician.

Within the next hour, the nurse coming on shift assessed the infant further and discovered redness and a burn at the site as a result of the warm compress. The compress was removed, and the physician called a surgical consultant for further evaluation. The infant was treated with topical ointment; no surgical intervention was necessary.

Deaths Not Foretold: Are Unexpected Deaths Useful Patient Safety Signals?

The Case

An 87-year-old woman with hypercholesterolemia, osteoporosis, and mild dementia presented to the emergency department after a mechanical fall and was found to have a hip fracture. The patient had well-treated hypertension, good exercise tolerance, and no known heart disease. On physical examination, her vital signs were stable and she exhibited no evidence of delirium. She had normal renal function, a mild anemia, and an electrocardiogram (EKG) with evidence of old Q waves but no acute or dynamic changes. The patient was admitted for orthopedic surgery, and a formal preoperative assessment placed her at "low risk" (based on the Revised Cardiac Risk Index scale). The patient remained on metoprolol and simvastatin in addition to enoxaparin for deep venous thrombosis (DVT) prophylaxis until her scheduled operation.

The patient had an uneventful preoperative period but suffered a pulseless electrical activity arrest in the operating room at the time of wound closure. Though she responded to resuscitative measures and remained in the intensive care unit the following day, she developed acute renal failure and shock liver. Based on previously expressed wishes, the family requested that the patient be made comfortable with no further interventions. At the family's request, no autopsy was performed; however, providers felt that the patient suffered a massive pulmonary embolus based on an intraoperative echocardiogram that suggested right ventricular strain. The death was unexpected, particularly given the patient's low preoperative risk, and the family and providers struggled to explain the outcome.

Elopement

Case & Commentary: Part 1

A 61-year-old male with a history of chronic pancreatitis and cardiomyopathy attributed to alcohol was admitted for chest pain, acute on chronic renal failure, and altered mental status. After being treated for his worsening cardiomyopathy and renal failure, his mental status began to clear. On the morning of anticipated discharge, he was not in his room at the time of the physician's visit. Such behavior was typical for this patient, who was known for being one of the hospital's "frequent flyers." However, when he did not return 3 hours later, security was called to locate him.

Finding that a patient has "gone missing" is a scary situation for providers and patients' families. According to the VA National Center for Patient Safety (NCPS), *elopement* is defined as: "A patient that is aware that he/she is not permitted to leave, but does so with intent."(1) In many cases of elopement, the patient may have a decreased mental capacity related to dementia or temporary delirium, or intermittent mental status changes related to medication, disease, or traumatic injury.(2) Despite the level of capacity or intent, both of which may be difficult to determine, eloping patients are often at risk for serious harm, and there are many cases where patient elopement has resulted in death.(3) On the other hand, *wandering* refers to a patient who "strays beyond the view or control of staff without the intent of leaving (cognitive

impairment)."(1) Wandering can also lead to significant safety risks when the patient has decreased capacity.(2) (For more information on elopement terminology, see Table.)

Leaving against medical advice (AMA) is different from elopement or wandering and is determined by the patient's decision to leave the facility having been informed of and appreciating the risks of leaving without completing treatment.(4) Fully competent patients are legally able to discharge themselves without completing treatment. In such cases, the physician should inform the patient of the risks associated with leaving. In most organizations, this conversation is recorded in the medical record and the patient is asked to sign a form indicating that they are aware of the risks and that they are leaving against medical advice. Patients who are able to make determinations about their own care should be given guidelines upon admission that outline their rights and responsibilities while hospitalized, including the need to communicate with staff prior to leaving a treatment area.

The Joint Commission's sentinel events policy defines "any elopement, that is unauthorized departure, of a patient from an around-the-clock care setting, resulting in a temporally related death (suicide, accidental death, or homicide) or major permanent loss of function" as a reportable sentinel event.(5) This reporting requirement reflects the level of harm to the patient regardless of the patient's intent to leave or mental capacity. The National Quality Forum has defined 27 serious adverse events and includes death or serious harm associated with elopement (disappearance) for more than 4 hours among its list of patient protection events.(6) According to Joint Commission sentinel event statistics, the primary contributors to elopement are breakdowns in patient assessment and team communication.(7) Protection of patients from elopement risks requires attention to preventive measures through assessment and elopement precautions as well as appropriate intervention after elopement occurs.

Adequately assessing patients for elopement risk factors and use of elopement precautions can prevent elopement and improve safety.(8) Such an assessment and possible precautions have been outlined in an elopement tool kit created by the VA Center for Patient Safety.(9) A "yes" to any of the following assessment questions indicates that the patient is at risk for elopement:

- Does this patient have a court-appointed legal guardian?
- Is this patient considered to be a danger to self or others?
- Has this patient been legally committed?
- Does this patient lack the cognitive ability to make relevant decisions?
- Does this patient have a history of escape or elopement?
- Does this patient have physical or mental impairments that increase their risk of harm to self or others?

In this case, the patient had a known history of altered mental status at the time he was deemed to be missing from his room, and his disappearance was not an uncommon event. Using the VA criteria, he clearly was at risk for elopement. For patients who have intermittent mental status changes, it is foreseeable that they could be at risk for serious harm if their capacity changes at a time when they are not adequately supervised. For this reason, the physician and staff in this case

should have initiated elopement precautions despite his pending discharge and intermittent orientation.

Patient care involves many gray areas in which professional judgment is required. Keeping the patient safe is the primary goal and should guide all decision making. For patients who are competent and who have left the area without informing staff, response to their absence is based on what is reasonable for the particular situation. For some organizations, an absence of 45 minutes triggers the elopement protocol and patient search.(10) Other organizations deem elopement response necessary when "it becomes reasonably certain the patient is missing without authorization."(11) To prevent unnecessary searches, units should have procedures in place for patients to sign out or otherwise communicate with the nursing staff before leaving the area.

Frequently referred to as "Code Green," the response to elopement requires both actions by staff in the area from which the patient is missing as well as an organization-wide response. A typical protocol includes the following steps:

- Notification of the operator by unit staff indicating a Code Green/Elopement.
- Notification of security with a description of the missing patient and pertinent clinical information.
- Notification of the patient's physician.
- Immediate search of the unit and surrounding area by unit staff.
- Immediate search of hospital and grounds by security personnel.
- Notification of the patient's family by the physician.
- Notification of police by security as appropriate.
- Notification of appropriate administrative personnel.(12)

Procedures differ among organizations. However, the key is to do what is reasonably necessary to return the patient to a safe environment. Patients who have been missing for a significant period of time, most typically 4 hours, are typically readmitted rather than just returned to their unit. Other organizations use midnight as the indicator.(10,12) Providers should consult with organization policies for specific guidelines.

Case & Commentary: Part 2

Ultimately, the patient was found outside of the emergency department (ED), with ED Discharge Instructions in his hand. The patient apparently told the ED staff that he had recently been discharged and was waiting for a ride. He was brought into the ED. Because he was a "frequent flyer" there and complained of pain, he received his "usual" 1 mg of intravenous Dilaudid and 2 liters of intravenous hydration and was promptly released with oral pain medications, despite being noted as mildly confused by the ED staff. In the course of his ED visit, no one questioned the presence of a hospital ID bracelet and hospital gown; additionally, the hospital computer system failed to recognize that the same patient had been admitted simultaneously to both the inpatient floor and the ED.

An immediate organizational response should be initiated when any patient with decreased mental capacity has left the unit or treatment area without authorization. Health care organizations should have policies and procedures in place indicating the steps that personnel are to follow in any elopement situation, and adequate training should be provided for all staff. These protocols should include assessment and prevention procedures to reduce the risk of harm for patients with diminished capacity. Such preventive measures may include placing the patient on an observation protocol (special precautions for patients requiring frequent or constant monitoring). Such a protocol may include locating the patient close to the desk, placing an electronic monitoring device on the patient when available, partnering the patient with a roommate, or requesting a family member or nursing assistant to sit with the patient. Additional precautions common in mental health and rehabilitation facilities include automatic door locks, alarms, and diversion activities.(13)

In the case above, we cannot determine if there was not a policy for staff to follow or if they merely failed to follow the existing policy. If inpatient staff had initiated a Code Green type of response, it would be likely that the ED staff would have been aware of the missing patient and may have noticed that he was in their area before discharging him (provided that the procedure notified all areas of the facility). Adequate communication of such an event across the entire organization is essential so that a concerted effort can be made to locate the patient and safely return him to an appropriate level of care.

Given the recurring shortage of staff and the increasing complexity of patient care, use of technological solutions to prevent elopement is becoming more common.(14) Use of radiofrequency (RF) devices can make the difference, particularly when they are paired with routine risk assessment and solid team communication. Wrist bracelets (15) that are linked to signal detection devices within the unit can trigger an alarm when a patient wanders too far from their room. This helps staff who are busy with other patients and who may not notice when the patient leaves. In some facilities, the alarm can be linked to systems that automatically lock doors. In one ED, the use of the RF devices and a new triage protocol reduced the need for one-to-one monitoring of at-risk patients by half.(16)

Care of patients in health care facilities is predicated on the patient's consent to treatment. Patient consent is obtained on admission to a facility and often throughout the course of a hospitalization for particular procedures. When a patient is mentally able to consent to treatment and is able to fully partner with health care professionals, the decisions of the patient regarding receipt of care must be honored. Competent patients who choose to leave without completing treatment cannot be held against their wishes. Doing so damages trust and impacts the reputation of the facility. In addition, providers would be at risk for claims of assault, battery, or false imprisonment.(17)

In all situations, including this case, there is a legal duty to exercise reasonable care and attention for the patient's safety, as their mental and physical conditions may render them unable to look after their own safety. Health care professionals have a duty to adequately supervise and observe

patients and to maintain safe conditions on the premises.(18) Additional liability can ensue when there is negligent administration or failure to administer medications, when there is failure to notify the physician of changes in the patient's condition, and in situations where there was a failure to properly search for the patient following elopement.(19) Patients with diminished capacity, such as in this case, pose a threat to themselves and perhaps to others. Failing to initiate an immediate system-wide search put the patient at further risk and created a liability risk for the providers and the organization.

Linking adequate assessment, precautions, good team communication, updated technology, and immediate system response with an overarching goal of safe patient care can improve outcomes for patients at risk for elopement, reduce costs, and limit liability for care providers and the organization.