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## Computerized Provider Order Entry at Emory Healthcare

*I think the CPOE implementation has gone exceptionally well so far. These CPOE systems are all pretty immature at this point in time. In the system we are implementing, the medication reconciliation module is awful; there are some other things that are awful, but, overall, given those limitations, I think the CPOE system implementation has gone very well.*

— Dr. Bill Bornstein, Chief Quality Officer, Emory Healthcare<sup>1</sup>

Late on the drizzly afternoon of June 11, 2009, Dr. Bill Bornstein, Chief Quality Officer of Emory Healthcare<sup>2</sup> in Atlanta, reflected on the progress of the computerized provider order entry system (CPOE)<sup>3</sup> implementation.

Emory Healthcare's CPOE project, a vital cog in a \$50 million electronic medical record initiative, began in 2007. Two years later, CPOE went "live" at Emory University Orthopaedics and Spine Hospital, Emory University Hospital, and Wesley Woods Hospital in a staged rollout.<sup>4</sup> While Dr. Bornstein felt good about how the implementation had gone thus far, as he looked ahead next month to July 13, 2009, the fast approaching go-live date for Emory University Hospital Midtown (EUHM) (Exhibit 1), Dr. Bornstein thought about the challenges and possible perils that lay ahead. He considered what additional actions he should take, if any, to prepare for go-live at Midtown, and if Midtown was ready for CPOE at all. One thing was certain; this hospital was different.

### Industry Background

In the 1980's and 1990's, several highly influential studies revealed that medical errors occurred in inpatient and outpatient settings at alarmingly high rates and underlined the need for improvements in safety and quality. In the early 1990's, researchers at the Harvard School of Public Health examined over 30,000 randomly selected hospital records from a population of non-psychiatric patients discharged from non-federal acute care hospitals in New York in 1984. Based on the results of their investigation, they estimated that approximately 1.3 million injuries occurred annually to

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patients in U.S. hospitals, 69% of which were at least partially due to errors in patient management.<sup>5</sup> In 2000, the Institute of Medicine published a report that concluded that more people died each year from preventable errors in hospitals than from car accidents, breast cancer, or AIDS.<sup>6</sup>

In a 2007 report, the Institute of Medicine estimated that between 380,000 and 450,000 preventable adverse drug events (ADEs)<sup>7</sup> occurred annually in U.S. hospitals at an estimated annual cost of \$3.5 billion.<sup>8</sup> After factoring in ambulatory and long-term care patient encounters, the Institute of Medicine estimated that over 1.5 million preventable ADEs occurred in the United States in 2007.<sup>9</sup>

As the healthcare industry became more focused on reducing the number of medication errors, industry interest in CPOE systems, in particular, grew. In November of 2000, a coalition of prominent health care purchasers formed The Leapfrog Group, an organization dedicated to improving the safety and quality of healthcare in the United States. Shortly after forming, The Leapfrog Group issued a manifesto; in it, they argued that U.S. hospitals should make three “leaps” in quality and safety:

- Implement CPOE systems to reduce the number of medication errors,
- Refer patients needing complex medical care to the hospitals that offer the best survival odds based on scientifically valid criteria, and
- Staff Intensive Care Units (ICUs) with specially trained ICU doctors.<sup>10</sup>

More recently, electronic medical record (EMR) and CPOE systems have entered the national political dialogue as members of the U.S. Congress debated ways to reform the U.S. healthcare system. In January 2009, President-elect Barack Obama pledged that the government would, “make the immediate investments necessary to ensure that, within five years, all of America’s medical records are computerized.”<sup>11</sup> In February 2009, Congress enacted a fiscal stimulus package that had major healthcare implications. The American Recovery and Reinvestment Act included a net investment of \$19 billion for health information technology (IT) implementations, including CPOE systems.<sup>12</sup>

## Computerized Provider Order Entry (CPOE) Systems

CPOE systems were designed to reduce, or, wherever possible, eliminate handwritten orders. Most CPOE systems were also designed to provide “real time” decision support<sup>13</sup> to providers. CPOE systems have been implemented with and without a full electronic medical record in place, although implementing a clinical data repository with results reporting is more or less a standard practice. CPOE, broadly construed, implies not a standalone order entry system, but one that links to pharmacy, lab, and other hospital information systems.

The most commonly cited advantages of CPOE systems compared with paper-based systems for writing orders are listed in **Exhibit 2**.

While studies have indicated that CPOE systems generally reduce adverse drug events, the results have not been conclusive.<sup>14</sup> Several studies have suggested that CPOE systems can lead to different kinds of errors that do not typically occur when ordering is done by paper. Nevertheless, research has indicated that CPOE systems that include advanced decision support<sup>15</sup> have reduced adverse drug events.

## Emory Healthcare

Emory University School of Medicine was founded in 1905. In 2009, Emory Healthcare, the clinical arm of the Robert W. Woodruff Health Sciences Center of Emory University, was the largest and most comprehensive health care system in Georgia, with 1,184 licensed patient beds, 9,000 employees and more than 20 health centers located throughout the metro Atlanta-area. In addition, approximately 1,000 community physicians and 1,000 residents practiced medicine in the Emory Healthcare system.

The Emory Healthcare system included The Emory Clinic, the largest, most comprehensive group practice in Georgia, comprised of 980 specialists, sub-specialists and primary care physicians; as well as the following inpatient hospitals:

- Emory University Hospital: a 573-bed adult, academic hospital;
- Emory University Hospital Midtown: a 511-bed adult, academic/community based hospital;
- Emory University Orthopedics and Spine Hospital: a 120-bed specialty hospital;
- Wesley Woods Hospital: a 100-bed geriatric specialty facility.

Emory Healthcare's partnership with Cerner,<sup>16</sup> an international supplier of health information systems, began back in 1992, and led to the implementation of many health information systems in recent years. In June of 2002, Emory implemented Cerner's FirstNet<sup>17</sup> and Cerner's Enterprise Master Person Index<sup>18</sup> at Emory University Hospital. In 2005, Emory Healthcare implemented PowerChart,<sup>19</sup> an electronic medical record system and PharmNet.<sup>20</sup> In 2007, Emory implemented SurgiNet<sup>21</sup> and CPOE in the emergency department. In 2009, Emory rolled out RadNet<sup>22</sup> and CPOE in its inpatient units. **Exhibit 3** details the CPOE leadership and organization chart for overseeing this effort.

### *CPOE at Emory Healthcare*

Before CPOE went live, physicians at Emory placed orders by writing them on an orders sheet attached to the patient chart. In some cases, a physician would call a nurse and ask him/her to write the orders on the order sheet.<sup>23</sup> When this happened, the nurse was supposed to verify the order by writing it, then reading it back and verifying it. While all verbal order sheets had to be signed by a physician, it was not uncommon for the physician to sign the order sheet after the order had already been carried out. Verbal orders were a standard and essential way doctors and nurses communicated. Charts that contained newly written orders were usually placed in a pending orders chart rack. If physicians were placing stat orders,<sup>24</sup> they were supposed to inform the unit clerk and nurse while in the patient care area. Before CPOE, orders for certain ancillary services, such as labs and radiology, were entered into the legacy system by a unit clerk and transmitted to radiology technicians or phlebotomists who would then carry out the ordered lab or imaging procedure. Before CPOE, medication orders were faxed, or scanned and then sent, directly to the pharmacy by the unit clerk. The unit clerk was charged with entering the medication correctly on the medication administration record (MAR) until a new MAR was printed.

**Ordering with CPOE** CPOE dramatically changed the ordering process by shifting order entry responsibility largely to physicians. Emory's CPOE system allowed physicians and other providers with appropriate access privileges to place orders directly into hospital computers or remotely via the web through a Citrix virtual desktop environment (**Exhibit 4**). First and foremost, after CPOE went live, physicians were required to place orders via a computer rather than the

traditional method of writing on the patient chart. Secondly, with remote access, physicians were able to place orders from anywhere, anytime, as long as they were connected to the Internet, reversing the previous process of a physician calling a nurse to place an order. Finally, the CPOE system empowered physicians to place their own lab and radiology orders rather than relying on unit clerks to transcribe lab and radiology orders into the computer.

After logging onto the system, a physician would select the patient for whom they wished to place an order. Physicians would then click on the problems list and the orders tab. Physicians then queried the CPOE system for the order they wanted to place. Physicians could enter in orders individually or enter in multiple orders at the same time by selecting one of the preconfigured PowerPlans.<sup>25</sup> Once the physician found the order or PowerPlan they wished to place, they selected it and clicked the "Add a Current Order" button. In order to send an individual order, the physician would then have to click the "Sign Orders" button. However, if the physician had selected a PowerPlan, they were required to click both the "Sign Orders" (to make the order pending) and the "Initiate Orders" (to indicate the order is ready to be carried out) button for the order to be transmitted to whomever would be carrying out the order, which would sometimes cause confusion to physicians as to whether an order was entered properly.

**Reactions to CPOE** Many physicians had mixed reactions to the recently implemented CPOE system. Emergency Medicine physician Dr. Andre' Matthews felt that the CPOE system had both positive and negative qualities, but overall it had a net positive effect. Dr. Matthews explained:

The positive side to the physician order entry system is that it's very customizable and the CPOE team is constantly improving the system so that it better meets the needs of emergency physicians. The flip side is that some of the less computer-savvy physicians actually may see the CPOE system as a hindrance to practicing medicine. They haven't actually learned how to use a computer to do things other than to look at films and imaging studies and are resistant to doing so at this point in their careers.

The most common mistake that you see is orders entered on the wrong patient, because the mouse was off by a few millimeters when you selected an order. So you always have to enter the mindset of, 'Once that order screen comes up, just double check the patient's name and make sure that it's the correct patient.'<sup>26</sup>

There was some organizational skepticism amongst providers about how effective the CPOE system would prove to be in terms of improving patient care. Surgical Oncologist, Dr. Toncred Styblo, was among those not convinced that the CPOE system would improve the quality of care provided to patients. Dr. Styblo explained,

We all know quality when we see it, but trying to develop a tool that can measure that is extremely complex, and so I think part of these order sets that are being developed are ways that you can pigeon-hole care and say, "You're an outlier." Or, "You're an inlier." And there are lots of reasons for doing that, in terms of going forward and negotiating contracts. You want to know roughly how much it costs us to take care of this diagnosis code, given these variables, so you can have some idea of how to negotiate what you should be reimbursed for that. I think ultimately all this data that's being gathered will be utilized some way to identify practitioners and the level of care they provide, and I think that's an extremely difficult thing to do, and I'm not at all convinced that the tools that are being developed can do that accurately.<sup>27</sup>

Dr. Matthews held the view that the CPOE system reduced certain kinds of medical errors significantly, but indicated that CPOE was not a cure-all for eliminating medical errors. He said,

I think overall it definitely reduces errors, because medical errors come in many different kinds of flavors. There's the medical error that's associated with ordering the wrong medication when you intended to order something else, and that could be a lapse in thought. Computerized provider order entry may not correct that. However, there's also the medication error that comes with medications that sound alike, especially when they're written rapidly in cursive handwritten and not printed, and computerized provider order entry definitely cuts that down, because it's a clearly legible order that's written. Some of the more common mistakes, such as parts of a name of a medication that potentially look like something else, are actually capitalized, and the rest will be in lower case.<sup>28</sup>

In addition to the debate over CPOEs impact on quality of care, many providers were concerned about the usability of the system. Some nurses, such as floor nurse Anna Bonner, who worked at Emory University Hospital, felt that the system was needlessly complex and cumbersome to use. She said,

The McKesson<sup>29</sup> CPOE system is easier to use. A fifth grader could use the McKesson system. The Emory CPOE system has a lot of extras. You know, Emory's CPOE extras are not easy to use. You have to go through a backdoor and jump over a hoop to get the information you need with the Emory system.<sup>30</sup>

Not all providers were equally concerned about the usability of the system. Pharmacists, such as Othman Mohammed, expressed enthusiasm about the CPOE system. He said, "The CPOE system is not without kinks, without issues; but, we have worked through them, and so far so good. The future here with CPOE looks very bright."<sup>31</sup>

Because of the perceived difficulty of use and lack of confidence that patient care would be improved, some providers found ways to work around their direct interfacing with the CPOE system without bypassing the system altogether. Dr. Jeff Olson, a neurosurgeon, explained, "I probably just turn it over to our physicians' assistants or our residents and hope for the best, which usually gets done reasonably well. But they run into the same problem, there are some things that just can't be done easily."<sup>32</sup>

**Shift in Workload** One of the key points of CPOE is disintermediation. Instead of physicians handing off orders to intermediaries, they can directly enter orders into the CPOE system, thereby minimizing verbal and written communication errors, while at the same time enabling real-time decision support to be delivered directly to the ordering provider. As a consequence of implementing CPOE, however, there was a natural workload shift from nurses, pharmacists, social workers, ward clerks, and other healthcare providers to physicians. Floor nurse Anna Bonner felt that the CPOE system unfairly shifted the workload from nurses to doctors, manifesting in physician animosity towards the system. She stated, "The doctors hate it, generally speaking, because it's actually more work for them. I am not going to lie, it is more work for them. It really is and I think some of it is unfair work."<sup>33</sup>

In addition, the CPOE implementation left nurses with the impression that there would be no verbal orders from physicians, and this created a new workplace dynamic in which responsibility for order entry was not always clearly defined. Dr. George Mathew gave an example. He said, "(Nurses) have the option of telling us to enter an order. I was at the grocery store (one night) and I got a call (from a nurse) and I said, 'Can you put the order in?' She said, 'Well can you go home, log onto the computer, and put the order it in?' It doesn't enhance anyone's patient safety."<sup>34</sup>

While the CPOE system shifted workload to physicians, it simultaneously freed up some other healthcare workers' time to perform other duties. Pharmacist Tony Ottaviano stated that the CPOE

system had reduced his workload and allowed him to take a more active role in ensuring that patients were getting the most appropriate medications. Ottaviano explained:

The implementation has gone so well, it has exceeded expectations. [As a result of CPOE] the pharmacist has more time. Traditionally, we entered the medication orders. That was a big chunk of our time, of our job. And so now, we are trying to transition from sitting in the pharmacy entering orders to now doing what pharmacists are supposed to be doing: actually being on the floor doing other things to improve medication safety and make the delivery more efficient.<sup>35</sup>

**Rollout and Training Reactions** The rollout and training of the CPOE system were received with mixed enthusiasm. One of the perceived strengths of the rollout was the availability of training resources. Classes were held to help employees get familiar with the system (**Exhibit 5**). Application Content Experts (ACEs) were specially trained Emory healthcare employees who were trained as experts of the CPOE system. **Exhibit 6** details the support that was in place for the CPOE rollout including ACE team roles and responsibilities. ACEs, who were paid for their assistance role, were made available and were often seen roaming hallways to see where they could be of assistance. A special hotline was also set up to assist with any CPOE questions. Social worker Alicia Gray felt the ACEs were a positive factor in getting familiar with the system. She stated,

They had the CPOE trainers coming and troubleshooting (issues) for people and asking if we had any questions about the system. It was really helpful because one never really knows (how to use a system) until you're in the system. (Once using it) you feel a little bit more comfortable approaching (the trainers) and asking, 'You know what, can you just come look at this real quick and tell me if I'm doing it right?' So I think they did a good job.<sup>36</sup>

Hospitalist<sup>37</sup> Dr. Mathew concurred and felt like Emory made a special effort to make resources available. He stated, "One thing I credit Emory with was that they really did try to provide the best education: I mean unlimited resources. Whatever you wanted, they were there. That's to their credit. And the hospitalists were the main folks who helped propagate it throughout the whole hospital."<sup>38</sup>

Doctors were required to attend a three-hour training course, which was received with both enthusiasm and cynicism. One perceived problem was that the training sessions were not individualized to accommodate the speeds of different users' learning. According to Dr. Jeff Olson:

They did a good job of training us. So the day it came online, I was able to do it and get the majority of the orders in. They purposefully sat down so I could torture those people and show them how it didn't work. We did a couple of iterations of that and I got bored. But, I think they did a good job of showing us how to do it. (We) kind of did a little online course and then we had to sit in a little three-hour classroom course, and then the first time I would write post-op orders or on the ward orders, there was somebody there to help me. That was good.<sup>39</sup>

While there was consensus that training resources available were adequate, others felt that a three-hour training session for doctors simply wasn't enough formal exposure to the system. According to Nurse Anna Bonner, "A three-hour class is a joke for somebody who has never spelled "potassium" all the way out, they just write 'K.'"<sup>40</sup>

## Standardization of Care

As Chief Quality Officer, one of Dr. Bornstein's top priorities was to reduce the variation of treatments and standardize care wherever possible. He explained:

For the majority of illnesses, there is not one clearly superior method of providing care. Usually, a physician has a number of valid options for treating an illness. So, there is this tradition in medicine; if there is no definitive evidence about what is the best way to provide care in a particular situation, then you can choose to provide care in the way that you see fit. However, we have found that this way of practicing medicine has monetary and safety costs associated with it. The more variability of care, the more complexity that clinicians have to deal with, and thus the greater the risk of error. For example, let's say, as a front line nurse you are caring for four different patients who are on a ventilator. During the course of a shift, you have four different doctors who instruct you to wean each of these four patients off a ventilator four different ways. With all of the variation, there's more opportunity for error. By standardizing practices, you reduce the complexity of practicing medicine, which in turn reduces the potential for errors. So, I have this bias to want to standardize even if the evidence about which treatment has the best outcomes is not there.<sup>41</sup>

Bornstein summarized his thoughts and said, "Really what we're trying to get across is that when variation is due to preference and is not based on evidence, we need to strive to minimize it. However, it's a fine line because we don't want to eliminate appropriate variation that is based on situational or population based needs."<sup>42</sup>

Because few order sets<sup>43</sup> existed at Emory Healthcare prior to the beginning of the CPOE project, Emory clinicians, in concert with the implementation team, developed most of the order sets for the CPOE system. Dr. Bornstein used the order set development process as a vehicle to increase the standardization of treatment protocols across the Emory Healthcare system. Dr. Rick Gitomer, Chief Quality Officer of Emory University Hospital Midtown, explained:

We [Dr. Bornstein and I] have this bias to standardize care even when there is not evidence that one treatment is superior to another treatment. In fact, during the CPOE order set development phase, we have explicitly attempted to encourage standardization of treatment protocols in situations where the best practice evidence does not exist. We spent a long time developing order sets with groups of physicians and nurses in preparation for go-live. When there was sustained disagreement about how many different ordering options to include in an order set and there was no evidence of a consensus emerging, finally we just sort of bullied them and said 'ok we're going to do it this way.' I think we're suffering the consequences of that now because some of the doctors are deviating and not helping us.<sup>44</sup>

One problem that Dr. Bornstein and Dr. Gitomer encountered in their effort to keep the number of order sets to a minimum to drive standardization was that the patient populations at EUHM and the other Emory Healthcare hospitals were quite different from one another. Because of different populations with different needs, Bornstein had to allow, in certain situations, for a greater number of order sets. Bornstein explained, "We have nephrologists on both the Emory University Hospital and Emory University Hospital Midtown campuses, but at Midtown, we treat a lot of chronic dialysis patients and we do not at Emory University Hospital. At Emory, we're more likely to deal with the acute person who gets admitted to the hospital who has a kidney problem. So, we may have to do two different order sets."<sup>45</sup>

Physicians had mixed reactions to the increased standardization of care. Dr. Jeff Olson, an Emory neurosurgeon, said that the CPOE system interfered with his ability to care for his patients because it wasn't designed for "complex care." Olson explained,

With CPOE, we just bumble through as best we can. You can change a dosing of or frequency that a medication is given, but you can't really tailor it. The order sets and CPOE system is kind of unbendable. I don't think it's dangerous. I just think it forces out the norms of our practice that were working. God forbid patients actually need complex, individualized care; the CPOE system is not built for that.<sup>46</sup>

Dr. Olson went on to elaborate that some physicians felt that highly standardized order sets did, under some certain circumstances, contribute to errors when ordering physicians were not careful placing their orders with CPOE. Dr. Olson again explained:

We probably are now getting more people leaving the hospital on unusual steroids and coming back to us with complications, you know, high blood sugars, can't sleep, or a reaction because they came off their steroids too fast because somebody forget the usual manner of tapering for a specific steroid and selected a more general protocol for tapering steroids. We are seeing that.<sup>47</sup>

## Medication Reconciliation<sup>48</sup>

In 2000, the Institute of Medicine issued a report entitled *To Err is Human...Building a Safer Health System*. This report laid out a national agenda for improving patient safety and reducing medical errors; the findings of the report ultimately led to the development of the Joint Commission on the Accreditation of Healthcare Organizations' (JCAHO) National Patient Safety Goals (NPSGs). These goals have been revised and published yearly since they were first issued in 2002. The 2005 edition was the first NPSG edition to include medication reconciliation as a national patient safety goal. NPSG Number Eight required accredited healthcare organizations to "accurately and completely reconcile medications across the continuum of care."<sup>49</sup> In 2005, organizations were required to implement and test processes for compliance with NPSG Number Eight and to have successful implementation by the beginning of 2006.

The medication reconciliation process typically included the following steps: 1) develop a list of current medications; 2) develop a list of medications to be prescribed; 3) compare the medications on the two lists; 4) make decisions about which, if any, medications need to be stopped or continued, and what, if any, new medications need to be added for the next phase of the patient's care; and 5) communicate the new list to appropriate caregivers and to the patient. This reconciliation occurred at most transitions in the location of the patient's care. For example, medications were typically reconciled at admission to the hospital, at the time of a transfer from one location to another location within the hospital, or when a patient was discharged from the hospital to a home, nursing facility, rehabilitation facility, or other care setting.

### *Medication Reconciliation at Emory Before CPOE*

Prior to CPOE, the physician or nurse would reconcile medications for a patient upon admission to the hospital by writing down what medications patients were taking at the time of assessment with the corresponding doses, routes of administration, and level of compliance (whether patients were actually taking the medicine and when they last took it) on an Admission Medication Reconciliation form. Physicians would then check off which medications they wanted the patient to continue, discontinue, or modify. Physicians would then list on the order sheet the medications they wanted

the patient to take while in the hospital. The unit clerk would then fax the order to the pharmacy and a pharmacist would add the medications to the patient's medication administration record.

### *Medication Reconciliation at Emory After CPOE*

Physicians began the medication reconciliation process by logging into the CPOE system. They would select the patient, click on the orders tab and click on the document home medications button. Physicians would then enter the medications, the patients' medication compliance, and the last time the patient took each medication into the system. After completing the patient's history, physicians would then have to reenter each medication they wanted the patient to take while in the hospital a second time on the reconciliation home page. In order to do this, physicians clicked on the "Convert to Inpatient" tab. When physicians clicked on the "Convert to Inpatient" tab, a dialog box appeared, which asked the user to enter the medication and dosage. When the CPOE system first went live, physicians were not able to view the history page at the same time as they were entering medications. This meant that physicians had to ask the patients a second time which medications they were currently taking.

Many physicians found the medication reconciliation counter-intuitive and frustrating. As hospitalist Dr. Mathew recalled, many physicians stopped performing medication reconciliation because the CPOE system's medication reconciliation module was redundant and difficult to use. He stated,

(The medication reconciliation module) is so badly designed that just to escape from it, you (would) hit as many buttons as you can hoping that you hit the right button. I can guarantee you that this system increased the potential for error because the physicians would do almost anything or hit any button to escape from the module once they were in it. In addition, we had to input medications at least twice. First, as the order was entered, then, if you wanted to continue, you had to put in the medicines again. Finally, if you discharged the patient, you had to enter in the medications for a third time. Many providers felt that the medication reconciliation was a major hindrance to the use of the CPOE system.

Dr. Mathew summarized, "It is the number one problem with this system. Everything else is aesthetics - how it looks, and how to make it more Apple-ish or how to make it flow well. But medication reconciliation is a big boulder in the road."<sup>50</sup>

Given the functionality and usability difficulties of the medication reconciliation module, it was often either used inconsistently or incorrectly system-wide. Nurse Bonner underscored this and said, "The whole medical reconciliation module needs to be reconfigured altogether. The doctors aren't clear, the nurses aren't clear, no one is putting it in correctly."<sup>51</sup>

As CPOE project director Jack Morford recalled, there was considerable debate as to whether to turn off the medication reconciliation module altogether before go-live and ask the physicians to keep performing medication reconciliation on paper. In the end, Morford decided to turn the medical reconciliation module off.

## **Unexpected Challenges**

The implementation of CPOE at Emory hospitals brought about dramatic workflow changes throughout the hospital system. These workflow changes led to a number of unexpected problems immediately after go-live. Dr. Bornstein explained, "When you make a workflow change of this magnitude, it exposes all the workarounds that have been in place that have been working fairly well

and we didn't even know they were there... As much planning as you do, unexpected things will arise and you have to have some fluidity. This has been challenging to deal with because healthcare workers can be very rigid."<sup>52</sup>

## *Post-Op Ordering Process*

Some of the unintended consequences of the CPOE system were the problems that arose during the transfer of a patient from the operating room to the post anesthesia care unit (PACU) to the hospital floor. Dr. Bornstein explained:

When a patient moves from one place to another in the hospital, a doctor writes a whole new set of orders for the patient and the nurse caring for the patient knows to automatically discontinue the old set of orders that were in place when the patient was in a different area of the hospital. Before CPOE, the doctor did not always explicitly discontinue the old orders. But, now, all of a sudden, if a doctor does not explicitly discontinue an old set of orders, they will be carried out until such time as the doctor actually discontinues the orders.

For example, a patient has had surgery and they are in the Post-Anesthesia Care Unit (PACU) recovery room. In the PACU, the patient is managed by the anesthesiologist. Pre-CPOE, the surgeon typically wrote orders for the patient some time after surgery that were to be initiated once the patient left the PACU. These orders would be attached to the paper chart, and the floor nurse would know to initiate these once the patient left the PACU and was transferred to a hospital floor unit. After CPOE went live, the surgeon had to wait until the patient left the PACU to initiate these orders. The problem is that, most of the time the surgeon is long gone by the time the patient has been cleared by the anesthesiologist to leave the PACU. So, surgeons were initiating floor orders for patients who were still in the PACU. All of a sudden, people were looking for a patient to draw blood on who wasn't yet on the floor.

As a result of this problem, many surgeons would return to see their patient a day or two after the surgery had taken place and find out that certain imaging studies or labs that they had ordered had not been completed.<sup>53</sup>

Within a month after go-live at Emory University Hospital, Bornstein and others had devised an alternative workflow that partially remediated the problems resulted from PACU to hospital floor ordering with CPOE. Dr. Bornstein explained:

The way that ordering works in the current version of the Cerner CPOE system is that a doctor selects an order set or sets, he or she signs them, and until the doctor clicks initiate, they are saved but not sent to the nurse or whomever else is assigned to carry out the orders. So, following surgery, a surgeon will write orders for a patient, but the surgeon will not initiate them. When the patient is ready to be transferred from the PACU to the hospital floor, the nurse will initiate them. The problem, however, is that with this current version of Cerner, decision support occurs at the point of initiation of orders. This means that a nurse who initiates the order now must sort out all kinds of alerts. So, we're still working out the decision support part of this.<sup>54</sup>

## *"There's No Gatekeeper Anymore"*

New orders were flagged with an icon on the EMR CPOE system so that nurses would know that new orders had been written; however, nurses had to log into the CPOE system periodically to check

if there were new orders for their patients. If nurses did not log into the CPOE system, they would not know that orders were pending.

Having to regularly log onto the CPOE system to check for new orders represented a dramatic change in the workflow for nurses. Prior to CPOE, much of the hospital floor nurses' time was spent in and out of patient rooms, and walking around the patient care area for the execution of their tasks. In some instances, the physician would physically come to the patient care area to write the order(s) and in other cases, the physician would call to give a verbal order. However, after the CPOE system was implemented, the ordering physician would often enter an order into the system from their office or from home. The nurse would have no way of knowing whether an order had been placed unless s/he was logged into the CPOE system. Many nurses at Emory felt that CPOE reduced the amount of interaction they had with the ordering physician. Thus, while the CPOE system provided better workflow tools (e.g., task management lists), it created significant changes in work practices.

Prior to CPOE, unit clerks and secretaries were often responsible for tracking orders. However, after CPOE went live, clerks no longer were able to act as intermediaries between the ordering physician and the nurse. Floor nurse Anna Bonner, described the weeks immediately following go-live as rough. She said, "It was horrible. In fact, I heard a couple of physicians saying 'I'm not doing it [using CPOE for ordering], I don't care.'"<sup>55</sup> Bonner believed that the lack of a unit clerk and secretary responsible for managing the flow of orders and alerting nurses and physicians when urgent or "stat" orders needed to be carried out led to confusion. She stated,

With CPOE, there's no gatekeeper anymore. In the past, secretaries and unit clerks acted as gatekeepers. They have been the gatekeepers for 20 years of my practice. A secretary will say, 'Anna, you've got stat orders, you need to hurry up!' There's no gatekeeper now. I'm sure somewhere down the road, not today, not tomorrow, may not even be next year, they're going to come up with something that's going to allow a gatekeeper.<sup>56</sup>

Dr. Jeff Olson was also concerned that once orders were placed, there was no mechanism to alert nurses of pending orders. This often led to orders being overlooked. He stated, "There are certainly orders we put in that just don't get looked at; I was addressing that with the nursing staff today. Just because it gets put in electronically doesn't mean anyone's paying attention."<sup>57</sup>

### *Increase in Lab Orders*

Prior to CPOE going live, unit clerks were largely responsible for inputting lab orders into the laboratory computer system. As such, the unit clerks played an important role in eliminating duplicate lab orders. On the other hand, the unit clerks would sometimes incorrectly cancel a test that was desired, or order the wrong test, or order the correct test but at the wrong time.

After CPOE went live, physicians were responsible for placing lab orders. Lab orders generally fell into three categories: 1. non-urgent labs that were to be done once at a particular time, 2. labs that were to be done at regular intervals, and 3. stat lab orders that were to be done immediately. Because physicians were not used to placing lab orders, it was not uncommon after CPOE went live for a physician to order a PowerPlan that included several lab orders that were to be performed at regular intervals, and, a day later, to place the same one time lab order that was included in the PowerPlan. As a result, the lab was flooded with orders in the days and weeks after go-live, and blood was drawn from patients, on occasion, too frequently.

## Emory University Hospital Midtown (EUHM)

In contrast to the other Emory Healthcare hospitals, EUHM was an open staff hospital, which meant that independent, community physicians who were not employed by Emory practiced at EUHM. Many of these physicians divided their time between EUHM, other area hospitals, and their own office-based practices. EUHM also had far fewer residents than the other Emory Healthcare hospitals. This was particularly relevant because at the other Emory hospitals, residents often entered orders in the CPOE system for their attending physician.<sup>58</sup> However, at EUHM, community physicians would, for the most part, be forced to enter their own orders into the CPOE system.

Many of the early CPOE success stories in the 1990's and early 2000's involved custom-developed systems in academic medical centers where residents, rather than community physicians, wrote most of the orders for patient care.<sup>59</sup> Physician acceptance of CPOE systems has often been seen as more challenging in open staff hospitals where community physicians, rather than house staff, order the majority of tests and medications.<sup>60</sup> Physician acceptance of CPOE systems has been identified as one of the key factors of successful CPOE implementations.<sup>61</sup> Dr. Bornstein and Dr. Gitomer felt they had the support of key community physician stakeholders at EUHM. Dr. Bornstein explained, "The communication with the community physicians at Emory University Hospital Midtown has been a bit different because it is a sort of a different place and a different leadership structure. I think the good news is the community physician leadership at Midtown are big champions of CPOE."<sup>62</sup>

Nevertheless, enlisting community physicians in CPOE training courses had been a challenge at EUHM. In addition, many of the community physicians at EUHM were familiar with different CPOE systems that were used at other area hospitals. Jack Morford, Project Director of the Emory CPOE project, explained some of his concerns about the EUHM rollout. He stated, "A large majority of these community physicians also practice at Piedmont and DeKalb,<sup>63</sup> and they already have CPOE at these hospitals. The system here will be a different system and they will have to adjust to that, without the help of as many residents as at other Emory hospitals."<sup>64</sup>

## Next Month's CPOE Rollout at EUHM

As Dr. Bornstein arose from his chair and picked up his briefcase and umbrella, he thought about the challenges the CPOE implementation team had faced over the last year and a half. He was reasonably comfortable with the CPOE utilization that had been achieved for the Emory hospitals that had already gone live (**Exhibit 7**), but he knew that the next hospital would pose new challenges. He wondered what, if anything, he and his staff should do differently in the month leading up to the Emory University Hospital Midtown CPOE go-live date. How do you address the complex task of transitioning patients from surgery to post-anesthesia care to the hospital floor using CPOE in an open staff hospital? How do you effectively manage change in a hospital with a high percentage of community physicians? To what extent do you enforce standardization of care in a facility with such a diverse array of providers? Was more user training required, should more ACEs be made available, and should greater efforts be made to champion the system and generate more user buy-in? Do you turn off problematic modules or do you roll out the whole system as-is and work on upgrades along the way?

With mounting quality of care and regulatory pressures, the evidence suggested that CPOE would play a key role in improving the quality of care, but balancing the necessity of CPOE and its impact on current medical processes at Emory Healthcare was proving to be tricky. Dr. Bornstein began walking toward the door of his office. As he reached the door, Dr. Bornstein paused and thought - how do you create a culture where people are willing to adapt to unforeseen problems that inevitably occur when you roll out a system of this complexity?

Exhibit 1 Emory Healthcare CPOE Staged Rollout Scheduled Dates (Past and Future)

Hospital Name and Stage	Rollout Date	Jan 1		Apr 1			Jul 1		Oct 1
		12/14	1/25	3/8	4/19	5/31	7/12	8/23	9/1
Emory University Orthopaedics & Spine Hospital	Mon 2/9/09		◆ 2/9						
Emory University Hospital - Stage 1	Mon 3/9/09			◆ 3/9					
Emory University Hospital - Stage 2	Mon 4/6/09				◆ 4/6				
Emory University Hospital - Stage 3	Mon 5/4/09					◆ 5/4			
Wesley Woods Geriatric Hospital	Mon 5/4/09					◆ 5/4			
Emory University Hospital Midtown - Stage 1	Mon 7/13/09						⊗ 7/13		
Emory University Hospital Midtown - Stage 2	Mon 7/20/09						⊗ 7/20		
Emory University Hospital Midtown - Stage 3	Mon 7/27/09						⊗ 7/27		
Emory University Hospital Midtown - Stage 4	Mon 8/3/09						⊗ 8/3		
Emory University Hospital Midtown - Stage 5	Mon 8/10/09						⊗ 8/10		
Emory University Hospital Midtown - Stage 6	Mon 8/17/09						⊗ 8/17		
Emory University Hospital Midtown - Stage 7	Mon 8/24/09						⊗ 8/24		
Emory University Hospital Midtown - Stage 8	Mon 8/31/09						⊗ 8/31		

Source: Emory Healthcare.

**Exhibit 2** Advantages of CPOE Systems Compared With Paper-Based Systems

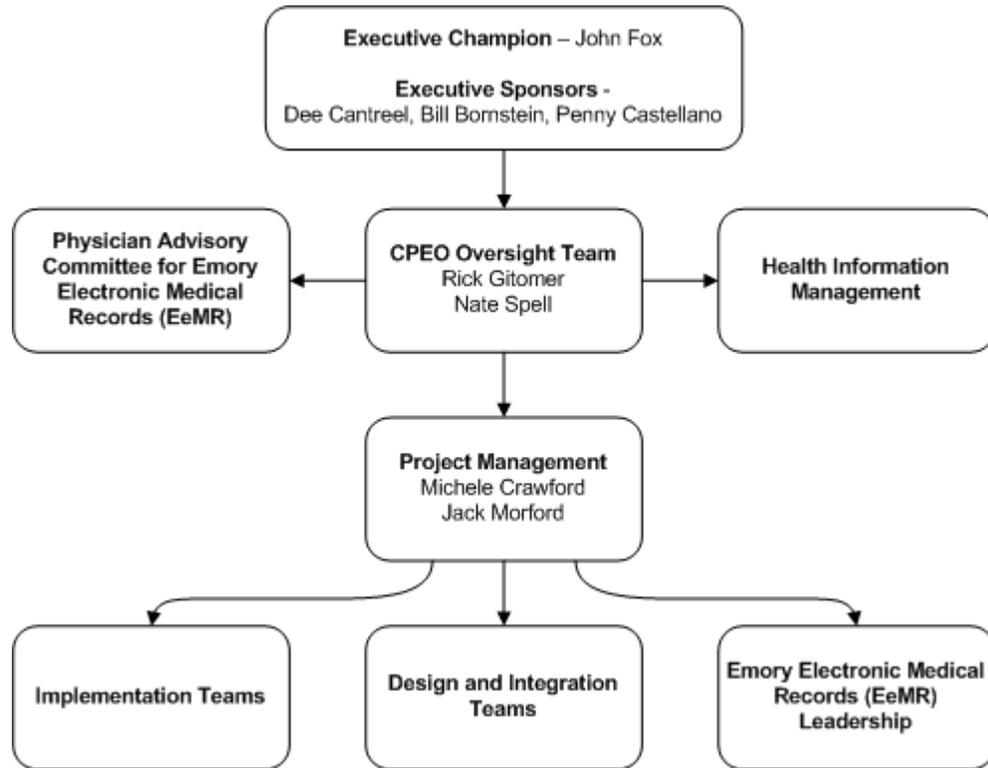
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Free of handwriting identification problems  
Faster to reach the pharmacy  
Less subject to error associated with similar drug names  
More easily integrated into medical records and decision-support systems  
Less subject to errors caused by use of apothecary measures  
Easily linked to drug-drug interaction warnings  
More likely to identify the prescribing physician  
Able to link to ADE reporting system  
Able to avoid specification errors, such as trailing zeroes and decimal misplacement  
Available and appropriate for training and education  
Available for immediate data analysis, including post-marketing reporting  
Claimed to generate significant economic savings  
With online prompts, CPOE systems can  
    Link to algorithms to emphasize cost-effective medications  
    Reduce underprescribing and overprescribing  
    Reduce incorrect drug choices

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Source: Adapted from R. Koppel, J. P. Metlay, et al., "Role of Computerized Provider Order Entry Systems in Facilitating Medication Errors," *Journal of the American Medical Association* 293 (10) (2005): 1197-1203.

Exhibit 3 CPOE Leadership and Oversight Chart



Source: Emory Healthcare.

Exhibit 4 Emory CPOE Sample Screenshot

This document is authorized for use only by Vikram Vaidyanathan in MBA Info Mgt Spring 2012 ONLINE taught by SHIRLEY SHMERLING from November 2011 to May 2012.

Source: Cerner.

Exhibit 5 CPOE Training for Physicians and Nurses

Physicians:

- Step one: two online learning courses – two hours:
  - Basics for CPOE/Medication Reconciliation
- Step two: CPOE classroom learning - three hours
  - workflow and application training
  - generic “day in the life scenario”

Nurses:

- Classroom training – six hours:
  - documenting medication histories and allergies
  - Using PowerPlans and placing orders
  - “Day in the life scenario” practice
  - Process flows, access to “How do I’s” online

Source: Emory Healthcare.

## Exhibit 6 Emory CPOE Rollout Support

T – Transformation Team. Composed of nurses, residents, and physicians, these “super users” will staff the CPOE Support Center that provides 24/7 support for the first three weeks of each go live.

**A- ACEs (Application Content Experts). Each unit will have a designated ACE who acts a permanent on-site expert.**

P – Project Team. The CPOE project team that provides support on an ongoing basis.

### ACE Team Roles and Responsibilities

#### Prior to Go-Live:

- Assist clinicians with practice after class completed
- Assist in ensuring that department members meet their training obligation
- Reinforce education of orders management and entry
- Assist in cleaning up the orders profile and any other clean up activities before go-live

#### Go-Live Support:

- Sign in to the Command Center in the morning – wear CPOE shirt/vest
- Provide ongoing communication of changes or updates to the system
- Address user “how to” questions and issues on assigned unit
- Complete change request forms and report issues to Command Center
- Become familiar with workflow process related to individual unit and roles
- Assist users logging into system for the first time
- Distribute information and learning materials, especially from daily check in meetings
- Participate in the unit check in meetings
- Communicate about issues (to and from unit/command center)
- Log issues on Issues Report Form and submit to roamers/command center
- Complete with daily unit report for unit check in meetings – discuss with manager

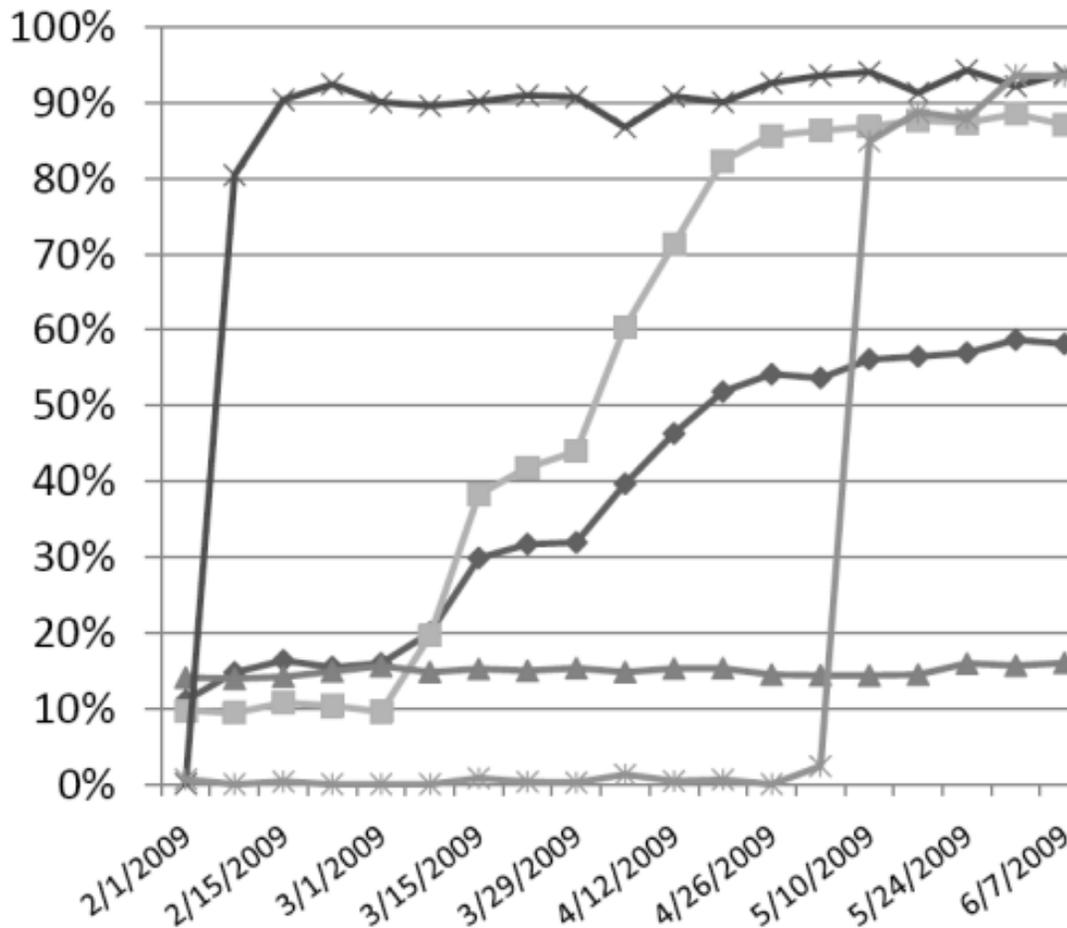
#### Post Go-Live (ongoing):

- Provide first line support
- Attend regular meetings to discuss technology and process updates
- Communicate these changes to assigned clinicians and providers that practice within the department
- Ongoing resource for assigned clinicians and providers that practice within the department

Ability to articulate the clinical process impacted by EeMR, CPOE, and clinical documentation

Source: Emory Healthcare.

Exhibit 7 CPOE Utilization for Medical Orders



	All Emory Hospitals
	Emory University Hospital
	Emory University Hospital Midtown
	<i>Emory University Orthopaedics &amp; Spine Hospital</i>
	<i>Wesley Woods Geriatric Hospital</i>

Source: Emory Healthcare.

## Endnotes

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<sup>1</sup> Casewriter's interview on June 10, 2009.

<sup>2</sup> The clinical arm of the Robert W. Woodruff Health Sciences Center of Emory University located in Atlanta, Georgia, Emory Healthcare was the largest hospital system in Georgia and a major academic medical center.

<sup>3</sup> A system in which clinicians directly enter medication orders, tests, and procedures into a computer system which then transmits the order directly to the pharmacist, nurse, phlebotomist or other allied health professional who will then carry out the order.

<sup>4</sup> Emory University Orthopaedics and Spine Hospital went live in February, 2009 and Emory University Hospital units and Wesley Woods Hospital went live from March until May of 2009.

<sup>5</sup> L.L. Leape, T.A. Brennan, et al., "The nature of adverse events in hospitalized patients: results of the Harvard Medical Practice Study II," *New England Journal of Medicine* 324 (1991): 370-376.

<sup>6</sup> Kohn, L.T., & Corrigan, J.M. & Donaldson, M.S. (Eds.). (2000). *To Err is Human: Building A Safer Health System*. Washington D.C.: National Academy Press.

<sup>7</sup> Injuries to patients that are drug-related. Preventable ADEs are injuries that are associated with errors that occur at some point in the drug ordering, administering, dispensing, and monitoring process that are considered preventable.

<sup>8</sup> Aspden, P., Wolcott, J., et al. (Eds.). (2007). *Preventing Medical Errors: Quality Chasm Series*. Washington D.C.: National Academy Press.

<sup>9</sup> Ibid.

<sup>10</sup> The Leapfrog Group Website, <[http://www.leapfroggroup.org/about\\_us/leapfrog-factsheet.>](http://www.leapfroggroup.org/about_us/leapfrog-factsheet.>)

<sup>11</sup> <http://abcnews.go.com/Health/President44/story?id=6606536&page=1>.

<sup>12</sup> American Recovery and Reinvestment Act website, <http://www.recovery.gov/Pages/home.aspx>.

<sup>13</sup> In the context of CPOE, decision support usually means rule-based alerts that are issued to providers when they order certain medications. For example, many CPOE systems alert the provider if a medication the provider is attempting to order is contraindicated because of an allergy or if the medication dose is outside the normal dosing range.

<sup>14</sup> E. Ammenwerth, P. Schnell-Inderst, et al., "The Effect of Electronic Prescribing on Medication Errors and Adverse Drug Events: A Systematic Review," *The Journal of the American Medical Informatics Association* 15(5) (2008): 585-600.

<sup>15</sup> Some degree of drug-allergy, drug-drug interaction, drug-lab, or other patient-specific alerts.

<sup>16</sup> One of the largest health information technology software vendors in the U.S.

<sup>17</sup> An emergency department electronic medical record system.

<sup>18</sup> A central repository for patient demographic, relationship, guarantor, employer and insurance information.

<sup>19</sup> An electronic medical record system.

<sup>20</sup> A pharmacy application that automates clinical and departmental pharmacy processes and provides the foundation for the closed-loop medication administration process across the care continuum.

<sup>21</sup> A surgical and anesthesia computer information system.

<sup>22</sup> A radiology computer information system that is integrated with a PACS (picture archiving and communication system).

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<sup>23</sup> These phone orders were often referred to as “verbal orders.” Hospitals have generally tried to minimize the number of verbal orders because it is thought that verbal orders increased the potential for miscommunication and error.

<sup>24</sup> Orders that must be placed immediately.

<sup>25</sup> PowerPlan was a patient care solution developed by Cerner. In this context, we use the term to refer to a standardized list of orders developed prior to the roll out of CPOE by teams of Emory physicians, nurses and administrators for patients with particular medical problems (i.e. for a patient just coming out of the operating room after a brain tumor resection).

<sup>26</sup> Casewriter’s interview on June 11, 2009.

<sup>27</sup> Casewriter’s interview on June 10, 2009.

<sup>28</sup> Casewriter’s interview on June 11, 2009.

<sup>29</sup> A large CPOE software vendor and health IT corporation.

<sup>30</sup> Casewriter’s interview on June 16, 2009.

<sup>31</sup> Casewriter’s interview on June 11, 2009.

<sup>32</sup> Casewriter’s interview on June 10, 2009.

<sup>33</sup> Casewriter’s interview on June 16, 2009.

<sup>34</sup> Casewriter’s interview on June 10, 2009.

<sup>35</sup> Casewriter’s interview on June 11, 2009.

<sup>36</sup> Casewriter’s interview on June 10, 2009.

<sup>37</sup> A hospital-based general physician. Hospitalists assume the care of hospitalized patients in the place of patients’ primary care physician.

<sup>38</sup> Casewriter’s interview on June 10, 2009.

<sup>39</sup> Casewriter’s interview on June 10, 2009.

<sup>40</sup> Casewriter’s interview on June 16, 2009.

<sup>41</sup> Casewriter’s interview on June 10, 2009.

<sup>42</sup> Ibid.

<sup>43</sup> A preconfigured group of orders that is commonly ordered together for a specific problem or diagnosis. Order sets often included requests for blood work and labs to be conducted and medications to be given.

<sup>44</sup> Casewriter’s interview on June 8, 2009.

<sup>45</sup> Casewriter’s interview on June 10, 2009.

<sup>46</sup> Casewriter’s interview on June 10, 2009.

<sup>47</sup> Ibid.

<sup>48</sup> The process of comparing a patient’s medication orders to all of the medications that the patient has been taking. Medication reconciliation should be done whenever a patient arrives at a hospital or health care center or whenever a transition in care occurs when new medications are ordered or existing orders are rewritten.

<sup>49</sup> [http://www.jointcommission.org/PatientSafety/NationalPatientSafetyGoals/05\\_hap\\_npsgs.htm](http://www.jointcommission.org/PatientSafety/NationalPatientSafetyGoals/05_hap_npsgs.htm).

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<sup>50</sup> Casewriter's interview on June 10, 2009.

<sup>51</sup> Casewriter's interview on June 16, 2009.

<sup>52</sup> Casewriter's interview on June 10, 2009.

<sup>53</sup> Ibid.

<sup>54</sup> Ibid.

<sup>55</sup> Casewriter's interview on June 15, 2009.

<sup>56</sup> Ibid.

<sup>57</sup> Casewriter's interview on June 10, 2009.

<sup>58</sup> In the U.S., an attending physician has completed residency and practices medicine in a clinic or hospital. An attending physician can supervise fellows, residents and medical students. Attending physicians have final responsibility, legally and otherwise, for patient care, even though many decisions are made by subordinates (physician assistants, resident physicians, and medical students). Attending physicians may also still be in training, such as a fellow in a subspecialty.

<sup>59</sup> *Computerized Provider Order Entry: Costs, Benefits and Challenges. A Case Study Approach.* Retrieved from [http://www.leapfroggroup.org/media/file/Leapfrog-CPOE\\_Costs\\_Benefits\\_Challenges.pdf](http://www.leapfroggroup.org/media/file/Leapfrog-CPOE_Costs_Benefits_Challenges.pdf).

<sup>60</sup> Ibid.

<sup>61</sup> Ibid.

<sup>62</sup> Casewriter's interview on June 10, 2009.

<sup>63</sup> Piedmont Hospital and DeKalb Medical Center, two other Atlanta-area hospitals.

<sup>64</sup> Casewriter's interview on June 10, 2009.