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Session: Health IT Detection of Medication Errors in US Hospitals – Implications for the VA Health Care System

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Dr. Jon White: Fantastic. All right, thank you so much Rob for the introduction. Thank you everybody for joining us. Topic today is an important one. he quality and safety of American Healthcare is an important [inaudible 00:11] unto itself. And the tremendous growth and expansion of health IT systems, and tools, and practices across American healthcare makes it a significant means by which care is delivered and therefore important to make sure that we get it right. And the good news is there's lots of that have been paying particular attention to this over many years and throughout their careers. And I am joined by three of those individuals today that are going to share some of the wisdom that they've gained over that period of time. Let me give you a brief introductions, David Bates, our first speaker is the medical director, of clinical and quality analysis information systems at partners healthcare system and is the chief of the division of general internal medicine at the Brigham and Women's hospital. David Classen is a professor of medicine at the University of Utah and is also a COIN investigator at the IDEAS Center at the VA Salt Lake City health care system. Jean Scott is the director of informatics patient safety in the VA's office of health informatics. And I and the associate chief of staff for research and development at the VA Salt Lake City health care system and a professor of medicine is University of Utah. I will be monitoring the questions and answers and if we have time for some at the end I will moderate those questions to our speakers. so without further ado, Dr. Bates, the floor is yours.

Dr. David Bates: Thank you, Jon, and it's great to have a chance to be with you today. One of the first landmarks in this area really is this report from the Institute of Medicine on health IT and inpatient safety and how building better systems, safer systems for better care next slide.

And let’s see, can you advance the slide? Great. One of the studies that sort of brought this into the public eye was this this studies which came out in Pediatrics in 2005 which suggested that there was unexpected increased mortality after implementation of a commercially sold computer physician order entry system. When you dug down into what happened with in this evaluation it turned out that patients were being transferred into this hospital, pediatric patients, who were critically ill. And the authors found that the mortality rate was higher in that group. If you go down a level though it turns out that that many of the issues were really related to how order entry was implemented at this institution and not to the underlying system itself. Next slide.

Another study that came out around this time was a paper by Jonathan Nebeker and a number of others that found high rates of adverse drug events even in a highly computerized hospital. And this study was actually conducted in the in the VA. And it was upsetting to some people because they said, well you know how can the rates still be so high even after you have, even after you've computerized? Next slide.

So the IOM report that I referenced earlier included a number of recommendations and the one I wanted to highlight here is that the office of national coordinator and ARC should work with health IT vendors in healthcare organizations to promote post deployment safety testing of electronic health records for high prevalence, high impact, electronic health record patient safety risks. And the reason this is so important is that organizations have a great deal of ability to configure records and much of whether or not you get a safety benefit from those records depends on not what record you pick but how it's been configured. Next slide.

The SAFER guides really underscored this. And this was a set of work that was that was sponsored by ONC and it is really a terrific set of recommendations put together by Kathy Kenyon, John Ash, Hardeep Singh, Dean Sittig what they did was to talk through what some of the safety assurance factors are for electronic health record resilience. So things that you could do that would make sure that you got safety from the electronic health records that you put in. Next slide.

And these were broken into several areas. There are some foundational guides which include high priority practices and some of the organizational responsibilities. And there were some infrastructure guides around systems configuration, systems interfaces, and contingency planning. And then some clinical process guides notably around patient identification, the computer order entry with decision support, test reporting, and follow up in clinician communication. Next slide.

And this slides then it shows the drill down around the CPOE and clinical decision support practice. And the suggestion here is to take the link for a test on a periodic basis to ensure that your system is a safe one and you'll hear good deal bit more about this as we go on. but the Leapfrog test is a test that was designed to ensure that when you when you put in CPOE that it includes the right checks to improve safety. Next slide.

And around this time there was also a safe practice that was implemented by the national quality forum around adoption of computerized prescriber order entry. And the objective of this was to promote the sole use of medications tests and procedures through the successful implementation of integrated clinical information technologies to reduce preventable harm to patients. This was based on a series of studies that showed that if you put this in that it results in fewer adverse drug events. Next slide.

And a couple of excerpts from this the computer order entry can be adopted in different ways. So it can be adopted with a staged approach. Once integrated information systems are in place to support safety and effective CPOE systems and again that should then be tested against the AHRQ/NQF impatient CPOE testing standards, also known as the Leapfrog standards, which were developed to provide organizations that are implementing CPOE with appropriate decision support. Next slide.

And we did empiric study and actually looked to see how well did these checks perform? And was there any relationship between the medication event rates and performing better on the Leapfrog computerized physician order entry tool? And basically what we showed was the scores from this evaluation tool closely related to the actual rates of preventable adverse drug events. And therefore you know there's something empiric validation that not only is this a good process test, but it's also associated with that with better outcomes if you take the test on a regular basis. Next slide.

And I'll hand over here.

Dr. David Classen: Great, thanks very much, David. This is David Classen and I will continue from here. So this is all about the leapfrog test, which is a flight simulation test to evaluate, as David's been talking about, the safety performance of your EHR system in actual operation. And so we use lots of principles of simulation to evaluate your system and we try to create as high fidelity a simulation as possible. So when this test is administered to hospitals around the country and in 2018, 2000 hospitals in United States use this test, and they've been using it every year since 2009. So a lot of tests have been taken. We make hospitals treat this test as if it were a real patient there admitting to the hospital and entering actual orders, again, so it's a high-fidelity simulation. Next slide please, Jon.

And the principles of this test were really to focus on those sorts of errors that actually cause harms as in adverse drug events. We could have focused on just any error, but as you know, most medication errors never lead to any harm to patients. So we were specifically focused on those errors that lead to actual harm to patients. An the proof in the pudding is the study David just cited which showed that you do better on the test you have to actually have lower rates of actual events, actual adverse drug events. So principle here was focused on those things that actually causes harm to patients. Second thing was let's set the test up so hospitals who take it can use the results to improve their overall performance in terms of safe medication safety in their EHR system. So the whole test was designed as a way to lead to a quality improvement effort. And then obviously accentuating the positive here, encouraging quality as well as harm reduction. So the tests address errors of omission and commission and, as you'll see at the end, we've expanded the test will be on medications. So really to focus on quality beyond just harm. Next slide please, Jon.

And we use the number of research databases to identify those errors that actually cause harm. This was from a study David did in Massachusetts which was very helpful as we set up this approach. We also use the database at the VA that Jonathan Nebeker had, and we used a couple other databases, researchers’ database, around the country so that we had an evidence base for the harm that we were going to target with this test. And you can see out of David’s study that many of the categories that we used in the test are represented out of the work he did Massachusetts. Next slide.

And so we have used in this test real world cases from these databases and from other experts. So we really wanted to use, not fictional cases, but real-world cases where patients were harmed with medication that errors that could have been prevented by the EHR system. So the test is a huge library of real-world cases where patients have been severely injured or killed. Here's an actual case we use in the test it was a female, 52 years old, came into the hospital for pneumonia she was on Coumadin but when they ordered it and this happened in a hospital with CPOE in place, their decision support didn't stop an overdose of Coumadin. And so rather than getting 5 milligrams once a day, she got it three times a day. She got it for five days, got over anticoagulated, bled out and died. So these are the type of scenarios we use in the test, real world cases. Next slide, please.

And the test has been employed since 2008. It's a web based self-assessment test that hospitals have been using all their own for a long period of time. When they first take this test on the web it usually takes them four to six hours to take it. But as they take it year after year the hospitals have learned pretty quickly how to do this test and most hospitals do it within about 2 hours now. So there is a learning curve at the beginning but after you've done it one or two years you get pretty good at. And basically the hospitals log on to the inpatient test through the Leapfrog safety survey and that gives them permission to take the test. When they take the test they get a series of simulated patients that are real world patients at their told to admit into their system as if they just admitted a new patient. Then the test gives them a series of medication orders to order against those patients they’ve just admitted to the hospital and they track all their responses, feed it [inaudible 13:09] the website and the website gives an automatic report of this test they can see by themselves, but also a version, and we’ll show this, goes to Leapfrog. Next slide please, Jon.

And the test is broken out into a number of categories based on all those research databases that gave us an idea of where we could maximize patient medication safety with clinical decision support. You can see the categories here. Can the hospital handle therapeutic duplication in the EHR system? I would have picked up ordering a dose of codeine and Tylenol the number 3 together. Can the electronic health record system with CDS pickup excessive single or cumulative doses, such as a 10-fold excess death methotrexate? Can the EHR system pick up allergies and cross-allergies? Such as prescribing, for instance, ampicillin to a patient with penicillin allergy. Can the hospital pick up the wrong route of administration? Can the health system pick up drug-drug interactions?

We classify these as basic decision support, but the test goes further, next slide, Jon, into more advanced decision support where that we ask the EHR system with decision support to give us advice on doses of drugs that might be inappropriate for a patient's diagnosis. Such as ordering a beta blocker in a patient with asthma. Problems where a dose of a drug is too high for the patient’s weight or age. Situations where a dose might be contraindicated either based on the patients abnormal renal function or based on a drug level in the chart that's very high. And then there are other aspects of the test, corollary orders, when you're ordering a dangerous drug like Dilantin or amiodarone, does the system prompt you to order an appropriate drug level? And then cost of care, do we make sure that people are ordering the same medication in the same lab test repetitively and inappropriately? So these would be the more advanced decision support. Next slide, please.

And I told you got the feedback that comes out of the test. The first feedback goes locally. So here's a hospital that took the test and they finish the test, they get immediate feedback about how they did in the test in each of the categories 100%, 25%, 0%. in addition they get an overall score that goes to Leapfrog and I'm going to show you what that looks like on the Leapfrog website. This test, if we go to next slide, please.

This is an example of a hospital that took the Leapfrog safety survey in 2017 and this test is just one component of the overall Leapfrog safety survey. So hospitals have to answer questions about infections, they have to answer questions about problems with surgery, other safety problems, and doctors and nurses and hospital staff but they also answer questions about practices to prevent errors. Within that, this test is one of the components, but there are also components around hand washing, communication, discharge, and staff work. So this is merely one part of this category which is part of basically five other categories is the whole Leapfrog safety survey. Hospitals take that survey, the results get published every year on the Leapfrog website. This is the actual results for one hospital that did the Leapfrog safety survey and took this test we’re talking about. And this hospital scored very poorly on this test. The reason I bring this hospital to your attention is this hospital uses Cerner the same vendor the VA is using. And this hospital was the build for the Cerner build that you did the DOD and might be used at the VA. So it’s very relevant to the VA's experience that they go down the road to put Cerner in and use a build that may have come from Intermountain Healthcare, which is the source of this hospital. Next slide, Jon.

And we studied this the first year was available in 2008, we looked at 62 hospitals around the United States that took the test. They tended to be larger, more academic hospitals, and we were really intrigued to see how well these hospitals are doing this test because the test is designed for common things that any hospital should be able to pick up. And many hospitals when they bought the EHR systems for clinical decision support thought they got all of this automatically in their implementation. But as David Bates said the key here is not what the software looks like on the shelf, the key here is what the software looks like after hospital’s implemented it. And hospitals have wide latitude to implement these things. So how safe software is on the shelf is irrelevant is how safe it is in operation. And what we found out is hospitals really vary here. Some hospitals picked up only 10% of the problematic scenarios. Other hospitals pick up as many as 82%. What was really concerning was embedded in the test is a small number of orders first that will fatally kill a patient if they’re let go through. And hospitals only picked up 53% of these fatal orders. Next slide, Jon.

And if you rank all the hospitals in the study by their actual vendor, their EHR vendor, and so every vertical line here is hostiles with the same EHR vendor, what you immediately see is there's more variation within hospitals with the same vendor than there was between vendors. Back to David’s point how you implement it is more important than what vendors you chose. This was a homegrown vendor in Boston, and they did the best. But just look at the enormous variation here telling us that the implementation of these systems is the key to their safety performance. Not which ones you buy. Next slide, Jon.

Now we've watched the hospitals taking this test in 2008 grow dramatically. And so in 2018 we got over 2000 hospitals every year using a test. That's not bad considering there about 5400 hospitals in the United States. So this is broadly used in the private sector. Next slide.

And if you look at the individual categories you can see the hospitals do well in the more basic decision support but don't do well in a more advanced decision support. And that hasn't changed much over this time period, that's really concerning. For one instance one category the drug diagnosis category, this includes pregnant women. And hospitals do very poorly on preventive pregnant women from getting drugs prescribed to them that would kill their fetus. Even all this decades and EHR use it’s still stunning that they do so poorly in this area. Next slide, please.

So we just perform, David and I just published an article in JAMA on basically looking at 10 years of hospital use of this test and the resulting safety performance of their electronic health records. And this involves thousands of hospitals. And we were very interested to see what's happened over time since this test came out. Have we made significant improvements in the safety of our EHR systems or not? And the simple answer is we made some mild improvements, but we still have an awful long way to go. And this is particularly concerning given the fact that the federal government had a meaningful use program that was supposed to make hospitals do well in every one of these categories. So one would say that in terms of improving actual hospital performance and safety their EHR system, the meaningful use program has failed. Next slide, Jon.

And this is basically the hospitals and the vendors that we included in the study. As you can see we included all the leading impatient EHR vendors. The hospitals that were included tended toward the medium size hospitals, but there were small hospitals and large hospitals as well. We had both rural and urban hospitals, private and, for profit hospital we had a good representation around the United States in this study. Next slide please, Jon.

And basically in the basic clinical decision support, remember those categories that I showed you early, hospitals did improve their performance moving from 70 to over 80%. But if you look at the advanced clinical decision support there wasn't a whole lot of improvement over this 10-year period. Very concerning because a lot of harm is tied up in this area of advanced clinical decision support. Next slide please, Jon.

If you look at the categories, as we did last time, once again you can see the basic decision support categories improved and were pretty good performance, but the more advanced decision clinical decision support categories were really not improving at all. And represent still awful lot of risk the patient in inpatient facilities. Next slide.

And if you look at the test performance by vendors it’s really variable. And vendor A is the famous one we've all heard about Epic and vendor B is Cerner. And look at the variation in testing results between Epic as A and Cerner as B. And then you look at Meditech, C, which is a much cheaper, less sophisticated system and it does better overall than Cerner does. So that's really of concern that Meditech which is a lower cost less sophisticated system is doing better than Cerner is. Next slide.

And if you look at all these vendors in terms of how well they do on the test you can see after adjusting for a variety of different things that vendor A, Epic, still does very well. Vendor B, Cerner, does not do so well. And if you look at the variation, basically bottom line is we can explain in our test about 15% of the variation. What we don't include in our test is those characteristics of implementation that David Bates talked about. So bottom line of this implementation is still the key how you perform on this test. Next slide.

We go a little further and we haven't published this in the JAMA study, but we have another publication coming with it and we asked the question: gee I wonder, if there are any relationship between which a vendor or hospital chooses and how they do on their quality reporting? And lo and behold, and we put a lot of factors in here to adjust ,turns out that people would vendor A Epic get better on their CMS quality star rating, they did better on their CMS readmission ratio. And vendor B actually did worse on both of those. No vendor was correlated with the CMS hospital acquired conditions safety rating program that thing based on the AHRQ PSIs, that didn't correlate at all. No surprise we all know that the seriously flawed safety rating system, no surprise there. But the fact that some vendors did well, hospitals with some vendors did better in quality reporting and some vendors did worse is, I think, a really important consideration. This will be the subject of an upcoming publication. But remember vendor B is Cerner, the one the VA is using. Next slide please, Jon.

The test is expanding we've gotten funding from AHRQ and from California healthcare foundation, The Moore Foundation to expand the test to focus on more areas of quality beyond just medication safety. And these are new aspects of the tests will be released next year. There will be a new component to test that take the choosing wisely campaign and built it into a way we can test the EHR system. We also have developed a module that focuses on hospitals decision support to prevent common hospital complications such as CLABSI or DVT. We've also added category of medication reconciliation testing, the ability of hospitals to do that and we have added a new category on clinical decision support usability. Next slide, Jon.

In addition we're expanding the test in the ambulatory arena. The test has been criticized for not having ambulatory component, we're adding it. Next slide.

And we're adding that because we used to have a safety net in the community pharmacy which would do all these drug checks so that even if we ordered something in the ambulatory clinic without indecision support the pharmacy, the community pharmacy would pick it up. Well now we know based on this study from Chicago Tribune, next slide.

And this study from the New York times, the community pharmacies are overwhelmed with productivity requirements and they’re not doing the safety checks that they used to. So in the future the only safety check that will be done, likely, is at the ambulatory clinic and that’s why we’re developing a test at the EHR at the ambulatory clinic. Next slide.

Here are the categories that we’re using in the ambulatory version of this test. Next slide.

And here are the initial results. And we should go by this one, just a quick look, there’s a lot of variability by vendor and you can see the vendor score for the one the VA uses on the right. Next slide, please.

I will turn it over to Jeannie Scott to share with you what the VA has done with this task. Jeannie it’s all yours.

Dr. Jeannie Scott: Okay, thank you. If you could move to the next slide. I’ll start with going over our project objectives. So we’re a program office in the Office of Health Informatics. And our focus is on surveillance and monitoring. And we came about this and we said as far as monitoring, how do we look at different methods for detecting the vulnerabilities? How do we know that across our enterprise if you look at one VA and you’ll look at another VA that we have consistent ways to detect vulnerabilities? How do we look at it within a facility? How do we look at it across different users type? And then given the scale of the VA we needed to look at what was a practical approach as you've heard Dr. Classen talk about the number of hours that are used in this. And I’ll go on and I'll talk about that in a bit. So those were two objectives: what's the methods that we can apply that will help us with monitoring for detecting vulnerabilities? And then also for sustaining that level of reliable use of it. So and this was consistent with the way that we're looking at high reliability. We want to be able to learn from what's happening and how do we quickly address vulnerabilities? Be mindful that this isn't simple as both Dr. Bates and Dr. Classen have both talked about, is that there’s a lot in a configuration. We wanted to be able to work with different folks. You know, what is the different expertise out there? So move to the next slide.

Just give credit to our project team, Dr. Classen who was on our team, Aaron Dietz, Danielle Kato, and Angela Laurio were all part of our project, provided different aspects of running the test among different facilities, giving clinical input. I’ll talk a little bit about data and then we had a contractor, Samantha Zybak that helped us with documentation and performing this. We’ll move to the next slide.

So just a little bit about how we went looking at this. First we wanted to find out, what does it take to do this? As Dr. Classen said, in the private sector as different facilities get used to it you know they can go from six to eight hours down to two hours. So we took a test system and we looked at it from a test system. And then we did a solicitation among VA facilities and it was pretty much on a volunteer perspective. I will say that we did not do this through Leapfrog, publicly reporting we had an agreement with the University of Utah, so they allowed us to use a copy of the test. I'm not going to go over a little bit of process, I really want to talk down here about the facility personnel needed. So as I mentioned we were looking to say what’s scalable, practical, feasible. And we look to see what does it take under the hood to apply this? You need your informatics expertise. You need your license provider. You need other aspects of the team at a facility to put this together. With our team doing curation of the tasks, each of these basically having these six facilities show up. We look at it takes about 4 ½ to 6 ½ hours just to do this initially. So let's go down to the next slide.

So what did we get out of it? I wanted to show here as David Classen has mentioned there's different categories. What does your system give you? And if you look under the VA expected it'll show what we have the capability to provide and then also what the task is. So when we look at these overall scores we have to look, did our technology even allow us to do that type of category? And then where does it allow other categories? So if I was to look at this I would say, well I definitely, for the features that are, that we can have we should be achieving 100%. As I mentioned we had several facilities, not all of them on the slide, but you could even see even just among the same facilities, the same vendor, so we’re all using our internal vendor you can see that variation. This is simple. So I like to say is what does it mean to get 100%? What does it mean to get 25%? What does it mean to get 75%? And how consistent is that? Let's move along and we'll go to our findings and some of their insights. And we’ll go right to the next slide.

So here's a little bit about under the hood. As we talked about configuration this is what we found as we looked at the different facilities and we looked at their particular scores against all of the different order categories. And we can see where there’s a variation in scores. So if we go down the second line drug-drug interaction, and we go across from left to right, we’ll see that our facility one had 75%. And then facility two and facility three reached 100%. And as we look at the configurations we see that that particular user in facility one had it disabled. Now these are all configuration settings, we think about them as data content. And I'll talk a little bit more about what that might mean for us as we look to see reliability of using the test from time to time. We'll go to the next slide.

Okay, and reiterating on that it's not just about the score but what was it that gave us a score. So this is as we work with each of the facilities we give them more prescriptive feedback. We didn't just come back and say hey you got 100%, or you only got 75%. We said send us your configuration so that we can help you understand what helped you get to 100%. So how do you maintain that? And then for an area where it did not reach 100%, why not? What did we see? And so this is the type of prescriptive report that we gave to the facilities. And then also the feedback of where even though if we look around the right-hand side, even though somebody may have scored 100% is that reliable from day to day, month to month, year to year? And as we looked at we said, hey on this instance that you did this test, yes, you got 100. But we also saw a vulnerabilities that your users can turn this off. You may want to reconsider that setting. And so this is a little bit more of the descriptive feedback that we gave to the facilities which helps to understand how do you maintain it over period of time. Let's go to the next slide.

We also looked at the differences that are displayed for the same CDS. So one of the areas of concern with CDS is alert fatigue and usability issues. And very thankful that Dr. Classen mentioned that the next part of this is looking at usability. So here's three different facilities, same system, different ways of the same dosage check will appear to each of the facilities. And if we look at this, we’ll say well, which one should I be looking at from a provider perspective and which one should I be addressing? And these are things that we need to look at to improve the way CDS works so that when we enable it, it is optimal to enable it and we’re balancing it with the usability issues. We’ll go to the next slide.

In building a little bit more about some of the human factors observations, so we’ll look a little bit deeper into this. Why might facilities or why might institutions be turning off their decision support? Based on the information that Dr. Bates and Dr. Classen has told us about, these are serious medical errors why would you be turning them off? So let’s look down the human factors part of it. Here's an example, this happens to be from the VA system. It could have been in any, you can find other examples in other systems. We talked about color, how do you pair different colors together. We look at the way things are emphasized in this particular example they're trying to point out to the provider that you're giving too much of a dose. And if we look at which words are capitalized, the word milligrams is capitalized but really what we want to say is, hey, this exceeds, this exceeds the maximum dose. So your eyes are shifted over one noun versus the verb. So that might give an indication of why, well, I can’t understand them, they’re complicated, let’s turn them off. The other thing is I want to point out in the lower part of this slide is again, how the different pops will show to a provider and how they’re addressed. In this particular case the pop up actually had more of a Microsoft Word or Microsoft Office look and feel. And as we were working with this particular group they dismissed it. It had defaulted to a yes, so they proceeded with ordering it. And they actually thought because they had so many things running on their desktop, oh, this is a Microsoft popup when indeed it was a pop up for the medication ordering. So again looking at design issues that affect how the results show on this particular test. Let's go to the next slide.

Another finding that we had is we were evaluating this assessment. It wasn’t, and I just want to reiterate, it wasn't, we weren't with the see what the score but really to understand more about the methodology and what else can it tell us. We also looked at the other ways that CDS guidance is provided. So if you look to the top of these two pictures there's blue lettering with underscore on it. That provides additional information about this particular ordering. Also down in the bottom of the slide on the left-hand side that info will also provide, there’s a blue circle with an I in it and that will provide some more information as well. This is what we call passive guidance and if we look at this there’s a lot of configuration to set up this passive guidance and is it really effective? How much does it help as far as, as we move through here. We’ll go to the next slide.

And here's an example of what that passive guidance looks like if you were to pull it up. Quite a lot of data but is it really providing information for this ordering process? We'll go to the next slide.

The other part that we talked earlier about some variability. So even if we talk about it from the passive guidance, these are three facilities, I pointed out just one of the drugs highlighted there in yellow is even among the same medication, same system, different paths of guidance is given. And totally different type of guidance. We'll go to the next slide.

We also want to understand how does all of this system functionality influence how you score it? So in our case we were, we were the team that was scoring it. So the facility was just on the other side of a virtual session and their role was just to perform the test. But then we had two of our evaluators, Samantha, and Aaron, they were recording it with Dr. Classen helping us as well, and then they had the guidance on how to score this. And the question that we raised though, how would the facility have scored this? So this says that the dose and check could not be done. And this happened to be behind the scenes of the way the medication is mapped and configured, whether or not the system could perform that. But would someone had said, hey, it gave me a dosing check or would it have said, no, this one’s not appropriate. We’ll go to the next slide.

Here's another example, is this valid for credit? So one of the categories is drug test, drug laboratory values and in our particular system that order check for kidney function comes up based on the patient not the medication. So once you open up the patient’s chart and you go to proceed to do a medication order, the order check comes up. Doesn't matter what it is. Doesn’t matter what the medication is this comes up. So in this particular example this would not have been given a credit for it because it wasn't specific to the medication and the category that was being tested. We’ll go to the next slide.

So what should we, what do we else want to look at this? So I want to give credit to Aaron Dietz with he adapted this particular, evaluating the impact looking at Kirkpatrick’s learning model. And the first thing was looking at the reactions. What was the perception of the utility? And as we talked with the different facilities afterwards and ask them what did they think of it, they were like, most of the perceptions really was, we didn't realize we had these settings. And so it gave them a sense of awareness. So the first part about running it was I’m now more aware of what my system configurations is. We have to take into mind that there is attrition of staff overtime and so settings may be set, and they may not be monitored overtime as we go into sustainment. And then we asked them, what did they know, anything different? Were they going to change anything afterwards? What was their learning about it? We haven't had a chance to follow up with the facilities but many of them indicated that they were now going to review their configuration in light of their results and address where there may be vulnerabilities. The next two areas which we have not yet looked at was how did this translate to organizational changes? Setting up a system requires a level of informatics expertise so as we look at it overtime and you're changing, you're having attrition or you decided if we look at it from a social technical model, a facility has to make cuts. Do we provide, do we have another primary care provider or another informatics person? What type of skill sets do we have there? And how does this type of a test help a facility through the organizational changes? And then the result. So David Classen had talked about retaking it the next, in another year. How do we go through this and look at other ways to improve safety? How often should we do this simulated retest? Six months? One year? Eighteen months? What are, now that the, we have more robust system that we have corporate data warehouses and other ways to get to the data, are there additional sources that we can look at that can give us another meaningful look what this test provides for us? And does the actual clinical data support results? What’s the confidence of reliably achieving that stated result? One of the areas that we wanted to look at it is from the behavior and the results is balancing wet getting a passing score, or your acceptable score and balancing that with the usability of the system and the human factors, and alert fatigue. Look at the next slide.

So one of the future directions that we've been looking at is starting to explore activity traces. So we can go, and we can simulation is a wonderful way to look at a very specific pattern and methodology. As I mentioned, it does take a certain level of resources and as facilities through the VA and other areas and all their demands is how much can you put on retaking the simulation? Are there other ways to do that? So Angela Laurio from our team, we explored using the data to also evaluate it. And this is a poster that was presented at [unintelligible 44:25] just about a year ago. And so we took the same set of patient criteria and the drug ordering and we looked for that within the Corporate Data Warehouse to say how well would that compare using the, what we did in simulation with what the actual data is. And so this is really to say if we were to outline the ideal settings, do we really need for everyone to take the simulation or could we check it with data? So this is our first exploratory [inaudible 44:57] how can we look different data traces for it? And as you can see in the chart below, how are different hospitals where their EHR data showed in blue and then the simulated order entry in orange. And you can see it you know in hospital one where they received a 75% but then when we looked at the data, their actual ordering patterns we actually saw at 92%. And where that variance may be, which we have to look further at, is in hospital one we saw a particular user setting. So when we look at the data we actually look across all users. And that can help us even target areas of intervention. We’ll go to the next slide.

So to sort of wrap up a little bit the CPOE assessment tool is a snapshot and that’s what we saw was a as we did it with each one of our facilities it was in the in the particular configuration that we currently have in the VA with CPRS, Vista it was a snapshot of that provider at that point. We do have an opportunity here is to learn more about our systems and what the simulation also offers us is a standardized way to observe user and system behaviors. And so we can actually compare use with the results of it but then also look at what, how the users are actually behaving and interacting with it. So you can do some comparisons there. We're also looking at what's the impacts of completing the assessment as facilities do this. Are they actually making changes are they able to make those changes and both Dr. Bates and Dr. Classen talked both talked about the impacts on safety. One of the points I want to bring out as we move to move that score towards where that ideal point for that score, and even as we look across different clinical ordering patterns, how do we balance that with also the unintended consequences such as alert fatigue or alert overrides? So we can say yes, your system can get this score. One of the things that we can record here currently in the VA is if someone overrides it. So how many times are we overriding them and how do we begin to make a more optimal thing? I firmly believe there’s an untapped potential of exploring the activity traces to give us another view in addition to how we do the simulated orders. And a point that I want to bring up is how are we measuring effectiveness between evaluations? As has been mentioned these are highly configurable systems and as you have different changes going throughout the time period you’re going to have system upgrades, you're going to have policy changes, you're going to have you attrition of informatics staff. And how do we make sure that these systems are 365, 24/7 reliable? That either I take it with one provider, or I take it with a pool of 100, which really isn't feasible to take it with a pool of 100. We talked about scalability. How do we begin to measure it that effectiveness between providers between evaluations? And do we have this opportunity to get to look at other ways to look at this. One of the other areas that we explored this year in complementary to Dr. Classen, and we're looking forward to working with him again this year, is exploring the other clinical risk domains for ordering. So we can have CPOE can be computerized prescriber order entry. I like to think of it is computerized provider order entry. So in the domain of imaging orders MRIs, contrast reactions, other types of contraindications for imaging, can we look at it and other ordering as far as dietetics, nutrition, food, drug allergies, food medication interactions? Are there other areas that we can explore to help assist as far there? So overall we found that there is many insights to using the methodology and we’ll be continuing to explore it and hoping to share more of our results as determine how uses this in such a manner that it does help us become effective for mitigating or preventing the risk or use of the various forms of health IT including prescribing of medications. At this point I’ll turn it back over to you, Dr. White.

Dr. Jon White: Alright, fantastic. I want to thank my presenters so much. It is fantastic work and thoughtfully laid out for the audience. I’m going to offer you just like a minute of commentary and then I hope if it's okay, we can try to turn to a few questions. There's two in the Q and A box. And I got some more my head if we don't get any additional ones. So I introduced when I introduced myself at the beginning I said it was the ACOS for research and development Salt Lake which is true. What I did not say is that I've been here for a year. For five years before that I was deputy national coordinator health information technology at the Department of Health and Human Services. And for 10 years before that I was at the agency for healthcare research and quality where I was the director of the health IT portfolio which is now the division of [unintelligible 51:24]. It's been a real privilege over the past 15 or 16 years to work with David Bates, David Classen, Jeannie, Jonathan Nebeker and just a host of other folks that have really been drill down into how do we use health IT to improve quality and improve safety? You know after listening to this presentation, yeah, so you may say oh my gosh. You know, what are we doing? What are we in for? And I want to offer the following thought to you that this sort of examination, self-examination and inquiry is exactly the kind of thing that a high reliability organization does. And that is not only a general [inaudible 52:21] to be but an explicit goal for the Veterans Health Administration is to become a high reliability organization. We take a look at what we do critically, and we try to identify places where it's not going as we want it to and then try to figure out what to do about it. So the positive leavening of all this is that, in general, you know the evidence shows that use of health information systems does improve quality does improve safety, but it can come with this it's really how you do it and how you use it. So not only do you want to get through things like workflows in advance, which I know that Jeannie's office has been doing, working very closely with the HRM but digging into the actual use of these systems and figuring out what switches have been turned on, what have been turned off. Are we getting the outcomes that we want? And that's the sort of thing that this kind of intervention does. The other positive note that I'd interject is that this is a perspective invention. Taking this test and taking a look at how you're doing on this can be done really even before you see patients if you want to do it that way. And is a tool in your arsenal to be able to think constructively about how you try to do things better. So order entry is one dimension of a really multidimensional information system. The VA is rightfully well known for advanced use of health IT in the delivery of care and it was really one of the components of the care that has that happened over the past couple of decades at the VA. And will continue to be that way as long as we can kind of look at these things you know from how do we get better you know kind of point of view. Okay so I want to throw, there's two questions in the Q and A , the first one David Bates, I hope it's OK if I put it to you. And here's the reason why I'm going to do it so this is the question about what should the VA be doing during the current transition from Vista to [inaudible 54:52] EHR during the go live with respect to health IT and patient safety? Those of you who may be fully VA focused and not know a whole lot outside of health care delivery systems may not know that within the past several years partners transitioned from a homegrown, or in fact several homegrown systems, to a commercial EHR system. David do you have any wisdom for us that you may have distilled from that experience to share with our colleagues here at the VA about what you can be doing during the transition from an information system to another with respect to health IT and patient safety?

Dr. David Bates: Yes, definitely. There are many lessons and I would say we haven't done as well as I would have liked. One is I would make sure that you have things set up so that users can give you feedback in a continuous stream and then you can look at the things that come in and you can, you can fix them as they as they come in. We had so many that I can't even believe it. There were things like our pharmacy was not in the in the list of pharmacies that you could order when we started if you put at Brigham, you got a pharmacy in Utah. That's an extreme example but I want to come back to what, and I would say you should take this test early. When Jeannie said people said they didn't realize what their settings were, that's what everybody says. And as things break over time and not only is there a staff turnover. And another point I want to relate to you is that we've showed empirically, this isn't published yet, but organizations that get lower scores improve more in the next term. If you take the test you find out that there are a few things that aren't there that is a strong motivator to get those the interventions in place.

Dr. Jon White: Fantastic. We’ll see how we’re going to do with time. Jeannie, I'm going to send this question to you. And there's a couple that are good, I'm worried that we're not going to get time to get to all of them. But let me start you off with the one that asks has this already been used at the VA to understand potential at differences between CPOE in Vista and CPOE in [inaudible 57:27]? And I will kind of give you a part two of that which is how white might we use this, or other tools if you want to talk about them, to improve our use of Cerner which we will be transitioning to the next several years?

Dr. Jeannie Scott: So to my knowledge this has not been used systemically through VA. My understanding is the evaluation that I discussed where we looked at six facilities. We looked at two of them in their live account and others were in their mirror accounts. That was really just to get an assessment of what it would take to implement it. So as I mentioned in the talk this is about scalability. We have 130 plus facilities, plus or minus how many divisions that they have. What we did find is we were able to find what's the baseline. And it kind of go to one of those other questions that someone says how does CPRS perform on, well they said on the Leapfrog. I don't know how we do on the Leapfrog because I'm not sure that VA has subscribed to Leapfrog. How does CPRS perform on the CPOE assessment? There is one of the slides in there and you will see the VA expected for drug dose, single drug dose daily, drug-drug interaction, therapeutic duplication, and drug allergy our expected score is 100%. In the drug monitoring we expect a 25% score. There were certain areas that we don't have yet in error-based system. So moving to how could how could we use learning what we have in our base system right now and then also what the opportunities that Cerner Millennium has for us. You could use a test like this to say I expect to have the same level. So we think about in the lifecycle you want to use this at your early adoption. You'd want to use it during maintenance, during your sustainment period. And also an opportunity to look at it is during those conversion periods. Can you use it beforehand in a prospective area to say here's what here's what the build looks like and as we're putting it together before we go live, by the way I put in several hours over the weekend on our first go live. Yay VA.

Unknown Speaker: Yay VA.

Dr. Jeannie Scott: Yeah it was, hey they had a snowstorm at a power outage on the night of go live and we have our first site up and running and kudos to all the people that have made that together. It's a test like this that helps you be prepared to make for successful go lives. Know what to expect before you go in. And so I think that there's an opportunity here to apply it in some of the builds that we have beforehand so that we know where we're going to get those improvements. One of the reasons that facilities do go to another, upgrade to another vendor is they want to have an improved performance. So here's a way to where you can actually have, reducing all the variables, you're using the same methodology to test your pre and your post. Test it with CPRS, test it with Millennium. I will say Cerner has a very extensive playbook that I've had the opportunity to just begin to look at where they describe how to go about the process for taking the tests. It's one of the areas that we've also looked at too as we've put together a playbook that if the facility would want to take the test here's the playbook of how to go about doing it. So I hope that addresses those questions. I think is throughout the lifecycle there's opportunities to use it with your current system, when you're when you're making changes through maintenance and sustainment, and then as you begin to go through that lifecycle of converting over to next system, it gives you a standardized way to do it whether it's this methodology of the EHR flight simulator or a suite or a set of methodologies that allow you to do those comparisons and monitoring.

Rob: Jon, we need to think about wrapping up in the next couple of minutes.

Dr. Jon White: Okay.

Unknown Speaker: I make one quick addition to Jeannie’s. In the private sector there are quite a number of hospitals that have Cerner that have scored 100% on this test. So it is possible with Cerner to get 100% of all of this.

Dr. Jon White: Okay and that's I think a positive way to end it so thank you for everybody who ask questions. I will try to work with Rob and our colleagues at CIDER to try to get them answered offline as best we can. I really want to thank the presenters Dave, Dave, and Jeannie both for the work that you've done over the years as well as your presentations today and I'm looking forward to working with you more. And thanks to our colleagues at CIDER for letting us talk about an important topic.

Unknown Speaker: Thank you Jon.

Unknown Speaker: Thank you everybody.

Dr. Jeannie Scott: Thank you.

[ END OF AUDIO ]