

A National Web Conference
The Socio-Technical Aspects of Health IT
March 28, 2007

I want to welcome everyone to this afternoon's call, the Socio-Technical Aspects of Health Information Technology. Let me turn things over to this afternoon's moderator Michael Harrison, from the Agency for Healthcare Research and Quality, and Michael will introduce the panel and get us started.

Let me provide a little bit of background on the webcast. Our speakers are Pascale Carayon, who is the Proctor and Gamble Bascom Professor in total quality in the Department of Industrial Systems Engineering, and Director of the Center for Quality and Productivity Improvement at the University of Wisconsin at Madison. The second speaker is Ben-Tzion Karsh, who's the Associate Professor of Industrial and Systems Engineering, also at the University of Wisconsin in Madison, and the third speaker or presenter is Ross Koppel, who's a faculty member in the Department of Sociology and Center for Clinical Epidemiology and Biostatistics in the School of Medicine at the University of Pennsylvania. All three of our presenters are AHRQ grantees and there are detailed bios available in the Biosketch section of your Web Event Manager.

Among several other health information technology grantees, Pascale, Ben-Tzion, and Ross have presented their ideas at AHRQ patient safety HIT meetings over the past couple of years and we have all discussed these at those forums and a variety of other forums. Now we have the privilege of sharing these ideas with you through this national webcast. Our hope is that you'll find the ideas presented here generally useful in your own work, so we really would welcome your feedback on the value and usefulness of the material that is being presented this afternoon and of course on the presentations.

Our format is very simple. Each presenter has planned a very brief presentation, which is really just a way to stimulate questions and discussions among all of you and among the presenters, and each one will only speak about ten minutes, and then we'll have about five minutes of questions on the particular presentation. And then when we finish that round of three presentations, we'll open up for general questions and additional questions for particular speakers.

The order of presentations moves from general principles of socio-technics which will be presented by Pascale, to the implications of this approach for implementation, which is presented by Ben-Tzion, and then to some of the realities of HIT operations that confront us as we move into the implementation process, and that third presentation is by Ross. Brian, unless there are other procedural issues, we can turn right over to Pascale's presentation.

Have you ever observed clinical IT users employing -- observing HIT ways that were not, I believe, ways that were quite different from both, that were originally designed? Question three is: Have you ever been involved in introduction of new HIT -- that's health care information technology -- which encountered serious unintended consequences? And the last question is: Suppose one of your colleagues asks you to -- about the contribution of socio-technical approaches or approach to the introduction of HIT, would you feel comfortable explaining what that meant?

Going to the third question, I think we have motivation to hear some basics on the socio-technical approach from Pascale, looking at the distribution. And looking at the distributions on the first two, and colleagues that are waiting to see it differently, it looks like there are a fair number of surprises out there and a fair number of them are unpleasant. They certainly correspond to other things that we've been hearing. Any of the folks want to comment on my reading of the data?

Why don't we head on then to Pascale's presentation.

Okay, thank you, Michael. Okay, I have been challenged to talk to you about the basic concepts of socio-technical systems. I wanted to start with an old story. It's a paper that was published by Train Studies in the U.K. That study was published in a journal called New Revelations in 1951. That study is a very interesting study, looking at the implementation of the new technology in coal mines in the U.K., and the main theme of the study was to show that technological change had huge impacts on the people, on the

A National Web Conference
The Socio-Technical Aspects of Health IT
March 28, 2007

organization of the work, on communication, and that was really one of the very first studies that showed the importance of looking at the implementation of the technology in a socio-technical way.

So a lot of these ideas regarding socio-technical systems have been around for quite some time. One of the basic definitions of the socio-technical system is that it is comprised of two systems: the social system and the technical system, and that entire socio-technical system interlocks with the environment. The important thing about a socio-technical system is that interface, or that interaction between the two subsystems. So the theorists in socio-technical systems have talked about joint optimization or joint design of the social subsystem and the technical subsystem, so it's really almost impossible to think about a technology on its own, because the technology interacts with the social system.

There are a lot of popular principles about socio-technical system. If you are interested, I have listed at the bottom of this slide some of the references. Another way of looking at the socio-technical system is to use that block system model that my colleague Michael Smith and I developed a few years ago. It gets more to the elements of the socio-technical system, and we have found that way of thinking about the elements of the socio-technical system quite useful. At the center of this system is a person, and in the case of health care, sometimes the person is a health care provider or a physician or a nurse, and you could also consider the person as the patient or the family of the patient. So there is the person at the center of the system.

That person uses different technology for various tasks. All of these tasks are performed in a particular physical environment, and then there are all kinds of organizational issues -- the structure of the organization, how words are defined, the schedules, policies and procedures. And so they all have these organizational issues that are also important in understanding a socio-technical system.

As you can see in that graphical representation of a socio-technical system there are elements, and it's important to understand each of the elements of the boxes, and the people, what are they all doing, the tasks, what tools and technologies, where the tasks are being performed, what kind of physical environment -- the lighting, the noise, and so on, and what's the organization like. It's also important to understand the interactions in the different elements, and so there are plenty of arrows going from one element to the other. So that's the essence of the system.

Our team at the University of Wisconsin, the SEIPS team -- SEIPS stands for Systems Engineering Initiative for Patient Safety -- has used that system model and integrated it with a quality model. We defined three elements -- the structure, the process, and the outcome. What we have done is use the box system model to define those care processes. We think that it is also important to understand the outcomes. We talked about many patient outcomes. We believe that it's also important to look at employee and organizational outcome. For instance, what happens to people when technology is implemented? And we believe that there is a relationship between patient outcomes and organizational outcomes.

So let me go back to the (box system) model. Again, this is one way of describing a socio-technical system. So when a technology such as a health care information technology is implemented, what that does is change that technology and tools box that we showed with the large red arrow on the graph. What that change then means is that there may be all kinds of consequences and you've heard a lot about unintended consequences. I showed you that some of these consequences can be planned for, and I will get back to that idea at the end of my presentation, but whenever implementing a technology, the system makes impacts, impacts on each of the boxes in the system, and on each of the other elements within the boxes.

So I'm just going to use one example. CPOE or computerized provider order entry is a technology that has received a lot of attention. A lot of research has been done on it. So let me just use that as an example, and so I'm going to talk about some possible impacts or some possible questions when looking at the implementation of CPOE. So CPOE is one technology that's going to have multiple impacts, multiple consequences, on the elements of your box system. Again, I'm going to talk about some

A National Web Conference
The Socio-Technical Aspects of Health IT
March 28, 2007

examples of impact. It's not going to be an exhaustive review of the total impact of CPOE. So the example is meant to show you some of the questions that we ask, when looking at the socio-technical impact of CPOE.

First of all, who is impacted?--of course physicians. They're writing the orders but there are also nurses and other health care providers that are impacted and maybe other staff. So it's important to think about the people who are directly and the people who are indirectly impacted by the technology.

How does the technology change the task? Of course, how the task is being performed. The CPOE may make patient remitted information more readily available, so that's an impact on the task; sometimes it may be too much information. It may be information overload. Again, that's a characteristic of the task.

How does the technology change the duration of the task, would be another example of a question that we'd ask when looking at the systemic impact of CPOE. The environment -- is another characteristic of the box system-- issues such as location of computers, issues of remote access, issues related to the work station design. There is a lot of information available in the literature on how to set up good computer work stations -- good table heights, good chairs (these people have to sit), good keyboards, good lighting, and so on.

When thinking about such a technical system and the impact of HIT, it's important to look at the technology itself, and how it's designed. For instance, looking at the usability or lack of usability of the interface and the reliability of the technology. There may be all kinds of organizational issues. Again, I have listed only some of them, workflow being an important one; the training, the type of training, and the external design or the technical support that's available during the transition, as well as after the implementation.

So again, this is just an example. Technology changes our tools and technology within the box system has all kinds of systemic impact. One of the issues I wanted to talk about in conclusion is it's possible to do a lot of things in a planning stage, at the stage of designing the socio-technical system. I mentioned already the availability of some information about work station design, information that's provided in human factors literature. We also know a lot about interface design, about usability. We know a lot about how technologies sometimes create additional stress on the individual workgroups -- for instance, in the form of information overload.

So there is a lot of information that we know about how to design group box systems that can be used when planning the implementation of an HIT. There are a lot of proven methods available -- task analysis, job analysis, box system analysis, looking at workflows, doing some type of prospective analysis to understand some of the potential consequences, negative or positive consequences, on the patient.

So I think it's important to mention that there are things that can be done at the planning stage, and the design stage. My colleagues, Ben-Tzion and Ross, are then going to talk more about the implementation and then the use and the continuous change aspects of HIT.

In conclusion, I just wanted to show you the way one of my colleagues in Australia looks at the world. He looks at the world in a very different manner than I do. So when you design and implement a technology, again, it's important to think about that person at the center of the box system, and think about how that person thinks about the world, how they think about their own box system, and how the implementation of the HIT is going to affect them. Then as a person is trained, their past, the environment, the organization, and then of course the design of the tool is important. So thank you very much.

Thank you, Pascale. That was very brief and to the point, and it's left folks with questions and some of them have already come in. Okay, thank you Pascale. There's one question from AR. Do you have suggestions for an organization with evaluating workflow environments, et cetera, is it really important?

A National Web Conference
The Socio-Technical Aspects of Health IT
March 28, 2007

I think that one reaction I have is that if you don't spend time thinking about some of the socio-technical impacts of HIT, it's probably going to bite you later on. So there is some investment that needs to be put in early on. The point that Ben-Tzion and Ross are going to make later on is that they're probably not sufficient, that there are a lot of things that we cannot plan for. There are still things that we cannot expect with the technology in use and understanding that is important. So I think that not doing all of that analysis may come back and bite you later on. The other thing is looking at it as an opportunity to look at the way our box systems are designed and make some improvements -- making some improvements around our tasks is more interesting, so the physical environment fits better with the way people do their work. So it may be part of a quality improvement, organizational improvement strategy of looking at some of these elements. I don't know if Ross or Ben-Tzion going to have anything to add to that question.

The only thing that I would add is that one of the ways you may be able to convince others, right now, is to look at the newspapers and the scientific literature--they are littered with examples of institutions that didn't actually look at how their technology would integrate with the physical environment and the workflow, and they had to throw systems out, or they ended up having to spend additional millions to make the modifications afterwards, because they hadn't done their homework.

I think if you look at even any of the basic information that consultants and researchers talk about for what helps ensure a successful change, it's understanding the way your current system works and understanding how that change will then influence it. So I think you might have a lot of information out there that you could help share with your hospital.

One additional thought that I would have is that the human resources folks may turn out to be potential supporters of this kind of approach. And there's a huge problem right now of shortage of nurses, and particularly shortage of really highly qualified nurses, and there's a lot of research that shows that the climate in an organization has a major impact on the people's desire to stay or leave. As Pascale was explaining, changes in technology and the way technology is introduced impact organizational climate. We tend to think of the climate as a barrier to technology, but the climate is also shaped by the way we use technology and the way technology gets used, and that's really why I think there could be a lot of dialogue between users and IT, which at the moment is not really taking place.

I'd like to add one point, and that is the Houston study that indicated that almost all attempts of introducing CPOE had serious problems, except those of home grown systems in large institutions, and that's because a homegrown system, as it's being developed, is by definition interacting with the rest of the hospital and the like, and over the long run is doing that kind of analysis of workflow and environment that has to be done for a system to effectively work. So they sort of blended into a new site that wasn't part of their original examination, but I think it does speak to all of us.

Thanks, Ross. There are two questions that the other panelists can see, one from MM and one from DC. Ben-Tzion, I think I'd like to ask you to start, and perhaps as you go along, you can comment on this question, which addresses the culture of an organization. That is really a fundamental element of successful change effort, and I think that that covers some of MMs question as well.

Okay, so you want me to just go ahead and get started?

I'm wondering if you can sort of think about that culture issue as you go, and all the rest, as we think about it. I'm sure we can come back to it if you don't address it.

Okay, absolutely no problem. So thank you everybody again for attending, and we will continue to do our best to keep up with all of the questions. As I'm talking I'm seeing more popping up, and hopefully we'll get to all the missed questions again. So what I'm going to be talking about now is hidden issues in input and implementing technology, and I'm going to very briefly go through a summary of information technology science. I thought what I would do is actually start with a story that I think will resonate with a lot of people who are on the teleconference. This actually is a deidentified story that came to me from a

A National Web Conference
The Socio-Technical Aspects of Health IT
March 28, 2007

nurse that was taking a course that I was teaching on human factors engineering for patient safety, and the module that we were in, coincidentally, was on technical systems.

So, like many facilities, our information systems department has acquired all kinds of technology based on separate departmental and individual requests. A lot of this story's system becomes outdated. In its creation, the information system department has let departments pick their choices, usually with little regard as to how it will interface with the main system for patient registration, et cetera. Each department insists on buying the program that is the best for their specialty, and they're usually under a lot of time constraints. I've seen a scheduled event and near misses occur time and time again because of the lack of communication among partner systems.

For example, pharmacy to ancillary departments to receive allergy information, et cetera. The very computer systems we have installed to try and improve productivity and communications have created new safety problems and frustrated staff. I think that one is important -- I'm going to pause here -- a point that Pascale made in her model is that when you integrate a technology, you really have to be concerned about the impacts both on the intended users, such as the physicians, nurses, and pharmacists, and also on the patients. And here these nurses identify that we have safety problems for patients and we're having problems right now for the staff. Remember that those problems, that the staff experience, can translate into additional problems for the patients.

So moving on to the story, recommendations for root cause analyses have led to begging the information system department for customizations to our main system. Each customization has been complex and very expensive. To make matters more complex, our IS staff is off-campus. Staff feels that they have little input into the system until enough problems occur the administration takes notice. The system was purchased in a hurry. This was an older one due to Y2K. She then goes on to say, I have an interesting perspective on the interaction because I was in patient care until five months ago. Never did I look at the relationship between the human side of my work and the computer system I use daily. And as Pascale was just saying, that is the main message.

So the hidden issue, basically, which comes to implementing your HIT, is that a technology change is tantamount to an organizational change. In fact, I would go so far as to argue there is no such thing as a technology change, because anytime you put in a technology, it is necessarily going to change things in the organization, whether you planned on those changes or whether you didn't. So Michael, to get to one of your questions, I have in the first bullet, your structure and your culture may be affected. People don't often think about it, but if you put in a technology, it may actually serve to either flatten it or create more levels, and it certainly will affect the culture. I think people often times think of culture as this touchy-feely thing, but in fact you talk about it a lot in engineering because culture fundamentally is the way we do things here. And when you put in a technology, you're now doing things here differently.

So I do most of my research on bar-coding systems for medication dispensing and administration, and I've seen plenty of cases where a barcode system is actually integrated into the culture the way people want their work to be conducted, and I've seen other cases where the culture changes, because now the way that we do things here for the nurses is very different. They feel they're rushing more. They feel now that they're treating their patients more just like a number, and that's not the fault of technology, it's the way that it's integrated.

I also note implementing a technology may require organizational changes to accommodate the technology and other technologies. So one of the things you saw in that story was we had a big interoperability problem that they had to invest more and more money in to solve, and that's the thing we're seeing right now with CPOE and bar-coding and electronic health records. How are all those different systems, often times from different vendors, supposed to talk to each other? And if they don't talk to each other, you as the people in the health care organization end up having to make up the slack and do additional work that wouldn't need to be happening if the technologies already spoke to each other.

A National Web Conference
The Socio-Technical Aspects of Health IT
March 28, 2007

And finally, implemented technologies may have to be designed to better accommodate the organization. Now, homegrown technologies, by definition, are grown to accommodate the organization, and yet most of you are dealing with off-the-shelf and vendor technologies. Those are not necessarily designed to accommodate what makes your organization unique. And each of your organizations are unique, and so there needs to be that dialogue, and not just acceptance that this is how the technology is, but to make sure that you're actually testing it, that it fits in the way that you want your work to flow, given the culture that you have.

I bring up the box model again, just to reemphasize the points that I just made, and that again, if you make a change to the tools and technologies, as Pascale was showing, you will actually have more ramifications for these other boxes. The technology change is in fact necessarily an organizational change, and we can't actually separate those things.

The next slide is the same picture, but with some more detail, to provide something that could almost be used as a checklist. What I'm going to go through is just to show how you can actually use this as a checklist when thinking about health information technology implementation. We have this puzzle piece on top, and that says you have the patient and provider, and that patient and provider work inside of a unit, or a clinic, or a hospital, however you want to think about that. And that unit or clinic or hospital has past demands, it has certain time available, it has already-existing technologies that are used, it has a sort of physical layout, it has the temperature, lighting that it has, and that unit tends to be in a larger organization, or that clinic is in a larger organization. And that organization has policies, and it has reward systems, and it has financial packages, and it has a culture, and it has a management structure, and of course that's all part of the larger health care industry.

Now think about what happens now when you drop a technology into this. The technology now has to somehow work, if you want to avoid unintended consequences, with all those layers and factors that Pascale talked about that already exist. In the middle, you see again these transformation processes. These are things that you can actually think about in terms of user performance issues that we need to think about.

When it comes to bar-coding, for example, if I'm a nurse, one of the things I know that I'm going to have to do is be able to sense and perceive the information on my little handheld scanner. I may have to just be able to search through the information. Perhaps now that I have this point of care information, I'll be able to rely less on my memory. But you can use this proactively to say what actually do we want the nurses to be able to do? And I can give you an example of an unintended consequence when these human performance issues from a socio-technical point of view weren't actually considered.

I'm going to go right now for searching and memory. Currently, in the paper environment, most of you use a paper medication administration record for medication administration, and on that single piece of paper, and often times nurses make their own little cheat sheets, but what's brilliant about the cheat sheets is it provides the nurse with all the information he or she needs to be able to plan their day. It has the patients, the meds, the doses, and they can go ahead -- and the times -- and they can figure out their day from there.

With hand-held barcode scanners, the only way for the nurse to actually even see the medication because the font is so small on the handheld device is they have to take out a stylus and scroll through that little handheld device. They now actually have to search to go through the handheld device, to find out what the actual medication is, and what the dose is, and what is the route that we now have to provide for our patient.

In my opinion, that wouldn't be good attention to the performance requirements that that nurse has, one of them being, being able to plan their day. In this particular institution, all the nurses actually still carry the paper cheat sheets, because the technology was not designed to accommodate their performance needs. And you can sort of go through with the other bullets. And then again, if you're not accommodating the needs of your nurses, your pharmacists, or your physicians, then there are going to

A National Web Conference
The Socio-Technical Aspects of Health IT
March 28, 2007

be implications on outputs. If the nurse is unable to actually go through and use that handheld device, it's actually going to be harder to make decisions and know what to provide for that patient. That frustrates the nurse. That upsets the nurse, and of course then decision-making can be affected on that patient. This is really just a more detailed representation of that model to help you think about the specific types of inputs and the specific processes that you need to consider when you're implementing a technology.

Now the good news is when it comes to technology implementation, even though there is a lot of consultant information, there is actually an entire scientific body of evidence that provides guidance to explain what can you do to help ensure that when you're choosing a technology, your implementation of it is going to go smoothly to help minimize -- not totally eliminate, because that's impossible -- but at least minimize potential for unintended consequences. And the bodies of knowledge that are really at the foundation of this science, the first one is open systems theory. Socio-technical systems is one of these open systems theories. It's just a theory that explains how elements interact together and how there is feedback, socio-technical systems being specifically a foundation. There is a lot of behavioral science evidence from psychology and also sociology that comes into play. Also, communication science, and also information that comes from organizational behavior. All of these different areas actually contribute to empirical evidence that help explain how you should go ahead and implement a technology.

The specific literature comes from concepts like diffusion of innovation, or technology acceptance, management of information systems, organizational justice, participative decision-making, et cetera. And what these all do is actually then provide you with evidence-based guidance. Just like you would want to practice evidence-based medicine, you actually have evidence-based science to help you understand how to go and implement a technology.

Now what I have done in a book chapter as well as a paper is really summarize the different factors that we know contribute to implementation's success, and when you look across all of the hundreds of studies that have been done, they boil down to these groups, and you'll notice these familiar categories: technology, organization, social culture, or individual person, just like Pascale has been showing you with the SEIPS model.

Now what's important to realize here is how to actually use this list and integrate it with the SEIPS model. We can all say, well obviously the technology should be easy to use, but what's not so obvious is what are all the uses that need to be easy? When we've taken the hand-held barcode system, while it's certainly easy now to carry around because I can drop it in my pocket, but it isn't easy any longer to actually see what are all the medications I have to give to my patients. It isn't also necessarily easy to know whether or not I have a match. Sometimes the beeps that indicate a match blend in with the background beeps that we have from other machines that are going on.

We like to say usefulness -- well, obviously it should be useful. But useful for who and for what? the nurse has to be able to find it useful for his or her job in giving medications, but it also has to be useful in how it integrates with other technologies. It also has to be useful to the organization from a safety and from a return on investment view. You can really go through and start thinking about all these different qualities that one must consider when going and implementing technology.

Same thing if we go to the next cost of the organization. We all say, well of course you need training, but training, as I'm sure you've all experienced, can be very awful and very useless, or it can be very good, and there's a whole scientific body of literature that explains how to design good training. I'm noticing that I don't have a lot of time remaining, and so I'm going to jump to this individual person one that often throws people. Because we know that age of the users determines whether or not we have success. We know that gender, believe it or not, determines whether or not we have success.

And I want to be clear that I'm not suggesting that all of you should only pick clinicians and providers that are of a certain age or gender. But what that actually means is that knowing that people of different ages have different performance issues -- that is, as you get older, it's possible it will be harder to see small font, and we know that our hearing performance also goes down. We have to make sure that our

A National Web Conference
The Socio-Technical Aspects of Health IT
March 28, 2007

technologies accommodate the range of individual users who are in our organization. And in all your organizations we have older users, and we have younger users, and if your technology can't accommodate their performance needs, then your technology actually is not going to work inside of your organization.

When you actually think about what do we do with all that information, the good news is you can directly translate it into implementable, strategic items for technology implementation. These practices are actually based on the scientific evidence. And I'm happy to take questions about it later, but basically each of these things maps to making sure that your technology can be implemented successfully, but they all have a lot of details, and I'm just -- because I don't have a lot of time remaining, I'm going to focus on end-user participation. All of us, for example, have heard that it's important to involve end users. But if we look carefully at the science, we find out that that is not a simple answer. If we involved our nurses or physicians too early in the design, when we're thinking about the actual database structures, we're probably not going to do much service to them, because most of them don't understand database structures. There's a right time to involve, and there's a right way to involve, making sure that their input is actually being used and they don't feel that they're wasting their time. And each one of these has a scientific basis for how to actually design a particular strategy. I'm going to end right there, and I'm happy to take questions now, or after all the speakers, thank you for your time.

Ben-Tzion, thank you very much for being a true soldier in terms of packing a lot in 15 minutes. You can e-mail any of the individual presenters for reference, footnotes, and what have you. A question came up which I think was a generic one, and that has to do with how applicable the kinds of things that both Ben-Tzion and Pascale presented are to ambulatory practices, and Ross to comment on that. Ross, do you want to comment?

Sure. I was speaking with a physician who has one of these new systems for ambulatory care. He pointed out that there were several hundred possibilities for a type cancer, and he was a generalist, and he kept on saying, how the heck would I know? I need a system that's focused just for generalists, not for all of the possibilities. I have to scroll through several hundred diagnoses just to try to get a simple basic one that I could use for my practice.

That's an example of not thinking through the use of a broader system for ambulatory care. Another one that's far more painful is when you see doctors now entering all the information into their laptops, and not actually looking at the patient. I spoke with somebody the other day who was watching an interaction between her daughter and the doctor, and the doctor was looking at the screen, even though physicians are trained to look at patients when they ask questions about that, and the physician completely missed what their child was saying, because he was busy or she was busy doing something else. That's another example of the kind of ambulatory care stuff that we forget about when we say, oh golly gee, now we can enter it directly into the laptop.

I'm looking at our clock as we go; I'm looking at the questions accumulating. Ben-Tzion, one that I think is really interesting is the one from RB on the software development lifecycle process. You want to comment on that, or one of the others, if it interests you in particular?

No, I'm happy to. The question is, I wonder why you all would not discuss the software development lifecycle process in discussion of socio-technical aspects of health information technology. My answer is that we just have very, very compressed time. But you're right, in the entire software development lifecycle process, this is something standard that actually should happen, but doesn't always happen. In the process of developing the software that is actually behind CPOE or the barcode system or nurse charting or whatever it happens to be, you should be thinking about how are we developing the software to accommodate the workflows that we want, the structure that we have, the other technologies that actually exist. I think it's absolutely critical and that should be a standard socio-technical process that you take care of, I completely agree.

A National Web Conference
The Socio-Technical Aspects of Health IT
March 28, 2007

Okay, I think that given time constraints, we're going to turn to Ross' presentation, and what I would encourage Pascale and Ben-Tzion to do is take a look at these other questions and see if there's some of those that you would like to address once Ross wraps up. Ross?

Sure. I get the joy of discussing some of the advantages and disadvantages from real life implementations. Let's say you did everything right, you did everything that Pascale and Ben-Tzion talked about in terms of looking at the culture, looking at the workflow, etc. I know departments interact, looking at the way people interact, looking at workplace culture and as a sociologist I think about the term "workplace culture" and I get the heebie-jeebies, but we'll ignore that. And you even looked at everyone's history of doing the implementation. In other words, every software system has been through literally hundreds of implementations, and you studied all of them. Of course, you couldn't possibly do that, that's absurd.

And then you come to the reality, and that is if you do everything right, if you did everything that Ben-Tzion and Pascale suggested, you would make a heck of a lot fewer mistakes. You'd irritate a lot fewer people, you'd get more participation. But there would still be the need for thousands of adjustments, thousands of adjustments, thousands of corrections. Why? Because HIT is pandemic. It interlinks with everything, and there is no a prior way, no matter how smart you are, of figuring this out in advance. It's redundant.

Let me give an example. There was a hospital that did everything right. They studied every process and the like, and one day there was this terrible confusion between the adults' and the children's orders, and it turned out that the nurses have -- I was tempted to say instinctively -- but habitually always used a different color order form for kids versus adults, and nobody had noticed that because it was part of the overall system. And people didn't catch it. When they figured that out, they didn't have to introduce a new system into the digital system that enabled them to capture, whether it was a letter for an adult, or for a child.

Let me give another example. Robert Weirs, who does an awful lot of great research on HIT and also EDs -- emergency departments, ERs -- down in Florida, his ED got a e-Whiteboard, an electronic whiteboard, that displayed everything -- all of the information that the old one did, as much as possible, electronically. But the way you entered and interacted with it, the way you controlled it, was on a console, a computer system, that was not immediately accessible to the whiteboard itself. With the old whiteboard, you could physically interact with it -- you could move things around, you could scribble things like, "I'm not sure about the pickups for Patient X," or "waiting for the x-rays for Patient Y. I've cleared them three times." You could physically amend it as you read it.

And people were very upset about it, and in Bob's photograph, Robert Wiers' photograph, all of the clinicians are really against this new, \$100,000 whiteboard, looking at the old one. It's a great photograph. The e-whiteboard just didn't work. And also, with the old one, you could put up a little idyllic teddy bear to indicate a patient who was an infant, an infant patient.

Next example I call Templates With Gods. Remember, I think about how questions are asked, and you can see the two questions there: are you in a relationship now or are you looking for a new one, or are you happy with your job? Some question tend to have simple answers. Some online forms demand information that doesn't make a heck of a lot of sense. I went into one where the physician had to put in the patient's weight before ordering a med. Assuming the patient's weight has absolutely no relationship to the drug, unless the patient is grotesquely obese or something like that, and the physicians often make up or estimate a weight -- less than 400 pounds, more than 100 pounds, and that's fine for that drug. The problem is that the next physician coming along is going to deal with a weight-sensitive drug. Let's say that physician is a nephrologist or something. He or she will look at that estimated weight, not know that it's estimated, and then make a horrible decision.

Obviously, there are a couple of technical solutions here. One, you could allow people to say I don't know what the weight is, and it's not important for this drug. But it's a forced field; it's a field you have to

A National Web Conference
The Socio-Technical Aspects of Health IT
March 28, 2007

put something in, and the computer's looking for a number. You probably couldn't do that. The other thing, you could have a correct and dated patient weight on all the screens, assuming that you have that modern data.

Last example. This, by the way, has been published, and I'll put up the thing on what's been published. The in-house staff -- that's the young doctors, the interns, and residents, are eager to try new and expensive antibiotics. Additions in the price, by the way, can be like five cents versus \$700 or \$800 a pill. You heard me right, that's five cents versus \$800 a pill. The infectious disease doctors who have had additional years of training, get to see and prove about 80 percent of the antibiotics that the in-house staff wanted to try. And they use the CPOE system and the online EMRs to see what's been ordered before, how sick the patient really is, what tests have been ordered. And they often disapprove, or they say we really should do another test before we put in that order.

Well the in-house staff wouldn't play with the new drugs, --they know their blood spectrum and very expensive, they've developed something called stealth dosing, which is they wait until the I.D. fellows go off duty at 10:00, and then they put the orders in. We want to see how many orders are actually put in at 10:05. It's really a lot. And it turned out there were orders that really were inappropriate, because in the morning, the I.D. fellows come in and they check out all the orders that were put in at night, and occasionally they would, more often than not, they'd let them go, because it's not easy to rip a very sick patient off of his or her antibiotic. But sometimes they stop it.

If you think about it, this stealth dosing weakens the oversight system, because the doctors get a chance to get into the system, and I've tried to display that here with the social system A, interaction with it, and the HIT affects the way HIT is really used, which then has a recursive effect on the social system, and I've tried to point that out.

This next slide shows really what Michael and Pascale and Ben-Tzion said, and then let's keep on going. Implementation of HIT is dealing with everything that has happened in that hospital earlier. It's dealing with all people's reactions to previous HIT. It's dealing with the design of the hospital, the history, the integration of current system, and we're not really concerned with all of the participants to receive this new system. That graphic is -- it looks like the Boston tea party, but those are actually computer consoles being thrown overboard.

So, I say the best HIT reflects learning from mistakes. In fact, all of science reflects learning from mistakes. That's true all the way around. But commercial HIT, which I'm an advocate of, but commercial HIT reflects a lot of decisions that have been made by a lot of people dealing with really different hospital systems or ambulatory systems or whatever. And you're dealing with all of these compromises, which is a good way to go, but it produces an opportunity, let's put it, to learn from those mistakes or to grow those mistakes and insist that you buy the next upgrade. And HIT benefits from the mistakes if there's continuing responsiveness, versus if there ain't.

So, how to get it right. It's an ongoing process. You have to look at how the HIT is being used in situ, in the hospital. You've got to look at all of the units of the work flow and all the things that I've been talking about, and you need more than one set of eyes. You can't just be a doctor or an IT person or a nurse or whatever. You need people to look at it. You need a heck of a lot of methods. Of course you do the statistical analysis of errors, if you have any data on errors that are worth looking at, but you need on-the-floor observation. You need to look at the workflow analyses, you need to do focus groups, and you need to talk to people. But you can't just talk to them alone, you need to talk to them while they're working, because they'll say everything's great, or everything's a problem, and then if you see them while they're working, you get to ask questions like, why did you hit that thing 17 times?

Next, you have to work with the vendors, but the vendors cannot be in control of the process. They have somewhat different aims than you do, and you have to never give up. It's an ongoing process, because just as we've been saying, the culture and the organization and the technology are all working together. You're never really done. And that's it.

A National Web Conference
The Socio-Technical Aspects of Health IT
March 28, 2007

Okay, that's great, Ross. And thinking, in terms of clichés, if you could summarize anything Ross said it's that the devil's in the details. He really is, but the other message I think we get from Ross is that this is not a one-time thing that you set it up and then just wind it up and it's going to run. You've got to keep working at it to go. Ross, Ben-Tzion and Pascale volunteered to respond to some of the questions that came in on the chat while you were speaking, I think I'd like to start with them, and that will give you a chance to look at the chat and see if there's a question you want to comment on, and then I'm going to try to get to some of the participants who were using the hand-raise feature and/or have raised other issues via chat. Ben-Tzion or Pascale, since you're in the same room, you can start with those first.

Sure, I think we're each going to pick about two to try to address, to try to get to as many people as we can. I got a question for my presentation that says, please elaborate about organizational justice, which is one of the factors I had under the organizations – how does it affect health information technology implementation success. Organizational justice is an actual and very-well and validated theory about organizational change that suggests that at the heart of successful change is making sure that the users believe that the outcomes and the processes and the interactions are fair. It's a great way to help understand how and when to involve people in participation. It's a great way to guide their thinking about training. But what it also says is that you can potentially go about doing a difficult change as long as your users understand that the process you're using is fair, and that speaks a lot to communicating what you're doing, why you're doing it, and really justifying everything along the way. Even during difficult changes, people know that they're being thought of and considered. That's how organizational justice comes into play.

The second question, and there's so many I'd like to comment on, but I'm going to pick the one that actually says, never underestimate that if you don't consider all the variables, staff will find a way to work around the technology. I was recently told about a facility where nurses were using adaptation ID bracelets on their person, so they wouldn't have to actually scan the patient IDs with the barcode scanner. We have seen the same thing over and over again, and from a systems point of view, the important thing to realize is that workarounds, in and of themselves, are not things that are bad. Sometimes what we call workarounds are "new best practices," and then we implement those. Often times workarounds do defeat safety features, but instead of thinking why is that person doing the workaround, what is their problem, we have to think what is it about the workaround that makes it easier or faster, and why can't we design the technology and the workflow to actually do that in and of itself, so there isn't a need for a workaround?

Can I jump in just on one point here, to reinforce what you just said, and tie it to what Ross said? That's why you've got to talk to people. In a lot of HIT grants there have been user satisfaction questions, but that's not the same thing as talking to people while they're doing the work, and that's how you find out why that workaround took place.

And I think the other thing going with Ross' multi-method, talking to people gets you so far. You also want to make sure you are doing observations and watching what people are doing and why, and you can learn a lot, too. But I'm going to turn it over to Pascale. Those are the two that I'll address.

Oh, there was one really interesting question about who owns the reengineering process in a hospital environment, from Bethany . We know that implementation is ten percent technology and 90 percent reorganization. Who should really own the implementation process? This is a very, very good question, and frankly, I don't really have an answer. What I have seen is either the IT people being in charge of the reengineering process, the analysis process, the planning, the design, and the implementation. There are cases -- I've seen more the quality improvement, people being involved. This is a really good question. I think that the interesting -- if there are people out there who have experience and if they could tell us what has worked and what has not worked. In one institution we have seen, the HIT people developing tremendous competency in workflow analysis. A lot of the skills that were actually needed by the organization beyond the technology implementation were in HIT. The HIT team was becoming more

A National Web Conference
The Socio-Technical Aspects of Health IT
March 28, 2007

a quality improvement organizational development type of resource for the organization. I think that's a great question that we do have a lot of issues regarding how to structure these implementations.

Pascale, Ross, do you see questions that you want to respond to? Have you had a chance to take a look?

We didn't get to respond to a question Pascale asked. First of all, hospitals are such complex organizations. You're dealing with the fact that you've got competing organizations with competing power, and it makes understanding the software and designing the software that much harder, and thus it makes reengineering or implementing changes that much harder. We deal with stuff like this all the time. We deal with software that's got to go throughout the organization, and you find a way. The important thing, I think as Pascale said, that you've really got to keep an open mind and keep them looking and see what's happening. Also that you can have the software ready for one department one way, and another department another, as long as the data will be available in a common format. But when you do that, you didn't have to deal with the fact that you have, for instance, residents who are rotating from department to department, and if they're used to looking at the data in one way, and then you have the EHR in another format, let's say, it might lead to errors. All customization is not free, and all customization has to be thought of in terms of the other raw implications.

Thanks, Ross. I want to try to switch format here and go to EB who had been waiting patiently with a hand raised.

The question has been answered already. There were a couple of questions in the chat about how what we're talking about applies to the EHR implementation in different organizations outside of hospitals, and I think that when we have discussed generally concepts and theories and models and principles, that applies across settings and across all types or organizations. And like you said earlier, the details are important and the specifics. The specifics may be important, and I think Ben-Tzion wants to jump in and add.

Just to continue on what a lot of people are saying, does this even apply to ambulatory? The concepts we're talking about actually were developed, as Pascale said, out of coal mining. And they actually apply within health care and manufacturing and transportation. I think the important concepts are to understand that you have all of these different system components, you need to consider that how they're designed will affect the ability of the people in your system to perform and do their jobs. That is the same no matter what setting you happen to be in, or what technology that you're looking at -- similar principles.

And I think one of the distinctive problems that physicians' practices have is that they may not have as much leverage over the vendors as large hospital systems have, and they don't have very often internal resources to do the kind of customization, the kind of evaluation assessment and improvement that some of the larger hospital systems do, and one of the possible solutions to that is collaboration across non-competing ambulatory practices, and of course there are a fair number of examples out there now of collaboratives that are trying to join in that kind of cooperation and collaboration.

Any panelists want to comment on the ambulatory sector, Ross or Pascale?

I would just add that it's really a pity that there's not a central clearinghouse where all of these problems that are occurring in very different offices across the nation are not sort of put out in one coherent format, maybe a web page, where the solutions that have been worked out in Washington state can be shared by the people in Massachusetts, because physicians' offices are facing the same problem, often with the same software, or different software, and people have come up with solutions. And yet, it really is isolated. Imagine if we practiced science with no communication. We're practicing all of this sort of individualistic problem-solving, which from my perspective is nuts.

A National Web Conference
The Socio-Technical Aspects of Health IT
March 28, 2007

There's a very strong incentive for people not to broadcast the difficulties that they're having in order to broadcast their successes. Then the other folks are thinking that it's a lot easier and smoother than it really is. Bethany has a question from the floor.

I just want to respond to Dr. Koppel, because I am from Massachusetts, and I think your concept of a clearinghouse is a wonderful initiative and one that -- I think the commonwealth is through some of the initiatives here that we're trying to do. But also, even for other kinds of technologies, especially CPOE. There's so much non-competitiveness involved in sharing and learning best practices and lessons learned, and maybe it has to stem from the academics to provide us with some of those resources or tools that we can all share from.

I think Michael's put his finger on the issue in light of very few people really discuss how they're creating and using their technology. Beyond that, because we have different systems, we would need to enlist either happily or not so happily the cooperation of the vendors to create open sites where people could put in what their problems were and what their solutions were. I'm not sure they're eager for that, although we could demand it as part of the implementation and ongoing assessment process.

I can tell you that from what we're doing here in the Commonwealth of Massachusetts especially, after we go to the CPOE, we are engaged in that kind of dialogue with our vendors and trying to address those issues, so that everyone has an opportunity to have a successful implementation.

If I could quickly jump in, one of the things too, in terms of sharing information, from a socio-technical systems point of view, Pascale intended to show how the organization task environment and culture can have impacts. What we can even be sharing are the problems that we discover and use. When we find that nurses are having to carry the key chains, and we look at what was the problem with the misfits, we can share those hazards, and that's a way of making sure that there's nobody to blame, there's nobody at fault -- they're just problems we've identified, and that could also be helpful.

There are a number of questions, panelists, that have raised issues about applicabilities to different settings. I'd appreciate it if you'd take a look at the repeat question from Mr. Kumar and some of the others who are in the room. I'm going to recognize JS from the audience, with a question.

Yes, hi. I'm JS. I'm actually from the Department of Veterans Affairs. One of the things that we're doing is that we're recognizing the patient safety role for IT. We're collecting information on how IT has affected certain patient safety issues from root causes, and we're just trying to develop where to use this information. One of the comments that I just wanted to put across is that you talk about this clearinghouse. Looking at the group at CCHIT, which is certifying CPOE software, one of the things that I have not seen in that certification process is usability in human factors. I've seen a lot of technologically of what it's going to include. If someone or something, they can say, oh, it's CCHIT certified, but it doesn't put into how the users can use it.

That's a very helpful comment. We certainly need a forum, and maybe there's a message here for the resource center, some of the things that it could be doing to help folks like you share use in generic sorts of way, the kinds of issues that people are coming up with, and how they're addressing them. Do either of you fellas want to comment on any question at this point?

I can add yes, yes, yes, and Ben-Tzion too can add yes, yes, yes. That's a really good comment. I think another thing that has come with the questions is the tools and methods, and as people are doing research and development and testing tools and methods, I think that we might be able to think about ways of making the tools and methods more readily available and more user-friendly, more usable by the people who are doing the hard work of designing and implementing the HIT.

Echoing what you said, Michael, about maybe another role for the NRC to try to put together some of the tools and methods. And I know that there has been some effort put into creating that toolbox, but there may be more that we could put in a toolbox.

A National Web Conference
The Socio-Technical Aspects of Health IT
March 28, 2007

We've got specific questions about the EHR in payer organizations, and we've got questions about HIT in a prevention and public health context, and I'm wondering if any of you folks want to address either or both of those contexts.

The question about HIT in a payer organization is I think some of the same -- again, some of the same concepts. The principles of implementation, for instance, that Ben-Tzion was outlining in the last slide of his presentation -- I mean, these principles, again, apply to a lot of different organizations.

I would just say that I think the important thing is as a payer organization, your performance needs and what you have to do with the IT may be fundamentally different than what a nurse or a physician has to do. Your goal would be to identify what are the performance needs, both for the user, and in terms of interoperability, and in terms of layouts and availability of the technology, just in the same way that a hospital or an ambulatory clinic might. Those issues are the same, but your performance goals will be different.

Okay, Ross, any comments?

To Robert Hayes' comment about physician resistance, there are two things. The famous Cedars-Sinai example, was not the resistance to CPOE but to the decision support system which asked a 60-year-old physician who had been ordering a drug for years, it asked him four or five times, are you sure? And it drove him nuts. Physicians maybe should be resistant to really bad HIT. I think good HIT would engender a heck of a lot less resistance. I think the idea of seeing clinicians as troglodytes, afraid of the technology, is probably wrong.

I think good software alone, if you build it, they will come.

Can I jump in here, Ross, to reinforce your point? I think one of the functions of the pilot phase, or the alpha phase, ideally, is to get this kind of feedback from folks. You can use Ross' phrase: what drives you nuts? I think if the HIT designers or implementers were just to ask users that question, rather than giving them elaborate satisfaction surveys, they'd probably get at a lot of the stuff earlier on and they could then address it.

Ben-Tzion said I had to scroll through seven screens before I finally get to the meds, or I can't see the size of the letters, or whatever it is. Some of this stuff -- every one of the 200-some-odd people on this call can describe something about the IT application that they use every day that drives them nuts. And I think if we had a list of those things, we'd be on our way to dealing with a lot of the socio-technical issues, and certainly a lot of the user interface issues.

Can I jump in for a second? There was a question earlier from a gentleman who asked about sort of the technology bandwagon, and how do we change our mindsets and the culture of thinking technology will solve everything. One of the things that I do when I talk to hospitals is I let them know that any technology you purchase, you need to think of as an assistive device, and think of it as a cane. And ask yourself, if your father or your mother was having trouble walking, is there any chance you would get them a cane that was 14 inches too short, where they have to bend over to use it? And you all laughed and said, of course, not, we'd get them a cane at the right height. Unfortunately, most of the HIT you're using is basically a cane that's too short. It doesn't actually get you to the goal you want. The cane should help you walk; your technology should help you order meds or make decisions or administer meds. They're actually not done that way. I think one of the ways we can help change that is to change our mindset about the role of technology, really as being an assistive device and not a solution.

I think it's a tool. It's not an end.

There are a number of comments on the chat which I encourage all of you to read if you haven't. They're observations, in some cases, bits of information. There's one about a learning network. AHRQ has also

A National Web Conference
The Socio-Technical Aspects of Health IT
March 28, 2007

had a number of learning networks in the last few years. These do provide opportunities for discussions that often move into the HIT area. One of the sort of themes that comes out of many of these questions are the particular problems when the HIT applications spread over a variety of settings, and I'm wondering whether one of you three panelists would like to address that issue. We're thinking about RIOs and data sharing and so on, particular socio-technical issues that arise there.

I think the main issue is that you're talking about interaction at the interest phase of several organizations, and so there has to be a motivation and a willingness on the part of the different members of the network to work together. I mean, the interactions of the interfaces between the organizations or the transitions -- I mean, it's called transitions of care when you look at a care process. In these, we think there may be perpetual problems. Trying to figure out where these interfaces are, and like Ben-Tzion said, what's the goal? What is it that we're trying to achieve with building that interface, and what is the technology, and how can we design it to support the interface, the interaction? But I mean, that's one issue that comes to my mind when we talk about RIO or networks or physician practices.

Okay, thank you, Pascale. Clearly it's going to be an even more complex process and require even more iterations when you're talking about a collaborative effort and when you're talking about an effort within a hierarchical organization. If hospitals are complex, so much the more so, systems of unrelated hospitals or systems of unrelated practices are complex. Let's take a final question from DC, and I think with that, we're going to have to wrap up, Brian tells us.

I first of all wanted to thank AHRQ for doing this conference. I think this is a crucial topic and it's one that is at the moment as people may be aware of, of national significance, because there is pending legislation in the Congress. And I wanted to pick up on a comment from the woman from the VA. There is very little discussion of this topic in those legislative efforts, and I would like to ask not only the panelists but the other participants to consider how this topic might be brought to the attention of people who are pushing the legislation in Congress right now, Senators Kennedy, Clinton, and Enzi. This seems like a crucial part of the public policy agenda.

Panelists?

What a great question. I think that the problem was, I think, indicated by one of the other commenters, that we are in love with this technology. We are looking to the technology to save us, without doing the basic groundwork needed to make the technology effective. I think people, as articulately as you have today, need to make those points to the people who are pushing the technology, to say, look, it's incredibly helpful but it doesn't exist in and of itself. It exists only in the context of these organizations, and just pushing it would be like selling cars to a nation without roads.

Ben-Tzion or Pascale?

Last thoughts?

I want to -- the sort of synoptic point that we're all saying is that the technology is fine if you do all of the work that we're talking about. I don't know if we're all saying that, but certainly I'm saying that it's not that the technology is evil or wrong -- it's wonderful. But you need to do all of the work that I've been talking about, to make it really work, or else you're just slapping something down on a system that's multi-faceted with all kinds of issues, and you can't throw it down like a coat of paint and expect it to work.

I would simply say that I would go back to Ben-Tzion's observation. I think it was that the workarounds are not necessarily bad things, that they may actually be revealing some of the issues. I think that we're sort of in the growing pain years of what is really a much longer process than most of us envisioned when we started implementing HIT, and we will look back on this period as sort of -- like the period when cars were operating on the roads and people didn't have licenses and you had to crank them in order to get them to run and so on, and it just may turn out to be taking longer than most of us anticipated it would, but

A National Web Conference
The Socio-Technical Aspects of Health IT
March 28, 2007

nonetheless there is a learning process going on, and the data around these issues is becoming more and more common. I would be guardedly optimistic that if we revisit this conversation in five years, we'll be able to see a difference in the tone of the discussions, hopefully even on the floors of the House of Congress, and provider systems.

On that hopefully optimistic note, I'm going to turn to Brian and ask him to give us sort of a technical debrief, so that those of you who want to follow up will be able to do so, and thanks to all of you for participating.