The U.S. Medicine Institute
For Health Studies

Edited Transcript — Forum for Decisionmakers

PDAs, Bluetooth And Wi-Fi: Beaming Healthcare Into The Future

Washington, D.C.
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Executive Summary

Wireless technologies increasingly are being integrated into the spectrum of healthcare delivery. Medical students wield PDAs as pocket references; care providers turn to mobile devices for examination, diagnosis, and patient education. Bar coding and electronic patient records promise to improve the safety and accuracy of care.

The **U.S. Medicine Institute for Health Studies** held a forum on December 2, 2003, to examine federal and private-sector experience with these new mobile technologies and to assess how they can be used most productively in future.

Panelists at the forum asserted that it is time for healthcare to *influence* – rather than simply react to — the development of wireless technologies. They asked for assistance from industry in devising improved wireless monitoring devices (bloodpressure cuff, for example) and in developing the standards needed to link wireless technologies for maximum benefit. Forum participants agreed that wireless technologies must demonstrate measurable "value added" to healthcare if their use is to be endorsed at policy levels.

Observations presented during the forum discussion include:

• Government's paramount role in the development and deployment of wireless technologies is to help define standards that allow portability of data, such as medical records, across devices and systems.

• Privacy issues — HIPAA being the prime factor — overshadow relationships between the federal and private sectors and must be dealt with as in the policy arena as wireless technologies mature.

• Wireless technologies can improve care in rural and remote locations through satellite connections, much as the television media transmit from war zones. The Indian Health Service successfully has used this technology to provide home care on reservations.

• A PDA version of an electronic health record is being tested by military care providers in Iraq. This test version mainly is being used for triage; data collected is "mapped" to a laptop version of the electronic record, which then is downloaded into the centralized CHCS version. Also being tested is the electronic information carrier, a "smart card" personal health information carrier that can link with the PDA.

• The Veterans Affairs Department uses PDAs and bar coding extensively in populating data to its computerized patient record system. For example, blood collection in VA medical centers is bar coded to indicate time of collection and length of time until administration. Drug therapy is accomplished through bar coding of medications to match bar codes on patients' wristbands. Such measures,

which feed into the computerized patient record, have improved safety and thus help improve care outcomes. Wireless networks exist in many VA facilities.

• In many cases, wireless technologies are undergoing "stovepipe" development — individual projects do not communicate and sometime are duplicative. A comprehensive strategy is needed in developing the "wireless environment" for healthcare.

• Wireless applications should be "device agnostic," because devices almost certainly will change.

• End-user support is critical for effective conversion to wireless technologies. Provider acceptance of these technologies seems to vary by age, with younger providers much more amenable to their use. However, once such devices are put in place, they quickly become essential for providers of all ages, because they offer increased flexibility — for example, the ability to read digital x-rays over a PDA outside the hospital.

• HL7 is the communication standard accepted by the consolidated health informatics project, which is led by the Department of Health and Human Services and involves other federal agencies. Wireless technologies can help standardize difficult areas, such as symptom descriptions, by providing "interoperability" across health information systems.

• The Department of Homeland Security is seeking an electronic record that could be carried on a laptop and could begin capturing information in the event of a terrorist attack.

• The Agency for Healthcare Research and Quality (AHRQ) views electronic data and wireless technologies as essential elements in improving the quality of healthcare. A new series of targeted grants will help promote health information technologies.

• Wireless technologies can help monitor lifestyle factors — weight gain, for example — and thus help promote healthy behaviors.

• Wireless technologies can help monitor patients in the home, thus reducing unnecessary healthcare visits.

• "New technology is definitely going to challenge old processes and old ways of doing things."

Forum Proceedings

Moderator — Hon. P.T. Henry

Our topic today is wireless technology and the relationship between wireless technology and health care. It's kind of a *vice versa* even — what does wireless technology do for health care, but also, what does health care do to influence wireless technology? I'm sure that at the end of today's session, we will have a greater appreciation of this tremendous synergistic role that technology is having and can continue to have in the health care industry.

Our goal is to provide an interactive forum for decisionmakers. We bring folks together from government, from industry, and from academia to take on the tough issues in health care and the tough issues in health care policy, to have an open discussion about those issues, and where possible to suggest solutions, if you will, or courses of action for the government.

I'm delighted to introduce our luncheon speaker, Mr. Richard Young, who is the technical architect for Public Sector Business Development Group of Microsoft Corporation. As a technical architect, Mr. Young works with the single level technology and business professionals from government agencies at the federal, state, and local levels, and he helps them to design, develop, and deploy information systems that leverage Microsoft solutions and technologies.

Richard Young

It is a pleasure to be here to speak to you about what Microsoft is doing in the area of mobility, and also to share with you some of the visions that we have around mobility. Over the last five years or so, we've really seen mobility shift from being a niche player in the marketplace to really being a driving force in the industry. A lot of that is related to the fact that technology has caught up to the visions that people have had over the last 15 or 20 years, about putting devices, portable devices, that is, in the hands of the individual, allowing them to be able to communicate.

Some of the challenges that we still face are to address things that have to do with policy, especially when we're dealing with the government agencies. That has been one of the biggest handicaps that we have to deal with, not so much from the standpoint of being able to address the needs of the customer, but actually being able to satisfy some of the things around privacy and other concerns that are coming about.

Other issues we have to deal with include how to manage encryption, for example, within this environment. As you start to use devices that are based on very small form factors, such as the Smart Watch or the Pocket PC or Smart Phones, the processing power required for that type of form factor plays heavily on the battery, and also you have the issue of color screens. When people go out and they spend $500 or more on a device, they don't want to get a black-and-white or a grayscale screen, they want a full color screen that's able to show full motion video and other things. Well, that comes at a price. That means that all of a sudden that phone that you had that could work in standby for 300 hours is now running in standby down to 20 minutes, because you are cramming 20 pounds into a five-pound sack. We have to learn how we can deal with that, and that's been a lot of the work that we've been doing at Microsoft.

Prior to taking the position within our Public Sector Team, I had the privilege of actually running the Enterprise Division of our Product Marketing Group. That meant I got to be the pinata for all of our Enterprise customers when they were asking why we weren't delivering our product fast enough to meet their needs.

One of the major issues that we have to contend with is how to address the privacy issue. It's not just something that the government is talking about; it's also industry. To be quite honest, we actually take our lead more from the industry and the consumer than we do from the government, and the reason for that has to do with requirements. As we look at the requirements that consumers have, typically they're about two to three years ahead of what governments and even large corporations are asking for. The average person on the street wants to make sure that no one is listening in on their conversation.

We tend to look very closely at that group, and they tend to push the envelope for the current state of technology. Now, as we start to back that up, we do look at the government and also industry to help define the standards, and that's really where government "plays", in our thinking. We look at government as being the voice of, here is the set of standards that you must adhere to, and then we roll that out to our consumer devices, and I think that has a profound effect on how soon we can actually deliver things.

The industry is also maturing at a very fast rate, meaning that five years ago, to get companies like IBM, Microsoft, Sun, Oracle — and the list goes on and on — into the same room and agreeing on a set of protocols — well, let's put it this way, a lot of people wouldn't have made book on that. But, we're seeing such a shift now, and one-time competitors are actually cooperating to define a set of standards. Such standards allow us to actually drive down the cost of these devices, and we're going to continue to see that.

To be honest, we're at the inflection point right now between the current state of technology and use, meaning that most of the devices that we have, whether they are Microsoft device or a device from one of our many competitors, are starting to stand still because we're waiting for people to tell us how they want to use the device. In the past, technology was one or two generations behind the visions or demands that our customers were expressing. We're at the point now, with a few exceptions, mostly around security and wireless protocols, that we are actually ahead of the game as far as the actual devices themselves. For example, every device that's coming out now has the ability to integrate a keyboard. We're also seeing virtual keyboards, meaning keyboards where you

basically roll out a wireless sleeve on a desk top, and you're able to type on that device, and it will show up on your PDA or Smart Phone device. There is no hardwire connection, it's all done wirelessly. We're starting to see those things come about — and that is available today.

What we're having to struggle with is how to actually make the form factors usable. If you happen to be like me, if you want to use something like an integrated keyboard on a very small device, you have to grow your thumbnails very long and sharpen them to a point, because your hands are just too big to really manipulate them. So, there is this issue of where form doesn't really address usability, and we're looking at that constantly. It is something that we spend quite a bit of money on; to be quite honest, the entire Pocket PC platform division is actually a loss leader for us. Microsoft is not making a great deal of money on that platform right now, but the reason that we continue to invest in it is that our customers are telling us we have to, we have to because that is the future — what we define as a computer today will not be the same definition a year from now, and it certainly won't be the same thing three years down the road.

Computers are becoming much more intelligent. We're going to start to see a day where what is currently a laptop in configuration, the amount of memory, the amount of storage, the processing power, you'll be able to have on your watch. I know if I had said that 10 years ago, people would have been laughing, but the laptop that you can purchase at Best Buy or Comp USA can outperform a Cray computer of 15 years ago. That's saying a lot. It doesn't have the backplane speed, but as far as the raw processing power, it's there. So. to say that in three to five years, you're going to have the same type of capabilities on a watch isn't far-fetched; it's a matter of how to actually solve the heat issues associated with the electronics.

Universities such as Brown and Princeton have been working on biocircuitry for the last 15 years and are using lasers to go over biocircuitry. What is the advantage for using biocircuitry? No heat. The heat situation is what causes problems within these mobile devices. As we start to look at things like biocircuitry, all of a sudden the heat issue goes away. That means we can get very creative in not only the screen size, but we can also get creative in the thickness of the device itself. You're going to need something that is rigid enough and lightweight enough that you can actually carry around and press down on it, because plastics, as they exist today, don't have the tensile strength to really withstand your pressing down on that type of device. You're going to start seeing very exotic metals being used to actually cradle the device, simply because they're going to be so thin and powerful that you can damage the device by either pressing down on the screen too hard or pressing down on the keyboard too hard.

You're going to see a lot of things come out as we start to solve the heat situation within the circuitry. There are a lot of things that are going on right now. Granted, some of these things are still in the laboratory. There haven't been any supercomputers made or anything like that that are actually taking full advantage of biocircuitry, but they are sending signals over this type of technology, which means that in 10 to 15 years, we could actually see devices built like that.

Looking two to three years out, we're going to continue to see processor speed improve, we're going to see the density of memory improve in these devices, you're going to start to see SD memory chips that will be in density up to four gigabytes in size within the next two years. Right now you can actually buy one-gigabyte SD RAM chips. As we talk to the different manufacturers

of these technologies, they assure us that within the next two to three years, they will be in the areas of four gigabytes or higher for storage devices which can go into Pocket PCs or PDAs that are built today. We're really looking at the ability to be able to exploit the fruits of our labor in the R&D area.

Now, what does this mean for health care? Well, imagine being able to carry out to the battlefield *Gray's Anatomy* on a chip. People who are serving our wounded as well as the indigenous population who are wounded as a result of the current conflicts will be able to treat them much quicker and have a much higher probability of saving their lives because they can get information much more readily. Also, as we continue to improve the radio spectrum around wireless technology, you're going to see us have the ability to communicate ship to shore, so that as we have hospital ships out in the Persian Gulf or other locations around the world, the people that are on the front lines who are actually delivering this information will be able to do so and not have to carry around a rig full of radio equipment. They'll be able to do it from something that they can carry on their back.

Granted, this is a military application, but it does apply directly to civilian medicine as well. Take the situation where a police department is flying emergency rescue helicopters. As accidents occur or people are trapped out in the woods or wilderness within the United States, they can actually treat them on the way back in, and there again, they're not carrying a lot of unnecessary equipment. They can maximize the amount of equipment they have because it's in a small form factor. You have the advantage of taking these things with you rather than waiting until you get back to a triage facility in the rear.

As we continue to look at how we can take advantage of these things, the HIPAA concerns come into effect. As we start to look at how policy is going to impact technology, I think it's going to be something that we have to be very much aware of. We're going to have to look at how can we reduce some of the complexity — or perhaps clean up the language that is stated in some of these policy decisions — so that doctors and nurses and other medical professionals can take full advantage of these types of technologies without fear of inadvertently releasing information that shouldn't be released.

It does impact the way we build our technology. It impacts us from the standpoint that when we do things like put X509 certificates onto a device, we can actually protect the data that is stored on the device. We're also looking at how we can build the device so that if you enter a password a certain number of times within a particular time frame, if it's entered incorrectly, that it will basically wipe the device, wipe the device in such a way that even if you were to take it apart and try and recover the data, you couldn't. We've been talking to the government for quite some time about doing that, and oddly enough, we've been getting a number of requests coming in from the consumer side.

A lot of people have fear of losing their phones now because their phones have become true computing devices — they're storing more and more data on that device. I had the opportunity to speak to a users group not too long ago, and several people told me that they were actually storing their credit card information on their phone because they could buy stuff online. When I was speaking to a group of Koreans who were here visiting the States, they indicated that they could actually make purchases with their phones, that they could walk to a vending machine when they

were in Seoul or Pusan and type in a number and make a purchase without actually physically touching that vending machine. They're not putting any type of coin in there or anything; it's using Bluetooth. They just sit type in their number and they get the product that they requested out.

As we start to look at those technologies showing up here in the U.S., which they will at some point in the future, it comes back to how to protect that information, and it does very much apply to the health care side in how do you protect end-user information so that patient data is not released without their permission, and what aspects of their information are released is solely up to them. Again, it's about industry working with government to actually solve these issues.

Discussion

Ben Karpf: I'm with the U.S. Medicine Institute. I'm wondering how much of an impact spectrum is going to have on the way we can use these devices, because the way I understand it now is that most of these are sort of dependent on the local network spectrum — what I've heard referred to is junk spectrum, basically 900 megahertz and things like that that Wi-Fi tends to use.

But for broader applications and wider area networks, how much is the way the spectrum shakes out going to effect what we're able to do? I'm thinking long-term, perhaps once the switchover to digital television broadcasting is done and maybe the analog spectrum comes back into public use, how is that going to effect the way these wireless devices might be used?

Richard Young: That's a good question. I really don't think it's an issue of reclaiming the analog spectrum once we go digital TV. The situation we have right now is just a matter of cost. It is very expensive to start rolling out Wi-Fi networks. We're going to start seeing Wi-Fi networks that are being rolled out that will have basically banned with capabilities anywhere from one megabyte up to 100 megabytes, using 802-11(b), (a), and (g). T-Mobile and other carriers today are starting to experiment with it. In fact, T-Mobile has rolled out a number of wireless spectrums. Verizon actually has the highest one right now as far as wireless connectivity that you can get using their EVO technology —somewhere around 500 kilobits is the high end that you can get in metropolitan areas.

The issue that we are going to have to look at is, what technology are we going with? One of the challenges we have here in the U.S. that doesn't exist in any other place in the world is the fact that we have so many different spectrums. If you go to Europe, they're using GSM; if you go to most parts of Asia, they're using GSM; if you go to Japan, they have two to three spectrums that they're using. They're using a GSM spectrum as well as a variant of the CDMA spectrum. China, on the other hand, is really starting to jump into CDMA as well.

Well, guess what, the United States has all of those spectrums, plus the anti-lock spectrum that we're still using as well as cellular packet networks that basically run our pagers. So, there are a lot of things that we have to address.

As we start to see the industry move towards one standard, right now I would bet that it's going to be CDMA. CDMA will give us the higher band width that we're requesting, or I should say

demanding, for our devices. That will also help to bring prices down. To be fair, there is going to be an initial up-kick in the price, because what's going to happen is, you're going to see AT&T perhaps and T-Mobile and other carriers move over to the CDMA spectrum at some point. That's going to have an increase in price because they're going to have to reclaim their costs.

But over time, you're going to see the curve flatten out and prices go down. One of the things that will happen as a result of that, you will be able to hop from network to network and you'll have a better chance of being able to maintain that signal. So some of the work that Microsoft is doing along with some of our partners such as Cisco is the ability to be able to automatically re-sync a data connection or a voice connection. As you're traveling between cell tower to cell tower, instead of you losing that connection and then having to redo it on your own, the software will be smart enough so that as you start to approach the limits of that particular cell tower you're at, it's going to scan for the next one, it's going to go ahead and start bringing that connection online, and then as soon as you're out of range for the other one or whichever one has the stronger signal, you're going to automatically switch over.

It's going to be pretty much a partnership between different aspects of the industry. You're going to see the hardware vendors, Microsoft, and the other software providers as well as the telcos partner in a way that will help to simplify a lot of that. But there are going to be different bandwidths, if you will, for different needs. I think that's what's going to start to happen. You're also going to be able in the future to subscribe to quality of service, types of applications within the wireless industry.

It would be my guess that certain applications, and I don't know who would actually mandate that, would have higher priority within that spectrum. So if you're dealing with things that are associated perhaps with health care or emergency responders, they would have a certain quality of service that no one would be able to interrupt.

Ben Karpf: What you're talking about — the Bluetooth thing that they were using in Korea to vending machines — and then the CDMA spectrum that's more of a wide area, are these things going to come together?

Richard Young: No, they serve very different purposes. The purpose of Bluetooth is really a PAN network, a personal area network. It has to do with proximity. Bluetooth is basically so that you can communicate with another device. That's going to be the purpose of Bluetooth. You're not going to see a lot of traffic going over Bluetooth as far as communicating with someone else is concerned. What you're going to see with Bluetooth is delivery of data, like printing something or exchanging files, but you're not going to see Bluetooth replace CDMA technology.

Now, it could be at some point in the future that one of the broader band technologies consumes Bluetooth, but I doubt that, again, because what you end up doing is muddying the waters. Bluetooth serves a very specific purpose, and the role that it has may increase because you increase the bandwidth capabilities within it, but I don't see it being replaced, only because, again, if I'm here in this room and I want to be able to communicate with the camera you have there, I could do that with a Bluetooth device, but why waste a spectrum of doing it?

Also, remember with Bluetooth, it's an unlicensed spectrum. As a provider, I don't have to go to the FCC and get permission to use that because it has such a limited range and that will continue to be the case.

Rick Jones: I'm with AMVETS, American Veterans. You mentioned 15 years of research in biocircuitry at Brown and Princeton. I simply don't understand the term "biocircuitry."

Richard Young: Basically, instead of using silicon-based wiring or any type of metal-based wiring to send a signal, you're actually using biological material. They've synthesized a circuit based solely on DNA of something — I'm not sure what it is, it's not human DNA. They've grown it in culture, and they're able to send an electrical impulse over that and interpret it on the other end. The way I understand the technology, the different colors within the spectrum that they're using — they are using green, blue, and red right now is my understanding — each color actually has a different frequency range that it can send information over, so they're able to send data from one side to the other.

There are limitations that they are still trying to overcome right now. One is distance. They can't send it as far. But if we can ever get that technology to work for doing microcircuitry, it would be great, because again, there's no heat loss, and that is the main issue that we run into when you're dealing with any microprocessor, the issue of heat loss.

Rick Jones: Are there any public companies involved in this?

Richard Young: There are several. You can actually contact the researchers of Brown and Princeton. I know Princeton is a little bit further along than Brown is in that area, and they can actually tell you that. It's not secret research that they're doing; this is actually open material that they're working on, and they've been doing it for the last 15 or so years.

Leon Moore: I'm with the Uniformed Services University. In more of the short term, while we still have those heat producers, do you see any relief on the battery end?

Richard Young: That has been one of the biggest challenges, battery technology. If you understand Moore's Law, every 18 months or so you're going to see an increase in performance while cost either stays steady or it goes down. As you look at hard drives, memory density as well as CPU power, that has not been the case with batteries. Batteries tend to be about three to five years as far as getting any noticeable increase.

Now, what has been happening is that we've been using more exotic materials to fabricate the batteries, and so we are starting to get better battery life. One of the challenges that we have with the batteries isn't so much getting better battery life, but getting optimized performance out of things such as the color screens. So, we've been working with a number of vendors.

Most people don't realize that Microsoft has a huge research division — quite frankly, we spend over a billion dollars a year just in that division alone, and they haven't created anything other than spellchecker for us as far as the products that we actually roll out. For us, it's not about making money with that particular research, because everything that they do actually goes back into the

public sector. There is nothing that's coming out of Microsoft research that isn't made available to the public today and actually made available so people can reuse it.

The reason I bring that up is that we have been working with different screen manufacturers to actually be able to increase the clarity of the screen while reducing the amount of power consumption that screen has. So, it isn't a matter of battery performance, it's about getting the other components that are drawing power from the battery to be much more efficient, simply because we are pushing the envelope right now as far as what we can do with batteries. We need to find more exotic materials, so we're creating more ceramics and other things so that we can actually do a better job with the batteries, because as you know, the batteries themselves generate heat.

The fact that they're generating heat means that they're actually drawing their own power. The battery itself is actually consuming power while it's providing power to other instruments. So, we are looking at how do we actually reduce the heat signature of the batteries. There are a number of things that are going on in that area.

Panel 1: How mobile technologies are changing healthcare

(Examples of innovation among federal and private-sector providers and assessment of lessons learned)

Leon Moore, PhD — *Professor and Interim Chair, Department of Bioinformatics, USUHS*
Ross Fletcher, MD *— Chief of Staff, Washington, D.C., VA Medical Center*
Mark Carroll, MD — *Chief Medical Officer and Telehealth Program Director, Tuba City Regional Health Care Corporation; Telehealth Clinical Consultant, Indian Health Service*
Robert Wah, MD — *Director of Information Management, TriCare Management Activity/DoD Health Affairs*

P.T. Henry

Biomedical informatics is an increasingly essential component of pre-professional and graduate education across the health sciences. The emergence of biomedical informatics as a discipline is due in large part to, one, advances in computing and communications technology; two, an increased awareness that biomedical knowledge and clinical information about patients are essentially unmanageable by traditional paper based methodologies; and three, to a growing conviction that the process of knowledge retrieval and expert decisionmaking are as important to modern biomedicine as the fact base upon which clinical decisions and research plans are made.

Leon Moore

When I saw the title of this panel, I was struck by the subtitle, not so much because of what we do with wireless or PDAs in health care, but because of what we do "beaming" the future of healthcare into our new physicians and our new advance practice nurses, both for the military and for the

public health service, at USUHS. I'm part of the Department of Biomedical Informatics at USUHS. We are the newest department at USUHS. We're not the smallest department, but right now we are exactly tied with the smallest department.

We started a PDA initiative with the first issuance of personal digital assistants to our medical and nursing students in 2000. These devices are used, have been used, to provide clinical reference material to our students during their clinical years, to facilitate their clinical experience log collection — one thing that has been, if not mandated, then very strongly suggested by our licensure agencies — and of course, the normal organizer functions of the PDA. One frame out of the video we used to introduce students to the PDA shows Dr. Elizabeth Mencken. When she talks about her use of the PDA, she says that it's "information that I don't have to keep in [my head] that I can keep in my PDA and keep with me. To me, that's the bottom line of the personal digital assistant, especially if we can wirelessly connect those to really large information sources.

We've issued PDAs over the last few years, and things changed a bit this year and will change the way that we use them with our students. In the past, we'd had a black and white screen on our PDAs because of some policy restrictions that we have had at USUHS. This year, we were able to issue a color-base device to our students.

In the past, we've issued them to second-year medical students before they go into their clinical experiences, and to the first-year nursing students before they go out into their clinical experiences. This year, we were able for the first time to issue them to our MS1 students, ourMS2 students, and our GSN students. We do offer a little bit of help for the students, which they seem to need less and less. We give them an intro on how to get it connected, how to get it working. We give them an intro to the clinical use of the devices and the applications that they can use on these devices. We survey the students six months after they have gotten the device and after they've been using it in their clinical years for at least six months.

The first group of students that we performed these surveys on answered a number of the questions about how did you use it, what did you find, et cetera, but the bottom line was the question, if the university hadn't issued you a PDA, knowing what you know now, would you have purchased one?. Over 75 percent of the students had no question that it was valuable to them in their education.

Among the applications that we provide our students are E-Pocrates and a number of applications collected by various departments at the university that they think are important to the education of our students. We also provide a portal for PDA items, some lessons on how to get the applications installed, because we haven't been successful working with the vendors to do an install of the PDAs before they're issued. Various groups have collected software that is also available on the portal site.

We tried this last year using an infrared access point that provides a connection to the Internet. We'll do it again this year with Palm tungstens, using a Bluetooth access point to provide a local presence for the devices to get them connected to the internet. We'll be doing this in our pathology course during a series of small group exercises, both providing information to the students on the PDA, trying to encourage the students to access our library resources, our learning resource center

resources, over 1,600 journals electronically, 150 different text books, trying to engrain in them the idea that you don't have to keep it all "up here," that you're going to need to depend on some help at least on occasion for the information you need.

We hope to follow these students, focusing on the medical students, through their MS2 through MS4 years on use of these devices. We'll also be collecting information from them. Hopefully, we'll learn something about the effectiveness of the devices in their education.

Ross Fletcher

I'm one of these doctors who keep trying to push the envelope. We know what you have in technology and we use it as quickly and as fast as possible, and we've had the very nice advantage at the VA in Washington, D.C., of being a laboratory, if you will, for things that eventually get spread throughout the whole VA system, which is a lot of hospitals and a lot of patients and a lot of doctors using the software. We have used CPRS [Computerized Patient Record System] and Vista, which many of you know about, and we were the first to use Vista Imaging, which means that we can see on every desk top the electrocardiogram and the chest x-ray as well as all the lab values and pharmacy values.

At our hospital, we are 98 to 99 percent paperless and filmless. That gives us the advantage of seeing everything we want to see in the hospital, number one, when we're not mobile, number two, when we are mobile. The advantage of being mobile is that we can go from patient to patient, because we have an 802.11 frequency wireless hardware sitting in our ceilings and can connect to it wirelessly with a laptop anywhere we happen to be in the hospital . We've been doing that for two or three years now. I think it's really feature that allowed this to go very, very fast in the clinical arena. When the doctor can actually just roll up with this laptop and see the x-ray and see the EKG and see all the lab data and enter notes and enter in orders, he has a very, very facile system which he won't give up once he starts to use it.

Needless to say, most of us have wondered what to do about the PDA. Quite some time ago, my colleague who's the chief of medicine, went in the Palm and was able to create a program where he could pull up a patient, see all the vital signs. If he clicked on a given vital sign, it would be grafted out. Labs and vital signs are all downloaded from the hospital system. Once they're downloaded, they're in the doctor's hands, nd he can walk from patient to patient and see this data, or as he walks out of the hospital and gets a call about the patient, he can actually look this data up and find out what was going on most recently.

The medications the patient is on are also a list. It has a "to do" list if he wishes to have that. It's a very nice system. We wanted to provide clinical tools which could be used at the bedside, but also could be used beyond that to retrieve information, increase efficiency, and improve patient safety, especially with the bar code identification. We have developed several tools, one which is the clinician's view, which actually sees CPRS, the cover sheet, the orders, the notes — they all can be visualized and now can be visualized wirelessly from this little PDA.

It is a ruggedized version of a Pocket PC. With Pocket PC, we have a whole lot of advantages that we didn't have with the Palm that we started off with, including the fact that you can actually write on the screen and it becomes written, not just written text, but interpreted as standard typewritten text, and that becomes very, very valuable. With the clinician's view, we have the cover sheet, we also have the BCMA—our parlance, that's bar code medicine administration. All of the medicines in our hospital and many other VA hospitals are set up such that they can bar coded, and the patient's wrist is bar coded before they get any medicine, so there is a match before it's given. This little system can do all of that and is doing that in our hospital at this moment in time. We have a ward totally equipped with these to be giving medications out in a bar code administration way, because the top part of this is a bar code reader.

Many of these things have come to pass from a technical point of view, but they haven't been approved by our policy committees. That is one of the big hurdles, although more and more as they see what we're doing, they seem to be getting on board with trying to bring this in.

Vital signs can be done. If you walk up to a patient and click on their wrist, you can enter on the PDA the vital signs, temperature, blood pressure, respirations, everything — and that goes into the hospital system and becomes part of the record. We have developed most recently a "care collect" system. Again, this is not fully approved at the VA central office headquarters, but it is a very good first step where we can go to a patient, find out what has been ordered through the system after bar coding the patient's wrist, and then pulling off lab labels that we can actually carry around.

We carry around a labeler that puts out the labels nicely enough, prints the time that you have printed the label, which means that you now have the time the blood was drawn. We have had a big problem passing JCAHO standards by not knowing exactly when we drew blood, but nowadays we don't have that problem. The labeler is an item which can be carried by the technician as he goes around and draws blood and actually puts the labels on. In addition, we have developed most recently "care collect" blood administration, the ability to take the type and cross and match it with the blood that's been given. If the blood has been there for more than 30 minutes, a sign comes up saying you can't administer it, it's too late, it's got to go back to the blood bank. If it's been there in 30 minutes and it matches the patient's barcode on his wrist, then we're in business.

Electrocardiograms are now wireless in our hospital. We were one of the first to adopt this. Once you roll the cart up to the patient, you actually download from the hospital system the name and a lot of the demographics, and immediately, once you've taken the electrocardiogram, it is up on what's known as the Muse System, which can be directly visualized by our hospital system, and that can be visualized from home. We can call in and see those tracings and find out whether the patient is having an impending myocardial infarction or not. We can actually send by e-mail that ECG to this Pocket PC. The software includes the ability to see CPRS, not just the cover sheet, but the medication summary, the postings, the allergies, the recent labs, vital signs. We have been using the I and Os and vital signs at the bedside as well as the ability to collect lab tests, lab specimens, and the ability to transport and electrocardiogram to the system. The beauty is that you can zoom the screen and get it to a point where you can read the tracings quite nicely.

When I log in and look at the data, for instance, vitals, I then can actually click on temperature and see if it's in the normal range, between the two red lines. If I wanted to see one of the values, I can

click on the value and immediately go to where is, and then shift to another value. It is very easy to manipulate. I can move over to labs, and I can see the white blood count and can isolate a given column. I have the exact value instead of just the graphic record. I can do the same thing with the hemoglobins and so forth. If I go to "meds," I will see the medications list; if I go to problems, I'll see the problems list; if I go to "allergies," I will see the allergies the patient might have had.

I can see the discharge summaries for the patient. This is extremely valuable. As you know, that contains a lot of clinical information. I can go to the orders. I can review the consult orders and see that they were done, the diet orders. Eventually this will allow the input of orders. It does not do that now, it just reviews what has been done at the patient's level. In addition, I can see notes. These are all tabs that exist on the current CPRS.

If I go to "vital signs," I would log in and pick a patient and enter the vital signs and just see those for the time being. If I wanted to see all vital signs, I change that so that I have many more tabs. I can actually write those in or I can use the keyboard to write them in. I just move along and enter in anything I wish to. I can go to I and Os, which allow me to put in all the I and Os. These are simple I and Os, but I can go to all I and Os and come back onto the system. I have IVs, I have total parental nutrition, nasal gastric tube, blood. I have urine output, I can put that in, and all that can be done at the bedside as you're looking at the patient, and it goes back to the hospital system nicely. I can write in notes if I wish to.

We have a very nice way of improving the safety of care to the patient. We are very anxious to do even more, and the more wireless and the more independent things get, the more techniques we'll be developing to help care for the patient at the point of care, or for that matter, remote from the point of care in a very effective way — with information rather than just guessing about it on a telephone.

Mark Carroll

The Institute of Medicine Report in the year 2001, *Crossing the Quality Chasm*, basically notes that if we want to have safer, higher quality systems of care that are more reliable and more dependent, we have to have a redesigned system of delivering that care. Some of the thoughts I'm going to share with you today around wireless technologies are ways that within the Indian Health Service and tribal facilities, we're looking at trying to redesign care.

The Indian Health Service takes care of some one and a half million Native American beneficiaries, over 50 percent of which are located in facilities or in areas that are tribally self-governed. So, the Indian Health Service actually contracts with and works collaboratively with various tribal organizations and tribes to deliver health care across the country. It's important for me to note that the Indian Health Service, like all agencies, has a strategic plan, and one of our four initiatives that we have actually identified for information technology and telehealth is to provide compassionate, quality health care, which I think is a very important place for it to be.

Tuba City, the facility that I work at, in northeastern Arizona, is in the western portion of a Navaho reservation. I'm going to share with you some things we've done there as an example of activities

that are going on nationally, not to actually hone in to one site in particular because many other sites are doing very similar things. Our motto, borrowed from Dr. Jay Sanders, is "service to the point of need." We're growing very, very quickly in terms of clinical volume for telehealth activities. There is a cross range of different activities, not just within radiology, but dermatology, psychiatry, and a list of some 20 different specialties that we're using.

The Arizona Telemedicine Network is really a network of networks within the state of Arizona. Up in the Northeastern corner is the Navaho area. In essence, it's a functional ring, redundant ring of broadband connectivity; if you know telecom, either of TU1 or DS3 capability, with big pipes of offramps to get to each state, New Mexico and Arizona, both university systems as well as to get out of Navaho area nationally as we need to.

I've noted that we use a lot of wide area network broadband pipes, and predominantly, those are microwave pipes. But I think it's important to note that the Universal Service Fund Reimbursement Program has been key for us in building this network.

We use different vendors for local area wireless telehealth activities within our facility. If you have a cart, you have a wireless network, and if you're broadband enough, you actually can move the carts to the bedside. We're testing these in the emergency department to, for example, visualize ENT or particular endoscopic images in the emergency department that a specialist at a remote location at a university or another emergency department better staffed than ours can review.

In terms of extended LAN activities, we're actually using 802.11.b technology with firewall and encryption to send signals from the roof top of our building off of a radio tower, down to a roof top, to a couple of roof tops, actually of local high schools, so that we can connect school base clinics to remote psychiatrists at the other end of the state as well as various other telemedicine applications. In addition, we're using this to outreach to homes.

A chapter house is a geo-social political gathering area in the Navaho nation where folks come together, and there are 88 of those across the reservation. We actually have established wireless connectivity from our hospital to chapter houses, and then from there to homes. It's important to keep in mind that many of the homes — in fact, most of the homes — are without telephone service, without reliable running water or electricity. Only about 50 percent right now on the Western Navaho have reliable running water and electricity. So, we're going to connect to that chapter house via wireless and then establish a circle of connectivity, working with Navaho nation community health representatives, who can take a portable briefcase — as is used by the media on an international basis, that's where we came up with the idea — go into homes and actually deliver service in the home, even in a traditional Hogan, which is an octagonal shaped room, without running water or electricity.

If you look at Tuba City, what we're trying to do is establish our services via telemedicine and wireless activity into community focus areas. We can have pockets, almost a network of networks of wireless service delivery.

Looking at wireless for local area networks, there are a lot of demonstration projects utilizing PDAs and tablets. Their predominant use is being focused in on the HIS electronic health record, which is

a hybrid product, a collaborative product between the legacy system of the Indian Health Service and CPRS from the VA, and we'll actually have the same capability as within the VA in the next couple of months as we roll out an initially 20 sites nationally this year, followed by another 20 the following year. That will give us pharmacy order entry, notes offering images, but very importantly, a national benchmarking opportunity to actually test and look at the experience with different standards, whether they're 802.11b or g, to look at how security is handled and how we actually standardize and benchmark security across our various wireless networks.

We're not vendor-specific with our tablets. We're actually testing some of them, and our other site is testing different tablets. But when we put new tablets and new technology in the physicians' hands, we have to give them a worthwhile tool at the other end. We can't just give them something that they say, well, this is a nice thing you've given me, but what's happening on the other side. On the other side will be VCPRS — our IHS version of the electronic health record, which will take into consideration important needs that we have in terms of third-party billing within the Indian Health Service. It will also enable us to link to particular clinical projects together. For example, we're working with folks at Harvard and MGH [Massachusetts General Hospital], with Dr. Octo Barnett, for a project on one-stop clinical shopping.

Primary care guidelines — not just that we develop, but that are being developed in other university systems. Ultimately, the holy grail, so to speak, of what we're trying to put together is smart packages, smart guidelines that inform a clinician at the point of care about decisionmaking that is going on right then. It's important to note that we're also working with groups like the Institute for Health Care Improvement — when we put in new technology, we actually want to have redesigned systems of care for outpatient flow as well as other focused areas

It's important to understand perspective and to look forward. I just bring to your attention that wearable technology, "wearable computers," is a wave of the future, especially as we look into moving into perhaps more home-based care, which I think is inevitable in terms of the health care delivery system in this country. I bring it to your attention because I think it's time for us as clinicians and us in healthcare industry to be out in front of the thinking on this, to influence development and to think about the possibilities it has for us to deliver better care, so that we're not always reacting to the technology as it comes forward to us.

We want to look at technology that best fits our service need, recognizing that new technology is definitely going to challenge old processes and old ways of doing things. Telemedicine took the old stethoscope and made it electronic, and that's a good thing. However, the stethoscope probably is not something that's the most reliable way to determine whether you have a lung problem or a cardiac problem, a heart problem. There's more reliable technology being developed in other sectors, for example, in NASA, that we need to be looking at and looking at deploying at some of our settings.

Overall, how do we look at measuring and improving our quality of care? I think by doing cost-effective analysis of new technology, so that we can demonstrate and truly improve access to care and add value — value that we can measure not just in qualitative terms, but in true financial economic quantitative terms..

Ultimately, it's the people we serve and the people who rely on us for health care who need to understand the technology and support us in our efforts, and we've worked very hard to try to do that in many of our communities.

Robert Wah

There's have been a number of discussions, both from the luncheon speaker and the panel, about the various devices we use to connect to a system. I want to change gears a bit and talk about the importance of having a system to connect to. I think the PDA, or whatever wireless device you use, is merely just something to connect to something else. The real value, and what we really have to work on, is what system are you going to hook up with. That's what we've been working on certainly in the Department of Defense, where the Military Health System is developing a paperless computerized life-long electronic health record for our patients.

We obviously have a very different scope and mission than most other health care organizations in that we have worldwide facilities, some 75 plus hospitals, about 1,000 medical and dental clinics, we take care of about 8.9 million people worldwide, but we also have a whole other theater of operations that nobody else has to worry about, and that is, obviously, the operational forces. So, we have to not only be able to have hospitals like Bethesda and Walter Reed, but we also have people that we take care of out in the battlefield and in tents and hospital ships and things like that. We have a much broader spectrum and scope than many other health care organizations. To that end, what we've developed and are currently in the deployment phase is an electronic health record for our military personnel and their dependents and our retirees. We call it CHCS II.

It's really a quantum leap above what we've had for the last decade, which is computerized physician entry for the ambulatory care system, and then we have worldwide deployed for over 10 years an ability to go in and enter all of our labs, our radiology, exams, pharmacy, and pathology results as well as the orders, into a system. We have results retrieval, you can order consults on it, you can appoint patients on it, and that's been out there at all of our 102 or so host sites.

What we're going to do with the next generation is, we're going to pull all that into a central data repository so that you have access to your patient's information 24 by 7 worldwide, regardless of where you are or where the patient is. Physicians can access their patiens' information even if they're traveling or if the patient is traveling. If the patient shows up in San Diego on Tuesday or Wednesday after being seen in Bethesda on Monday, they can have their same patient information pulled up electronically through the system. We have that currently deployed to about 10 hospitals in the United States, and it's worked so well that we just recently got authority to go out and finish the worldwide deployment.

In about 30 months, we hope to have that deployed worldwide. I think it will be a huge aid in taking better care of our patients. What that's given us the power to do it is the powerful computers we have out there. A lot of that is moving information around, because the paper chart is really an impediment to the way we do business in medicine, but it's what we've used forever. Because it has been with us for so long, the patient record has driven a number of business processes that are framed around a paper chart, and we have to look to how we redo our business processes as well as

how we design the technology, because a lot of times the technology is the easy part, the business process we're engineering are the hard part.

When we set this new electronic record into one of our clinics, we found all kinds of things that were business-processes related to the paper record. For instance, one of the ways the corpsman always knew that there was a patient that needed vital signs was, after the patient came in and checked in — Mrs. Smith gets checked into the system, they put their chart in a rack, and the corpsman can see a chart in the rack, so he grabs it, takes the vital signs, gets her all set up, takes her to an exam room. When they first started an electronic record, because there was no chart any more, there was a big back-up of patients. Nobody could understand why, and the corpsman would say, "Well, I didn't realize a patient was here because there was no chart in the rack." The quick, immediate fix that they thought of was, well, we'll just stick a little piece of cardboard in the rack to say that there's a patient out in the waiting room that needs to be taken into the system. Nobody really thought of the fact that we have simultaneous access electronically to the record from multiple access points, but that's how we can get very wrapped up in our old business processes with a paper chart.

So whether we use a PDA or a desk top work station, a wireless handheld, or a notebook, or a tablet, I think it's important that we look at the business process in which we use these tools, not so much focus on the tools of the technology. CHCS II is going to be out there in 30 months. We will have, again, not only lab results, but we're also going to put in the history and physical in a structured way. This is going to be different than many of the other electronic records that are out there which are text based. We're actually going to put things in using a structured note writer, so they'll be discreet data elements in our database as opposed to just large blobs of text. We'll be able to manipulate those discreet data elements in a much more powerful way than currently with many of the text based records.

It also standardizes across the enterprise how we're going to describe certain clinical conditions, and so you can do a lot of other epidemiological studies. We can do much better population health if we have a standard way of describing all of the things that we do in health care documentation. Currently, there's a million different ways —I'm an ob/gyn, and we love abbreviations. We pride ourselves in being able to do an entire note without one English word on the entire page, so you know, that makes it very good for us because we're in a hurry to write, and if you're another ob/gyn and you have the decoder ring, you can read all of that, but if you're a cardiologist or if you're a pediatrician or any other specialty, oftentimes, another specialty's abbreviations are very, very hard to decipher.

I believe JCAHO is trying to undo a lot of the abbreviations we've done. They have a list of "do not use" abbreviations, and we're going to have to learn to get rid of all of our abbreviations that we've held very tightly to.

I think those are some of the powerful things our system is going to be able to do. Some of the wireless technologies we're looking at, certainly I think like everybody else, we're interested in trying to find a way to connect the physician to the system with something other than a wire.

There's a lot of different ways to do that. There's infrared, there's the 802.11(b), there's older technologies, other bandwidths that can be connected, and we have a number of those things. But I think that the important thing that we started out with was a good foundation, a good bedrock on which to build all these other technologies and hook them up to. We've got our entire electronic health record on a notebook version so you can put it on a laptop. At Walter Reed or Bethesda, there are some experiments that we're working on in the laboratory now — we haven't deployed them — where we have that facility.

Because we can put it on a laptop, we can also take it out in the field with us. So in the deployed environment, one of the physicians in my group spent about six weeks this summer over in Iraq showing the the medical people over there with the Iraqi Freedom Operation how to use the laptop version of our electronic health record, and they're currently using it in a number of smaller divisions over there. They're collecting health information on the laptop, again, using a structured note writer and discreet data elements, and that's eventually going to feed our central database.

The way we have it architected is that you can have an interim database that's smaller and more agile than the central database. In a PDA, a Palm Pilot, or a Pocket PC, whenever you have communications available, you can sync that up with the mothership database so that we have the same data in the centralized database. We have the architecture in place to do a number of things with wireless or PDA or notebooks, but we haven't got all of those currently deployed, because we felt the most important thing was to get out that initial system, which we're pretty excited about being able to get out worldwide.

But, we have this laptop version that's out there. Associated with the laptop version, the people at TATRC have developed a PDA version that fits on a little form factor like this where we can do triage. It's mainly for core staff and independent duty corpsmen that are out in the field. It's a little point and click operation. They can document and triage patients they may see in a battlefield situation. What it does is allow you to point and click through a rapid description of the injury, the type of injury, where it is, the location, as well as document any medications given, current vital signs and condition, and then how the patient was moved or evacuated, and that can be wireless or wired connected to the laptop. We've mapped the data that comes out of here directly to the laptop, so again, that structured database that we have will be populated by the data that comes off our handhelds. We have, I believe, a very good plan and architecture to accommodate a number of different points to our system.

I'd be remiss if I didn't also talk about another portal to our system. We have a lot of Web-based initiatives. We're looking at ways to access not only the clinical data repository, but also the electronic health record that we have deployed. So again, the mobility that we have in the country today, both our patients and providers, if they can access the web, they can have access to our system, and there are a number of good initiatives for that. TriCare Online is our current one that we're using for accessing information for our patients. We have 18 million Web pages where our patients can go in and look up any number of things about health care, symptomatology, they can look up the medications they've been prescribed, they can establish a personal health record so they can put little notes about their various visits in one central place. They now can go online and get primary care appointments in all of our military facilities. So, they can do it at 9:00 at night, and don't have to wait on the phone.

We're just about to start an online refill system so our pharmacy medications can be refilled online across the enterprise. We had to put a small server next to each of our 102 host sites that are out there, because we currently are distributed — all of our health care information systems are distributed across about 102 locations worldwide, and so by having a small web server next to each one of those, we have access to each one of the major databases that exist at the 102 host sites. Once we merge that all up into our single clinical data repository, then we'll be able to shut down a lot of those small web servers and bring them into the central one and have much more rapid access to the entire enterprise as opposed to the distributive method we have now. But, the distributive method has a lot of advantages, too, because it does offer a back-up. Obviously everyone is worried that what happens if you lose your long line access to your central repository. We need to have some sort of a backup, a fall-back position, a contingency plan.

So, there are a number of issues that come up when you talk about wireless or any other kind of remote connection with a system like this. Obviously, security is a big concern, and encryption, and protection of the devices. Somebody unscrews the back and can access the RAM chips in it, or you take out the little card and they can start trying to access that. There are technologies available where if you try to hack into it or you try to log into it multiple times unsuccessfully, then the system comes in and wipes it out.

Our patients are relying on us to take care of their information. They probably don't even recognize the vulnerability as clearly as we do. But I will tell you that many, many patients have as their number one fear, when you talk about electronic health information, that they don't want to see their medical history show up on the Internet some day. It's probably second only to seeing their credit card being pulled off of Amazon.com. They just would hate to see their diagnosis, their medications, their recent lab results show up inappropriately on some Web site somewhere.

I think we have to be very, very cognizant of the fact that patients are concerned about that very danger — a danger that is not that remote, given the current technology that we have in the encryption world. Obviously, there are HIPAA concerns that mandate a number of privacy and security issues that we have to address, but I'm not even sure those go far enough to prevent somebody's information from being captured. So, the transmission time or the transmission link that last mile, when you leave the device onto your network — how secure is that?

The security of the individual devices is an important concern that I think we all have to be thinking about and worrying about.

Discussion

Randy Ade: I'm from SAIC. We talked a lot about the different devices that everybody is deploying, and it's been a while since I've taken a look at the area I'm going to describe, so I'm curious what everyone is doing, and that's the area of the wireless interference with medical devices.

Mark Carroll: We did a spectrum analysis across our facility just to know what we have in what frequencies in what areas. Once that's identified, then you understand what you can deploy and what it won't interfere with. It's been very interesting to note the things such as those cell phones that we have posted up really don't tend to create too much in the way of interference problems, if at all. But we just don't want people carrying in things from the outside that might actually interfere. That's we have actually done, and I think it's a very important thing for a facility to do, and it's not that expensive.

Ross Fletcher: I think the fact that we have been relatively liberal on what comes into our hospital would suggest that there's not much out there that interferes with doing business in the hospital itself, we've not seen that problem. I happen to run the Eastern Pacemaker Surveillance Center, and of course, one of the first things people worry about is, will anything radioactive, microwave, so forth, interfere with pacemaker or defibrillator function?

Indeed, there was a time when the cell phones were thought to maybe cause trouble. The current cell phones, even put very, very close to a defibrillator, don't seem to be causing the trouble that people were anticipating. So at least from a health point of view, and the devices folks have inside them that they rely on, the wireless technology doesn't seem to be causing any trouble.

There was a time when on a CCU, we would try to limit anything that might come on the unit for fear that it would interfere with our ability to transmit the data or ability to take care of a patient with a pacemaker. That seems to be less and less a problem. There's more and more technology that is built into these devices that prevents anything from the outside from being seen, and we have not limited people as they come into our hospital.

Bill Montgomery: I'm with Nextel Corporation. At the University of Florida, as a CIO there, we implemented a cellular network throughout the whole campus, and did it so the cell phone doesn't have to boost up past one miliwatt, and that caused no interference with any monitoring equipment. We put phones on top, behind, every place you could find it, and it all has to do about the energy that it's creating around its environment. So as long as the cells are close enough where you're not causing the phone to juice up a lot to go find an antenna someplace, there's really no interference.

Ross Fletcher: I happen to be on the AMIA Pacemaker Committee as well, and we have an interference thing going on right now with the FDA and others. Among the devices that have been brought to our attention are the boosted antenna and amplifiers that are on boats. Once your cell phone goes into one of those, it will carry a great deal of energy. We are in the process of trying to discover whether that increased energy will cause trouble with devices.

Once again, one of the leading problems one might worry about is whether the signal would be seen as a tachycardia, and therefore, cause a shock to the patient, or for that matter, be seen as a normal rhythm when the patient is not in normal rhythm at all. So, it's an important thing. I think this was part of the talk at the beginning, that we are all changing our environments. One of the interesting changes is the lack of limitation in the outside arena on boats and things to the power that amplifiers and antenna can have.

Bill Montgomery: Given the system that the VA is using, which is very interesting, are you finding the need, as you leave the building and away from an 802 — is it becoming critical to stay connected?

Ross Fletcher: I think so. As soon as I get home, I'm connected, because I can come in on phone lines. But to be connected wirelessly would be extremely valuable for me and the patient.

We need to keep it encrypted; we need to make sure that no one else can read it, and we have all kinds of processes going on in the VA right now — air fortresses, a current thing on the wireless networks that we're trying to use to limit the ability of anybody else to see them. Because even if you're relatively close to a VA building, if you get in their parking lot and so forth, you might be able to pick off the 802.11. If it's encrypted or if it requires a lot of sign-on security, that is not a problem. We're trying to do both, and we'll try to limit it. But, indeed, what we'd like to see is good encryption being beamed out.

We have a program called My Healthy Vet, where each patient has his own record, and they sign on to the Internet, but they sign on with their own password, and it is doubly encrypted to them on that website, so we can actually connect to the patient in a relatively confidential way. You would have to break into the encryption, and each patient has a different encryption, so if someone happened to get Mr. Smith's, it would not work with Mr. Jones.

Bill Montgomery: We talked a lot about health care around hospitals, primary care, things like that, and there was one mention about the MIT lab work going on. I'd like to know from the panel of experts where you think we're going to make the biggest advances on disease management being monitored remotely with a patient constantly as they walk around, for the improvement of their health.

Mark Carroll: I'd love to jump in on that one. I used to run the prevention program, and as you know, there are various levels of prevention, and not just primary prevention, but secondary and tertiary, depending on conditions, and I think that's a terribly important one, and it will change processes I think pretty dramatically.

The VA has done some very interesting work with home-based monitoring in the state of Florida, and that's expanding. What we're trying to do in a very rural area in the Indian Health Service is create a similar model. We actually do have more urban-based activities and programs we can do, too, but that requires us to have a redesign of how we're going to deliver care, because I don't think it's right to actually have 24/7 monitoring coming into a data bank. That is being processed through algorithms that can tell you when something is offline or out of boundaries, and not have someone there to respond to it. We have not had the people yet and haven't shifted resources in that way, because we haven't quite made that point, at least in my experience, to start actually shifting folks and hiring folks to be working with small algorithms.

Smart algorithms have been developed by a company for electronic ICU, which I know that DoD has been doing some work with, and you probably read about recently in *The Wall Street Journal* that we're lalso ooking at a smart algorithms, with someone in front and a system to respond.

But there's a flip side of that which is, you get information on someone from their home and they don't have a telephone, and it's not an emergency, but you want to interface with them. Do we have the actual system for us to send out visiting nurses? We think it's incumbent on us to design that before we actually start getting that information. But it's a very tricky balance point, I think we're right at a junction right now.

Ross Fletcher: This is sort of the cart before the horse or the horse before the cart, chicken before the egg and so forth. If you analyze the capacity of smart algorithms in health care, they could as easily decrease the need for physicians as increase. For example, if the patient's blood pressure remains 130 over 70, on recurrent numbers, the visit that's been scheduled for four months from then does not have to occur, and actually the visit could wait until 10 months when the blood pressure actually rises up or when you need to rewrite the prescriptions.

So, there are ways to work the data being provided by the peripheral patient to the central system that would greatly reduce the need to actually see them each time, and have them become part of their care. Indeed, the worst part of my business is to watch a patient gain 30 pounds who's in heart failure, and me try to dry him out. That requires hospitalization and requires him to come in in a very resource intensive way, whereas if I got him at five pounds, six pounds heavy, or the nurse practitioner happened to get them, you know, an intermediate level of care, then we are able to keep these folks out, and I think we're only beginning to see how good this is.

We do have the capability in My Healthy Vet of putting in daily weights, not just on these machines, but the patient getting on a scale and writing in a weight, and having their own vital signs, and blood pressure cuffs and so forth be tracked. What we do as physicians right now is, we see this long, long list of data points that a patient has put in and we do nothing with it, we just look at it and maybe describe it in one line in our note. But if we had the actual data coming in and we're responding to it, we actually might find efficiencies, not just problems.

I go around in our own system to folks that have gotten a little gun shy on My Healthy Vet trying to discuss this possibility, and even the psychiatric patients where there is a lot of question on how much data should be in the hands of the psychiatric patient, our psychiatrists want to have depressive screens available for the patient to fill out, and when their number gets to be 15 or 16, they should come in. We have an open access policy now in our place and we're trying to do more of it, but that's when the patient ought to come in, not two months later when he should have been on a medication for that entire period of time.

It's a very interesting problem, and we get a little nervous, but to deploy almost means to find the advantages as well as the disadvantages, so we tend to deploy — plan as much as we can and deploy, but also look for the efficiencies.

Robert Wah: Certainly, there are a number of things that we have to do in the Department of Defense, again, because we take care of patients from a wide spectrum, from the battlefield up to Bethesda, where we have to have remote access to our patients. We have I think a number of initiatives that are pretty exciting on the realm of patient monitoring, but also patient care through telemedicine and other remote devices.

We have both live interactive as well as what we call store and forward, where information can be put on a system and then forwarded, can be picked off. It's particularly useful when the major time-zones shifts across the globe occur. It's not always easy to get a real life consult for somebody in Okinawa when they're quite a few hours off of Bethesda's time schedule. So, we do have the store and forward capability. We also have a live interactive ability to view patients as well as their x-rays and things like that across the remote locations.

Bob Schlesinger: I'm with SAIC. Are all of the VA hospitals up to the level that the Washington Hospital is up to, relative to their utilization of wireless? Do you find the other providers at the facility as excited and energized about the potential for the technology and use it as you seem to be into it?

Ross Fletcher: Those are two very important questions. I would obviously say the Washington VA is always at the lead, but I have a little bias along those lines. Interestingly enough, as was stated, CPRS itself, Vista CPRS, is deployed across the system uniformly, and you can walk into any one of our hospitals, and as a doctor, soon become used to what is available there. The imaging is about three quarters deployed now, and it's been deployed for a long period of time, five or six years for CPRS, and the imaging is, well, in our hospital, it started in our hospital, which was about 1992, so you can see how long ago. Now, it wasn't in its current form at that time.

It is of interest how people respond to a PDA. Doctors love them, and for the reasons that were already discussed. There's a ton of data, E-Pocrates and everything, that they use and they like and the PDR is there and so forth, so they're very, very interested in having them. I'm sure that 75 percent for a physician is a shy number. Most physicians would want to buy them if they know how much stuff they can put on already.

If you take the younger person, they grab onto this very fast and they run with it; if you take the older nurse, there is a little bit of a problem finding the keyboard. The keyboard is relatively small and they like a little bigger one, so as mentioned by you, tablets work for those people. If they want a bigger space, you just provide them more space. They don't even know they can actually handwrite. I mean, I was with my programmer just yesterday and was going through this. I said, "Well, I don't have to write — I don't have to punch 19, I can write that in, look, just take the transcriber and write it, and write your note." It's actually quite surprising, if you spend just a little time slowing your writing down so that it actually is even minorly legible. My colleague said, "Your handwriting is terrible." I said, "I know, but this computer can read it, you can't, but it can, and it did." So, these things are all very, very important to keep pushing on. But some people need a little more space.

I think, again, if it's deployed and used, we will solve many of the problems and actually find the niche of where people will work. They don't even know right now in my hospital that they can get ECGs on these. I know they can, but we haven't really deployed that well. The I and Os, the temperatures, and the care collect systems have not been deployed. But I can guarantee you, up at central office, they are just dying to find a safe way of blood administration. There have been a couple of bad accidents, it's not in the current bar code administration — here we suddenly have done it for them, and they're ready to run with it.

So, you know, I think the enthusiasm will increase with time. If you don't like something small, it's not necessary — whatever you're doing in there can be done in a bigger environment. I don't think you want to go to wristwatches yet, but people will use the PDAs. Physicians use them a lot, and nurses, I'm sure, will be using them as well.

Rick Satava: I'm from DARPA. In education, now that our students don't have to carry it in their heads, are you changing your pattern of education? Are you teaching them different things since we don't have to remember everything all the time? Second, for all the wireless systems, what measurements do you have that show that it's better to do things in a wireless environment? Are we saving time, FTEs, or what measurements do we have? Otherwise, I can't sell this to anyone.

Leon Moore: It's unique to our situation, but it's also fascinating to watch the difference between the GSN students who have been out in a hospital for five to eight years before they come back to USUHS for an advanced degree adopt the PDA. Many of our medical students who are just out of undergraduate or just out of a line position that don't have that clinical experience, watching the difference in those two is absolutely fascinating, and the clinical experience has sold virtually all of the nurses before they get the device in their hand, or at least they see the utility very quickly.

Have we changed how we educate our students? We've been doing this since 2000, so I can beg there hasn't been enough time, but this is something that that difference or that realization is going to take a bit of time before we do it.

Ross Fletcher: Well, it's interesting that there is a minor reluctance. I've got people coming into my hospital as we speak who are great measurers of these things. Let's just talk about the system as a whole, because in general, the same question needs to be asked of that — why go away from paper? A person like my chief in neurology just plainly says he can make rounds in two hours at the VA, and he goes over to Georgetown to try to make rounds, and it is five to six hours because he has to hunt for the x-ray and he has to hunt for the reports and so forth.

The comfort of seeing a patient and having all the information right in front of you versus not is just enormously different. We used to — I don't know quite how to use this word — we sort of faked it a little. We didn't have the information. We tried to use our intelligence and pulling patients' histories and getting as much as we could as we saw the patient. It's not just the VA hospital, but it's been well-shown that in the private sector as well as in the VA, records are missing a third of the time, and it can be higher than that on given clinics and given days. So, to have no record missing, no data missing is a new era of taking care of patients, but it hasn't been cleanly measured.

When I say, well, it takes this much time versus this much time, you know, someone has to come in and do a metric and actually see someone be spending that time and then get that kind of number out, because while it seems like it should be done, it is costly. So, it's not just how much effort an individual person has to make, but the institutional organization has to invest a certain amount.

A little bit of what is now being monitored is the, like in bar code administration, how many medical errors are there. We know there are huge numbers of errors, the Institute of Medicine has told us this. We have reduced it strikingly, and the handwriting is no longer a problem, and so there

is just an order of magnitude difference, and we can assign a number to that. Our ability to do preventive care with reminders — hypertension, cholesterol lowering drugs and so forth— is very, very much better. We are actually benchmarking. You take the VA hospital system and look at patients who have had high blood pressure — in the country at large, about 33 to 34 percent are returned to normal. At the VA, we are trying to meet a criteria of 70 percent, because last year we met a criteria of 65 percent returning to normal.

So there's some things about the way we do business and taking care of patients that just greatly improved the patient care, especially in terms of preventative medicine, where we have measured the differences and we are benchmarking in the country.

Kenneth Hoffman. About 10 years we used one of the DoD methodologies, integrated definition modeling, and we we decided what information to collect to a logical model that would support that. One of the findings was, in one place where we did activity-based costing, 15 to 80 percent of the provider's time, and it was the most experienced provider, was spent in documentation, not patient care. Using automation to facilitate the value added activities, the guesstimate was that we would be able to pull it back to about 10 percent — a lot of the cost shifting, and everything would get diverted from documentation cost to actually patient care preventative and being able to track people through continuums.

But this area of logical activity modeling sometimes drops out, I think, in the focus of a lot of the development of different technologies.

Michael Cowan: [Navy Surgeon General] We've talked about the delivery of health care services and using these tools essentially as information tools to facilitate the delivery of health care services. The bulk of health care problems that we have in America today are caused by lifestyle problems that begin in the teens and 20s, smoking, drinking, bad diet, sedentary, obesity, and so on, and manifest themselves in the 40s. For us to begin the delivery of health care in the 40s starts us out at 25 years behind the power curve for the patients for many conditions they come in with.

Clearly, the next step for American medicine is the management of health, not the reaction to disease. I wonder if any of you have given any thought or developed any programs that manage behaviors to use these information devices, also communications tools, TriCare Online, kind of reaching out to patients, to begin to partner with them, to change behaviors at a time when they are amenable to change and before they precipitated the disease conditions of middle age.

Mark Carroll: I think it's a very important question, and we've done a few things. With that network reaching out into the community, such as the Chapter House community I described to you, one of the uses of that is to enable local not-for profits to actually have access to the information, to let our nutritionists have access to that network, to let people in various chapters, — you wouldn't think that this is a technology rich environment, but it actually has folks that have been very, very responsive to new technology to receive information — when they come to the Chapter House for lunches, for daily meals, for gatherings, to let them connect up to outside expert resources, because sometimes folks on the outside are perceived as more expert than we are, and that's just a phenomenon that we need to acknowledge.

We actually are participating in the Arizona Telemedicine Program's Virtual Diabetes Center Program, which was recently funded through a grant, and a lot of that will be focused on education, creating peer groups in the schools. So with that network in the schools, you can have a group of teens and young people in those schools talking maybe to a group of teens in another part of the state, and maybe that will do something to actually generate more attention and more look at it from a prevention standpoint.

There are a number of opportunities. We actually have an interactive key house project. It's not wireless, it's very much wired, and we borrow heavily from other agencies, which we're very thankful for. We borrowed this, developed in the Palo Alto VA, letting patients sit down in a key house have access to information. We're not yet at the point of access to their own information, but access to easy to read information at a fourth to sixth grade level, which all of us like, no matter our educational background, and we're actually developing interactive videos so that people — teens in particular and young people, but even adults — can test decisionmaking, they can go through an interactive model and actually have an actor turn to the camera and say what next, it freezes and you make a decision. I think it's a very powerful tool and something that we're going to look to evaluate.

Finally, it's really multi-discipline and it's across the board, but it's very hard to evaluate wireless by itself, because when you evaluate wireless, you're evaluating what you can use on the other side of it, and you have to change processes. The evaluation is tricky and very important and hopefully in a year we'll have much more information for you.

Robert Wah: Once we get the patient into our system, whether it's wireless or otherwise, we are gaining a number of powerful tools to use the computer to help take better care of our patients. Again, it comes down to having a central database with structured data in it. We can start having the computers sort through all that data and figure out what the preventative measures are that they may be due for or overdue for, and things like that.

Again, that relies on the patient's actually coming into our system. How do you reach out to the people who have not yet come into the system to take better care of them? I think the Web is probably our best avenue to do that right now, and certainly TriCare Online is an attempt to do that. It certainly isn't to define a solution by any means.

But I think there really are two different issues; one is, how do you reach those patients that have not become patients yet, haven't come into the system yet, and then, how do you take better care of the ones that actually access the system? I think we're doing probably a little better on what do they do when they actually walk through our doors, whether it's an alert system or a primary care physician can have their panel constantly analyzed in emails or messages by phone or mail and can go out to the patients to remind them to have various preventative measures done.

But, I think the challenge is still before us on how do we reach those patients that have not yet come through our doors and not come into our system yet.

Panel 2: Examining new frontiers

(What areas of healthcare are most ripe for further development of these technologies?)

Randy Ade — *Corporate Vice President, SAIC*

Ron Poropatich, MD — *Director, Telemedicine Directorate*
Walter Reed Army Medical Center

Scott Young, MD — *Director, Health Information Technology, AHRQ*

Randy Ade

I want to let our minds get really loose and try and imagine what it means to breakthrough. Imagine if we could go 10 years into the future, what it might look like. A lot of times when we get involved in re-engineering, and some of the examples I'm going to use in describing this are going to be non-health care examples because sometimes when you move a little bit away from where your comfort zone is, it's easier to get something out in front of you. For example, I spent a couple of years working at Bell Atlantic just when they were breaking away a bit after divestiture — as they broke away from Ma Bell, all the baby Bells had the same systems. So, they were trying to figure out how to differentiate themselves from each other. They had all the same information systems, and they all had the same problem with them — and that was, they didn't know what a customer was.

They knew, for example, that Randy Ade had one phone number, and they knew that Randy Ade had another phone number, but they didn't know I had two phone numbers. They knew a street address, but they couldn't tie that back to those two phones and so forth.

So, you see, right away a business opportunity — but what was their problem? Their problem was, they had to think through the migration. Their biggest competition came from companies that didn't have that shackle around their leg, companies that could move quickly and redesign their whole system around what's available today, and so that was a challenge for them.

So to help us think about that, I want to talk about imagining. I want to build two lists around the idea of who wants what. From a user's perspective, I've taken some typical well known categories, patients to providers to payers, the insurers, and I'm trying to break them down a little bit more granularly, because I think if we do that, we start to see users that don't jump out, and then we might start to be able to talk about those users and what would be important to them.

From a patient perspective, my wife bugs me about knowing, if anything happened, where is everything — all the records. My mother is about 84, and when she goes to see the doctor, walks in with a stack of stuff that she's compiled, because she knows that whoever said that the records aren't available, she's tired of that,. So, she carries her own around, and the problem with that, of course, is nobody is going to read through it. and it's not in the standard format, so it's not particularly helpful. I was at an e-health conference, I'm reaching in a pocket looking for a USB device, they were giving away patient health record, things that you could carry around on your USB device. So there's a new use that my mother would love to have, because then if it was in some sort of standard format, she could start to do that.

We talked a bit about what's different about wireless. Well, the obvious answer, it's not wired, so you can move around with it. I can stand over here and use it, I can stand over here and use it, and sometimes in the elevator it will actually work — but never in a garage. The second thing that seems obvious today is that the screen is smaller. So, we know two things about it that's different. There may be other things we can start to think about, which was the idea of Bluetooth and the proximity idea and wearable computers.

In my community out in California has just implemented the largest, or is implementing the largest, Wi-Fi region in the entire United States. We've got a little downtown area with a fountain and picnics and things, but they also set up displays sometimes, so this Wi-Fi vendor was down there with his wears. I thought it would be a good thing to do on a Saturday morning on the way to the grocery store, and I stopped. I said, "Why do I want this?", and he said, "Tell me aboutyourself." I said, "Upstairs in the office I've got my computer and my wife's computer and the house is wired from Cox Cable." I've got high speed Internet there, and down in the kitchen I've got a little laptop, and you know, when I'm making breakfast for the kids, I can knock off an e-mail or two." I said, "Tell me what this Wi-Fi is going to do for me," and he said, "Nothing, it's not for you." That was his answer. I said, "Well, who is it for, what's the target audience, what do they look like?" He said it's for people who are going to come out around this fountain area, there's a coffee shop and there's a library and a school, so the kids can go to the library with their laptop, and it's so people can come out of their townhouses and go down and have a coffee and knock off some emails, not have to worry about where they're at, and ideas that go beyond the way I do business today.

For me to use it, I'd have to go through a paradigm shift, and I don't think that's breakthrough thinking, which is what I really want to talk about.

To go to the future, I want you to be able to do that without any constraints. I want you to assume that that's all there — the standards, the interfaces, any resistance to change, whether it's my grandmother who died never using a microwave, or my 84 year old mother who's learned to use the computer, or even one of the guys that I went to school with who still won't use one, transition costs, put all that aside, and even who pays, set that aside, because I think that there's a different model coming on who pays once you go to a breakthrough model.

I was at an e-health conference in San Diego about a month ago, and one of the things that struck me was a question about what to do for some of the younger population, to get at them and to get them to get some information they need to manage their health. For example, Web MD is paying its employees to go on a website and enter a risk profile. As a result of that, then they feed them back information about things they ought to be doing, and then the reward they get is, they get some flex comp dollars, or they get, if they do it in repeat time, put in a drawing for a trip to Hawaii or whatever. It's really increased the number of people who are putting in for that. It's minimal cost when they compare it to the amount of money they have to put out to maintain the health of that population, their contribution to the health care for that population.

Who knows what they were imagining when TV first came out, whether they were imaging bringing theater into the home, that was the thought. But look what we do with TV today. We don't just bring theater into the home, now we've got instant replay, we've got -- you can see a game better sitting in your living room than you can if you went to the game, we've got news, we've got

commercials, we've got video on demand, you know, not at your house, but at my house I can pick a movie, watch it, rewind it, right on the TV. Music channels —we turn on the holiday music. Whoever thought I'd be listening to uninterrupted music, no commercials, holiday, Christmas time from my TV.

The question is, what a user do or know, some ex data point or some kind of derived data point analysis, smart analysis that goes together, that would be of value anytime or anywhere, because remember, we want to talk about wireless, not just leaping to what can you do with computers, but wireless, so anytime, anywhere, what could be valuable to me and what would that improve? We can take each user and think about sort of things would be valuable to them. Let me give you some ideas to open your mind up.

My father-in-law died of a heart attack while driving his car. Fortunately he didn't hurt anybody, but what if his condition at the time could have been known by an emergency crew, the police, his car, his family, his doctor. On the other side of that, what about alcohol, what if your car knew you were drunk? Well, maybe the Civil Liberties Union doesn't want us to exactly have that loose yet, but it's possible. Maybe you want your car to know if you're drunk or no, maybe your mother wants to know if you're driving your car drunk, but who could you deliver that information to?

What if, as you entered the emergency room, your coverage, health care coverage and allergies and medications could be known just at the moment you're wheeled in? What if speech were considered a tool? I mean what if you could just talk into your computer and have everything be captured? What kind of data would you be putting there and what kind of formats?

We can look at a lot of different ways. One of the things this e-health conference did was bring a lot of people together, smart people, and they broke up into groups and had contests to vie for grants, if you will, come up with a great idea how to use electronic technologies for grants. The idea our group came up with was that some of the medications that are being given for cancer patients, for example, if you read the medication, it doesn't list any side effects; well, part of the reason is, nobody was living originally long enough for there to be any known side effects. Nobody was willing to take it who didn't have cancer, so you didn't have anything listed, but over time, there were definitely side effects, and the people who were taking these medications and living a long time are having lifestyle issues being impacted by the medication. If those things could be known and monitored and reacted to with possibly additional medications, the compliance rate might go up.

Pharmaceutical companies might be very interested in collecting that kind of data. If there was a way to monitor and collect that, there's a new area where somebody might have funding to pay for something like that. My sister works at a pharmaceutical company where she has to make regular calls to make sure the patient is on, again, medications that are for cancer and leukemia and other types of things, that they're reordered so that there's a compliance issue. What if there was a way to monitor things like that?

The final thing I want to leave you with is, what would you do — what could you do, what ideas could you come up with if you were unconstrained? Where could wireless information set loose 10 years in the future be? With answers like that, companies like SAIC, DARPA, people who have

grants, there's a lot of opportunities to go out and experiment in those areas and drive in those areas, so I think a lot of people are interested in hearing those ideas generated.

Ron Poropatich

I am very lucky in that in the Army. I get to move around to a lot of different areas. Some days I'm practicing medicine in a clinic; I go to Fort Detrick, where we manage a very large portfolio on telemedicine up at the TATRC, the Telemedicine Advanced Technology Research Center, $120 million last year, about $170 million it looks like in '04; working at Walter Reed, looking throughout this 21-state health care region, looking at congressional money; and then working at the Surgeon General's office on a lot of other policy issues gives me a wonderful spectrum on the telehealth field.

What it has afforded me, I think, is an ability to try to leverage some of these projects against one another. I think that's really the challenge. The challenge is going to be taking and linking all these different things that we do, which has really been *ad hoc*, and putting it into some comprehensive standardized network that's going to allow us to have this longitudinal electronic medical record that will then enable teleconsultation. That's obviously something that we're all moving towards and one that we're going to be looking at very closely.

I was asked to talk about wireless technologies. What we've been noticing at Walter Reed are islands of individual PDA use. We've got all these wonderful young providers, they get their own PDA and they're using it, and then we have all these wonderful docs who have very influential patients who then try to provide some congressional money for Walter Reed, where now we have these little fiefdoms of incredible financial resources that are good for one or two years, and then when the money runs out, they're knocking on the door saying can you help — we can't take this away.

We've got all these different clinical applications that have been developed. One of my jobs is trying to find the funding. The Surgeon General of the Army provides $5 million in telemedicine money that we compete every year. We've just had our first go-around. We've used this money to deploy telepathology, if you will. We're now operational in12 sites in the world; we're going to be going to six more. So, the Surgeon General's office provides not only that kind of money for telemedicine, but for the last five years we finance about 25 projects every year. All undergo institutional review board, and MRMC, the Medical Research Material Command at Fort Detrick, manages that program and has its own congressional money.

It's a very interesting mix of opportunities that we use to help develop new clinical champions to sustain this effort both among the combat medics, the nurses, and the docs. We are actively researching and developing proposals for new wireless technologies, and we've got on this last go-around for this new '04 $5 million — of the 30 projects that we've picked, we've got about 10 that are PDA wireless based, a lot of them in the OR, the perioperative setting, trying to standardize the anesthesia record, where right now you'll see the anesthesiologist every few minutes actually noting by paper the vital signs.

We want to pull data and port information. At Walter Reed, we have about 160 different clinical information systems. A lot of that doesn't talk to any standardized DoD system, and it's a major nightmare at Walter Reed. We have become victims of an *ad hoc* network that is now trying to, if you will, work within the confines of the U.S. Army in this national capital area. CHCS is our hospital information system, and then you have CIS, which is the Clinical Information System, our inpatient paperless record. We have all that data now merged into something that many of you are familiar with called the Integrated Clinical database, an Oracle database that runs something on another congressional plus-up to Walter Reed called Healthy Forces.

It has provided us a network to read and write to a database to do other kinds of e-health. The problem is, there's a lot of these different versions out there in the Army, and we need to eventually map to the clinical data repository. But it gives us, in the interim, until CHCS II is fully deployed, an opportunity that I hope will take the best of these kinds of applications and marry it up to CHCS II at a point when they're in the received mode, so that we can port the data to either a cell phone, a PDA, or a PC.

Pilot projects I'm going to talk about are wireless bar coding, the nosocomial febrile illness, diagnostic algorithm, the wireless stroke assessment of CAT scans, and the e-vital signs kiosk. Some of these projects I'm the PI, the principal investigator, some of them I'm the contracting officer representative up at Fort Detrick. What we have here are a lot of different projects that use both PDAs and wireless technologies.

How do we measure effectiveness? The 91 whisky, the combat medic, has trauma education that's required. They come to Walter Reed to recertify, and we have schools coming in every two or three weeks. We give the students, E-5 to E-8 and NCOs, non-commissioned officers, who need to study a book for two weeks before they come to Walter Reed, two weeks of instruction. Day one, they get a test, how much do you know; two weeks of instruction, day 14, they get a test, how much have you learned and do you have a passing score?

We've broken up the students into two groups, those that get the book and those that get the book and a PDA with all the trauma information condensed down to its essence, so that we have what we call in the Army hip-pocket training. You have on the PDA all that trauma stuff that we're expecting the combat medic to know. They get that two weeks before with their book. We have a code running behind the scenes inside this PDA that tells us how often they turn on the PDA, what applications they use, so that when they show up at Walter Reed on day one, they hot sync the PDA, and it downloads all the usage from that particular experience over that two-week period. We then look at the two groups, both in terms of the scores for the two groups.

A hypothesis is that these young soldiers are more inclined to study off a PDA that they can carry with them, they use for their own personal information management functions, they keep their address book on it, it's a multi-purpose device that, oh, by the way, they can also pull up the trauma modules. We start enrolling in January on this Institutional Review Board protocol to look at that particular project.

Wireless bar coding. This is a project being funded out oft hat $5 million. It identifies patients by assigned bar codes, it accesses the medical records for allergies, required meds, and it allows access

to order results. The provider orders his medicines in CIS. CIS is our clinical information system, it is our inpatient record deployed to roughly 12 DoD sites, so it's not pervasive across the DoD.

As a doc, I order the medicine, it goes to pharmacy, which takes that order and manually retypes it into CHCS — okay, waste of time and effort. They then generate a bar code and the medicines are bar coded. It then goes to the omni cell, a commercially available device that we have to store our medicines. The nurse on the ward has a patient, the patient has the bar code, the nurse bar codes the patient. The nurse knows to give the patient the medication, IDs the med, documents when it was given, and then everything goes back into CIS to continue the electronic longitudinal inpatient record. That's the essence of the bar code project. There is a bi-directional interface between CIS and CHCS that we're testing right now in our hospital, so that we don't have to have our pharmacy go between one system to another to populate that.

Then the drug is available in the omni cell, then the nurse removes from the omni cell the drug, and the nurse bar codes the patient, gets the med, and then that med is then charted into the nursing note — that's the ideal situation. When we did the pilot, we're still not going to have quite that bi-directional interface in play yet. That is currently going through alpha testing at Walter Reed. But again, all these different types of information systems that have gone through the formal acquisition cycling that still don't talk to one another, and it's just amazing, but that's the way that we practice medicine right now, and it's better, though, than 20 years ago when I was flipping through looking for lab results, you know, and trying to read notes and prescriptions, etcetera. The bar code project is an exciting project that we will start in demonstration this month [December].

We've got the wireless laboratory, it's up and operational right now. The hematology/oncology ward, where we know we give a lot of blood products and a lot of IV medicines, is where we're going to test the bar code project. We have dedicated clinicians and nurses willing to try it on that ward. Our patient safety officer, medical officer, is actively engaged. This is a project using a RIM Blackberry. Nosocomial infections are hospital-inquired infections, very expensive – they can extend a stay up to 24 days for patients, ith excessive costs up to $40,000 per survivor of a nosocomial infection. In 1999 and 2000, a study at Walter Reed showed increased morbidity and mortality due to nosocomial infections. Next slide.

What we've done with this project is, again, fund it from the Surgeon General's office. We take all the information off of that Oracle database, and it's a six-minute latency from CHCS. It automatically pulls out — and from CIS — it pulls out the temperatures on a given patient, their white blood cell count, their cultures, et cetera, their vital signs that are all being recorded. It sort of like an expert system; it says if all these different things are trending in the wrong direction. The Infectious Disease Service carries a RIM blackberry and a pager. We don't have RIM's for everybody, but then they get a page saying go check Joe Smith on ward 75, we think he's developing a nosocomial infection. We've got 75 patients enrolled in the study to date.

An Institutional Review Board protocol essentially will push it to either the RIM blackberry or a pager. The pager just says — it's only 12 numbers, and it's a code that says ward 75, bed 63-2, and the last four of the social security number of the patient so that the Infectious Disease Service doc knows exactly where to go and now sniff out what's going on with the patient, an early intervention with the hope that we can mitigate worsening nosocomial infections in-house.

Another wireless project, we call it the wireless stroke, involves real-time wireless transmission of CT scans. We've done time-motions studies at Walter Reed with tablets in the orthopedic clinic where we push x-rays, and we've watched the orthopedic surgeon in total hip/total knee replacement clinic go throughout their normal work flow.

We have digital x-ray machines. Everyone gets their x-rays done in ortho, and then the docs, along with all the other docs in total hip/total knee clinic look to see what the x-ray shows. We're trying to put these x- rays, these CAT scans, all in a tablet in ortho clinic eventually whereby the doc sits with a patient, pulls up CHCS through something called terminal emulation, does the order entry through wireless terminal emulation, pulls up the x-rays wirelessly so the patients can see, "This is what your hip looked like before surgery, this is what it looks like today, one month post-op." They can do their whole note on the fly, so to speak.

The time-motion study for that particular project was very substantial, to the extent that we are redoing the whole way the orthopedic clinic is laid out to cut off even more wasted time.

Another project looks at moving not just to a tablet, but to a PDA, a laptop, and a computer screen, with the notion of how low can you go, how far can you push the image to a form factor whereby the air rate is minimal at best?

The tablet, in my mind, is as low as I'm going to be able to look at things. But certain things like nuke med studies, I saw a guy in New York City sitting in a restaurant who got a call on his PDA, pulled it up, reviewed a scan, made the interpretation right there in the restaurant, and sent it off wirelessly.

These things are happening all around us. Because this money is R&D money, I have to marry all these different projects into an R&D question, but it also forces me to have the evaluation metrics to determine the success. The Surgeon General of the Army always asks me, "So what, Ron, so what that you did this, how are you saving me money, improving access or quality of care?" If I can't answer that question, then he's not interested in any of this stuff. He is a true believer in the role of technology but is putting the onus on us to prove that there is truly value added.

The e-vital signs project is leveraging a congressional project that I am the principal investigator on with Norway. They are co-benefactors of a U.S. congressional plus-up called the U.S.-Norway Congressional Project that's in its fourth year of funding. Their job is to use some of their emerging technologies to come up with wireless sensors for vital sign capture, so that in the OR, for example, I can just put a small disposable device on the forehead that will measure your pulse oximetry, your heart rate, blood pressure. All these things are still being worked on. We haven't gone wireless yet. But some of that money is being used also to do this e-vital signs kiosk. The patient shows up in the clinic and takes out the military ID card, puts it through the kiosk, then that patient's record is pulled up on ICDB. It brings up their record, patient puts their hands in this little kiosk that has all these off the shelf component parts, measures their blood pressure, pulse oximetry - it has a series of questions.

JCAHO requires us to have the patients tell us how much pain they are in, 0 to 10. There's a whole bunch of other questions, are you taking over-the-counter medicines, are you taking herbal supplements, do you smoke, do you drink alcohol, if so, how much? All of that is walked through the kiosk to the patient, and then those vital signs are automatically populated onto that healthy forces clinical note so that now we've captured the vital signs, we've captured all this other information on the patient, which then is married up with the information that we're pulling off of CHCS, the pharm lab s-rays.

That's the kiosk project. We go live in the gyn/ob clinic at Walter Reed on 22 December. The project has already been developed in our wireless lab, we've already tested it. Now we're just configuring the kiosk to make it look nice, and we're looking at better capture devices.

The blood pressure cuff, unfortunately, we've looked at a lot, we've looked at wristwatch blood pressure devices, fingertip ones. Wwe've done the market surveys, and we're not convinced that any of them are reliable. We've done the due diligence in measuring the variability between the blood pressures taken manually versus machine, and now we're ready to go live, but the blood pressure has to be taken manually, so we have to have a nurse or someone there to help.

The Midas Project from Titan, the Mobile Integrated Diagnostic and Data System. This is a PDA that's wired to a glove with various sensors. You put the sensors right on the chest and it automatically takes your heart rate, bloodpressure, pulse ox. We're hoping to go wireless. The Navy telemedicine initiative — the clinical validation is going to be done at Walter Reed — the Titan in '03 is a set of tools that are lightweight, small size, user friendly and that help the medical corpsman, if you will, triage multiple patients rapidly. On air flight travel essentially, when you're in the helicopter, listen to a blood pressure, all you're doing is really checking for a femoral or a radial or a carotid pulse and that's all you can really do when you're bouncing around flying in a chopper. You've got the glove, the diagnostic acquisition glove, talking to the PDA with Bluetooth, and then over 802.11(b) going through the base station and eventually back to the theater surgeon.

Sensor devices for the vital signs, similar to what we already have. We need to find a better blood pressure cuff. Those of you in the business of developing tools like that, help us out.

Lessons learned — we need to develop a comprehensive strategy geared towards a wireless environment, which we're doing at our facility, develop a migration to wireless computing, develop early prototypes, and modify them based on clinical use and gain user acceptance through training and support. Be device agnostic, I don't plan for one device because they change. Some of our guys like OS, some CE, some RIMS. Automate the content management and distribution. Beware of vendor promises, because I found over the years that they fall through. Avoid point solutions.

User feedback is critical to development process, clinical and technical, especially the information management office participation is paramount to success. Commitment to clinical process re-engineering will drive success, and end user and application support is vital to effective wireless conversion.

Scott Young

I am from AHRQ. We're a science agency, we try and define and discover evidence-based ways to improve both the quality, safety, efficiency, and effectiveness of health care in the United States for all of our citizens. I do direct the health IT programs and research portfolio, and that has grown substantially this year.

I don't know how many of you read Elizabeth Glenn's study in *The New England Journal*. Elizabeth essentially defined how many medical decisions are made based on evidence. I still see patients a half a day a week in an RV van in Montgomery County for the uninsured, and I can assure you that my access to evidence based-decisions, based in our paperless environment, which is no charts and no computers, is fairly slim. So when I say paperless, you have to make sure that definition is the same.

Elizabeth found that 53 percent of the time, on average, in the United States, medical decisions are based on evidence. That study had quite a splash in the press. A recent poll asked about concerns over errors resulting in injury happening in their family — 42 percent, and that's a heck of a number. Concerns about an event with a commercial airliner — 32 percent. People are more concerned about an event occurring in their health care than they are about an airplane going down.

We look at how safety initiatives are deployed and pushed through, the epidemic model. It's kind of the non-linear propagation, much like you'd see a virus: Stage one, identifying errors, raising awareness and capacity, putting little nodes out there; stage two, implement improving practices, linking the nodes up, developing innovative practices, developing culture. Stage three is actually forming the sustained way. It's an interesting and we think an instructive way of looking at a non-linear way of taking safety and quality improvements and pushing them out.

Let's talk about some of the things that we've done at health IT and quality and improve at the agency in the past years. Our portfolio has grown. Much goes right to development, evaluation, diffusion of HIT, principal and clinical settings. We just finished our CLIPPS program, Clinical Informatics to Promote Patient Safety. We've got a significant bump this year, it's $60 million. That is in the President's budget, and as many of us know, we are awaiting Congress to act on the spending bills. We were hoping that would have been done by now. I think we're looking early part of '04.

Some of the evidence base that we've built thus far is varied. Electronic health records, shared online health records. Blackford Middleton has done some nice work in that at CITL, automated lab testing, follow-up to reducing medical errors, use of handheld devices, acceptance benefits and barriers in the use of handheld devices and supporting systems principally in the ambulatory setting. We're trying to drive a greater understanding of that.

Improving chronic illness — there's been a lot of studies on best practices around chronic illness and coordinated care. Diabetes invention…[it's been] found that complex interventions resulted in improved diabetic control. One of the things noted is information system enhancement — decision support system —is critical in supporting those complex interactions.

Secretary Thompson [points out that] we have wonderful technology, but some grocery stores have better technology than our hospitals and clinics. I went shopping at Giant last night, checked myself out,…[yet] I don't know where my medical records are in this country. I've moved around a little bit. Some of them are in my file cabinet, some of them are at clinics, some of them are at hospitals. If I wanted to swipe a card today, or dial up one number and aggregate them, I couldn't do it, I couldn't do it. Next slide.

A study from Blackford Middleton's group [Dr. Middleton is Director of Clinical Informatics Research and Development for the Partners Healthcare System, and Assistant Professor of Medicine at Brigham and Women's Hospital, Harvard Medical School].on advanced CPOE systems [found that we could] eliminate two million adverse drug events per year and avoid nearly 1.3 million physician visits — 130,000 of those are life threatening. Here's the bottom line, $44 billion per year from uniform diffusion and adoption of advanced CPOE systems in ambulatory settings.

Some of the work that we've supported and have just seen published last year — the handheld devices, e-Pocrates, I use e-Pocrates, it's probably the only computer in my clinic, the little PDA I pull out. For fifty percent of physicians surveyed, use of the device prevented one to two errors per week, and helped physicians keep track of new drugs and guidelines. Sixty percent of physicians reported it took them less than 10 seconds to find the information compared to the use of the PDR. I can't find a PDR in 10 seconds, or 10 minutes — and when I find a PDR, is it this years PDR, is it last years PDR, is the information up-to-date? I had to resort to a PDR a couple of weeks ago to try to identify a pill. A patient came in, pulled out a handful of pills from her pocket and kind of threw them on the table and said, "I stopped taking the blue one, I'm still taking the red one, and you know, my blood pressure is fine now." and I said, "What is the blue one" "I don't know." We started digging through the PDR — I think I spent an hour, and I never did find it.

The President's '04 budget request: improving health care quality and safety, $84 million for patient safety activities, test and develop new interventions, reproducible across health care systems. We think it's interesting to see something that occurs in one very specialized arena, but we really want to see things that are diffusible, generalizable, that we can push out in multiple sites. Within that $84 million, $60 million dedicated to health IT efforts, $50 million initiative to demonstrate hospital based information technology solutions, including an emphasis on small community and rural hospitals, an additional $10 million that sits on AHRQ's budget line. We are working with ASPE, the Assistant Secretary for Planning and Evaluation, in determining the best way to spend those dollars around clinical data standards.

Let me break it down a little bit more. Of the $60 million, $50 is broken up into two buckets, a $26 million bucket and a $24 million bucket — $26 million to implement improving technologies in small and rural communities where HIT penetration has been low, and $24 million targeted to developing and implementing evaluations in a more diverse setting, and again, $10 million around standards.

As you might imagine, it was a challenge when we saw this coming down the pike to figure out the best way to target these dollars, and so we did what we do many times, we convened the meeting,

an expert meeting, in July of '03. We had 45 folks, federals, experts from around the country and multiple stakeholders.

We wanted to see a spectrum [of stakeholders], get them in a room and have them come out with some concrete recommendations, and we did that over a day and a half. Some of the themes that came out, and some of the recommendations, focus on local and community collaboratives, public private partnerships. We wanted to see people working together. We have to share information — people said no more stove pipes. Whatever is required, we want to see people demonstrating mobility and data exchange, develop frameworks to assess the value of specific features of HIT in diverse clinical settings, assist the role of financial and non-financial incentives to adopt HIT, develop the business case for HIT, and finally, evaluating emergency health information technologies, where they fit in, where they don't fit in.

As for assessing the value, we recognized early on when people go to CEOs with proposals around health IT, that they have to convince that CEO that that's a better solution than many other things that compete for capital dollars and personal expenses. There are new health care centers, cardiovascular centers, parking garages, everything else that HIT competes against, and you have to be able to understand something about the value framework.

Transforming health care through IT, the ticket initiative, some of the planned AHRQ initiatives around that — three grant solicitations hit the streets about a week and a half ago. We intend to develop a health IT resource center initially available to our grantees, so they don't unnecessarily reproduce infrastructure supporting needs around their grants, also to give some avenue to diffuse knowledge, intersect with other departments and federal resources. We're doing a collaboration with the Indian Health Service, doing a build-out on the RPMS system, doing some collaborations with CMS, and thinking of joint programming with them.

Our grant solicitations are for $41 million. The first grant is $10 million to assess the value from the adoption, diffusion, and utilization of HIT, and that's really fairly classic research, a so-called RO1grant. The next are more for on the ground implementation, planning implementation. The first $7 million is a series of one-year grants to institutions who are sitting there with a blank sheet of paper — they want to do something, they know they want to do something, but they need a little money to support personnel and maybe a little bit of a consultant's time to actually lay out a project. The last, $24 million is for implementation; these are three-year projects, up to $1.5 million of federal dollars. We want to match $1.5 million from the grantees, and this is about putting solutions on the ground, actually putting them up and testing them.

Let me talk a little bit about our future initiatives. We want to continue to demonstrate the value of HIT on quality and safety in multiple settings, ambulatory settings, hospital settings, even settings where you take the provider out of the loop and it goes right to being patient-centric. Building on previous investments – certainly we've built on past years. This year is a beginning, we're going to keep going and expand collaborations with public and private partnerships.

Another one of Secretary Thompson's quotes, which I think really just kind of sums it up, modern era, is that every century has had its major advance and has brought medical science another giant step forward. What will the major advance be in the 21st century? I am convinced that the medical

revolution of our children's lifetimes will be the application of information technology to health care. I hope my kids can get their health care and their information at least as efficiently as I can check out at the grocery store.

Discussion

Marian Warwick: I'm from the National Science Foundation, and I couldn't help thinking about the potential for collecting information from patients who are out in the field and also the possibility for EPI analysis. Many times we define health as the absence of disease. There may be many of us here who have normal lab values and normal vital signs, but there may be a difference in our health, depending on how much we exercise, or other criteria that could define levels of health. I know there have been some studies on the value of certain exercises versus other ones, does anybody know whether work is being done in this area?

Randy Ade: You're absolutely on my point of, what would you want to know if you could know anything any time. So you're starting to think about the things you would want to know if it was available, and I think there's some very interesting data. My doctor at Kaiser wanted me to come in and pay $15 to get to know her. I said why, and she said, well, so that when something happens to you. I said I come in about every three years, I think I'll have a new one by then, so I save the $15.

But if that information could be collected somehow, and I think it's a valid point, what could we know if we had that kind of collection of information?

Enrique Mendez: [USMI Senior Scholar]. You know, the three things that we generally do for people are one, to maintain health, two, to prevent disease, and three, to treat it when the first two fail. We have spent most of our time in number three, and properly so in terms of the subject that we're discussing. But we've learned a lot of lessons from throughout the years from population-based medicine. I believe that we don't pay enough attention to clinical preventive medicine, which is the knowledge that we acquire from population-based medicine applied to a single individual. What I see is a strategy of medicine that is based on clinical preventive medicine that is both adjusted to age and gender.

Therefore, what I would do with a 17-year-old in terms of maintaining health, if he happens to be male, is different than I would do with a 62-year-old in order to maintain his or her health. We have the ability to be able to delineate these things now, to be able to evaluate what testing is proper for that age group and what the actuality of that testing is, not only in terms of availability, but in terms of reality, as far as how good or how poor it happens to be.

If you are to do that, then you have great difficulty in trying to set up a system which is based on clinical preventive medicine. But it's interesting to me that the question was what areas of health care are most ripe for further development of these technologies. I personally believe that your question speaks to clinical preventive medicine, and it is ripe, but it must be philosophically ripe as well in order to be able to lay it out and apply these technologies to it in the future.

Mark Carroll: There is actually a wealth of literature that's been published, literature on protective factors versus risk factors. We've been trained in our model of education. There's a whole wealth in social sciences of protective factors, and I'll just give one example of trying to bring that in, because it's an interesting non-opportunity in some ways for IT, but I think we have to really think creatively and laterally.

I presented some information about a protective factor study in my facility a few years ago. A group met once a week, and then they had open heart surgery. Lo and behold, the folks who were part of a group actually survived much better statistically and very impressively than the group that did not. One of the opportunities, and I was explaining it to a colleague, was a bowling league. His question to me: "Well, so what, we're supposed to start a bowling league?" My answer was, "if it works a lot better than what we're doing, I think we should consider it." I'm not sure whether we have virtual bowling leagues or things of that sort, but there is a wealth of information, perhaps not as much as we'd like in some of the literature that we review from a medical standpoint, but it's a paradigm shift and it's a shift in processes we have to consider.

Evan Williams: I'm from TriCare. Is there some standards-making body or some group that you think that we're headed toward, so that I can take that medical record to any hospital? Even in TriCare, you don't go to the same place all the same time, you don't even go to the medical facility. How can I take that medical record and make sure that it can be read by any hospital system?

Randy Ade: I can start by telling you that even within Kaiser, you couldn't do that today. You've got Kaiser in California, Kaiser North and Kaiser South — I'll let somebody else talk about the DoD systems — but we heard a lot about the stovepipes developing all over that are going to cause a lot of challenges. It goes back to some of the initiatives that Dr. Young was talking about of standardization of certain data elements in patient records, so that if you could identify those things that you would always want to have consistent. Then, of course, you've got the Rubicon of how do you translate them, because they come out of a lot of different systems, and still have them be meaningful. There's a lot of work being done in that area, but it's not solved today.

Robert Wah: One of the new frontiers I think is right for change in this whole area of wireless, or, in fact, health information technology, is standards. It's kind of a wet blanket; it's not the neat stuff that we've all talked about, but I think it's really an enabling technology that we have to put money into and time and effort into. One of the things that we are doing is the consolidated health informatics project which was led by HHS, bringing together several federal agencies — DoD was one of the lead participants, along with the Veterans Affairs Department. We're looking at 24 domains of health information and trying to develop some standards in those various domains. Some are very easy — HL7, pretty predominant, pretty well accepted, so we can accept that as a standard. If we all use HL7 to communicate, that's going to facilitate moving information from various health systems.

So, how do I take my electronic health record and plug it into another system? There has to be a standardization about how we're going to call it history and physicals, how we're going to standardize lab results, how we're going to standardize pharmaceuticals. Some of the easy ones have been lab results, pharmaceuticals, as I said, the HL7 messaging. Some of the radiology

imaging issues are easier to standardize. The ones we're wrestling with are symptoms — how do you describe a cough? There are a zillion different ways to describe a lung finding or auscultatory finding of a heart. So those are going to be tough things to standardize. I think that's an area where we're truly going to have interoperability across all of our health information systems, and that's where the wireless technology is going to be a facilitator: We have to have the same standards to be able to move that information around. I think that is an area that we haven't really touched on here that I would bring up as important for the implementation of our health information technology.

Ron Poropatich: The information card, the personal information card is an Army program that's equally of interest, I think, to the other services. The smart card is another mobile device that would allow you to put medical information on a card or a high-capacity flash memory device, which we in the military call the personal information carrier, which has now been changed to the electronic information carrier. The Army is rolling out to Iraq next month a striker brigade that first will be looking at the PDA, the BMIS, that battlefield medical information system that holds that electronic dog tag to capture those encounters.

This has been of interest for some time, and it's now gone through several different iterations in the field, and it continues to be explored in terms of its role in the health care delivery. It does provide a means for soldiers deployed in different operational environments to have their electronic medical record follow them through the different eschelons of care as they're treated far forward and then work their way back to the United States or Germany for more definitive care.

The standards piece is one that we've wrestled with in a program that I deal with, NATO teleconsultation standards. I chaired the panel for the last three-and-a-half years. We've been trying to standardize teleconsultation among NATO countries. We finally developed a STANAG, a standardization agreement among 26 NATO nations that's now being vetted through the chiefs of military medical services. All the surgeons general of the different 26 nations are now reviewing this document.

Another hat I wear is from the American Telemedicine Association. I was able to move that organization into the standards realm, and we've decided that the VA and DoD have a strong interest in teleophthamology, so we've developed clinical, technical, and administrative standards for teleophthamology as it pertains to diabetic retinopathy. That document is now available. It's currently being reviewed by the membership of the American Telemedicine Association, and it's one that we're going to take to the professional societies, the American Diabetes Association, the ophthamologic and optometry associations, and vet it through those professional societies for their endorsement. From there we want to go to home health care and try to standardize as much as we can, so that we move industry as well as academia and government into the same areas as we start to articulate how we actually want to do teleophthamology or teleconsultation in a deployed environment or home care.

So, there is a great deal of interest in the standardization field. The problem is, the whole field of IT is exploding, and we're having a very hard time just trying to standardize it within our own little world; i.e., the Army or Walter Reed for me, let alone doing it among DoD or other federal agencies. It's a very formidable task, and it's just one step at a time.

Bill Montgomery: In this sense, I'll be representing HIMSS, as I'm on its board. Right now, there's a big initiative going on with HL7 and HIMSS — that there's an electronic health record standard out for review right now out of HL7. The CPRI, Computerized Patient Record Institute, a part of HIMSS, is supporting that, and there's actually a record design for the same purposes of taking HL7 transactions and moving a defined part. The first standard out is not the full electronic medical record, but it's what they call an electronic health record. They asked the question about how I would take my record and give it to someone else and have it load down onto your system.

Steve Lieber: I'm from HIMSS. Quite honestly, I don't think I can answer that question, and that's part of the problem we have. The work that Bill is referencing is certainly a major player in this, in trying to establish a national standard for both format and consistency of an electronic health record so that then you can go to that next step of communicating it from one vendor or one provider to another.

But the first step, as we all know, is simply coming up with the common framework, common structure for the record itself, and that's the process that we're going through. Some of you may have been involved in that effort this summer when a proposed national standard was first presented to the industry and went through a balloting process. That balloting process failed, but as part of that, it brought the industry together. We really feel like we've made tremendous headway in terms of coming up with a more definable and more manageable scope of a proposed electronic health record that we can then use across vendors and across provider settings.

Scott Young: That's been an interesting and detailed project. What do we mean when we say e-prescribing — when we talk about e-prescribing modules and electronic health record? What features does it have or not have, and what are optional or what are going to be the standard features? It seemed like an innocent enough question at the time, that we should be able to define that. We've started peeling back the layers on it, and it's become more and more complex. When one smartcard plugs into a system, and you have data around the prescriptions or the medications or the treatments, is it actually going to map over the same way?

The standards are one thing — are they going to talk the same language — but is it going to map over one to the other? That was what we were striving to do, so we can have, at least from a federal perspective, something to react around and something where we can say, here it is, and here is what we're going to define it as. The next ballot is in January, isn't that right?

Steve Lieber: The preliminary ballot in January, the formal ballot will probably be in March.

Randy Ade: It puts on the table the discussion that I was alluding to with telephone companies. It brings to health care, do you want to migrate or can you start over? How much for any given patient record, what's the effort to migrate it to a standard, and what's the effort to start over, and what do you lose if you don't, what if you just archive the current systems and just leave them alone, so they're there, we could get at them if we need to, and we start fresh, or what's the right model for starting? I think that's also an interesting discussion.

Robert Wah: We just this week met with the Department of Homeland Security, because they're looking for some sort of an electronic record that's portable on a laptop, so that in the event of a

domestic disaster or a terrorist attack, they could start capturing medical information. They're currently writing an RFP to go out and purchase that, and so we offered what we've learned in the Department of Defense about how we developed ours. We also showed them our laptop version of our CHCS II system in theater, and they were very impressed with the functionality that we have already built and is out there. They can probably capture it very quickly.

So, there may be opportunities to merge private and public sector activities in this regard, and I think that that's where we need to spend more time in looking at opportunities, to take what's already been developed in the public form or the federal side and see if that doesn't have some benefit to the private side as well.

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