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Impact of Technology on Health Care Delivery Systems

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Summary: What are the new medical technologies and how are these going to affect the practice of medicine, the delivery of care, the costs of care, the insuring of care, claims handling, utilization, and cost management? Panelists discuss issues relating to these questions.

Mr. Joseph G. Korabik: Let me briefly introduce our speakers. First is Dr. Elizabeth Brown, who is a national medical director with the Blue Cross/Blue Shield Association in Chicago. She's heavily involved in technological assessment. Next is Joan Ogden, a principal with Joan Ogden Actuaries. I'm sure if you've been to any health session before, you've experienced Joan Ogden's comments. Dr. David Snell is a health care management consultant with Milliman & Robertson (M&R) in Seattle. His main responsibility is the development of M&R's health care management guidelines (HMGs).

As many of you know from previous sessions, technology in health care is a very important topic to health care actuaries as we're trying to figure out prices and what we can expect in the realm of cost. It's actually rather a broad and dynamic topic that we're trying to approach from several different angles. Dr. Brown will be discussing some of the new technologies that have come up in the health care arena in the past several years, as well as their impact on the health care costs as compared to other

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Note: The charts referred to in the text can be found at the end of the manuscript. There are three chart documents, 9sea103ch2, 9sea103ch3, and 9sea103ch4.

cost drivers. Joan will present a cost-effectiveness assessment she did on one of the new diagnostic tests—the AutoPap as opposed to the traditional Pap smear. Dr. Snell will be approaching technology from the angle of information technology and its use by providers in hopefully lowering the cost of health care.

Now, as an introduction, if I could just get a feel for how many health care actuaries are here. A few. How many have attempted, but have not likely succeeded, in getting a grasp on what the cost of a particular technology is? I know in my organization we've struggled for the past year with figuring out how much the cox-2 inhibitors are going to add to our premium cost. Has anybody made any attempts at something like that? Not nearly as many. And, finally, for the benefit of our medical people, how many of you have a good feel for medical technology and terminology? Would you know what "schema" is? Without further ado, I will hand this over to Dr. Brown.

Dr. Elizabeth Brown: I'm going to provide an overview of some of the reasons why new health care technologies may increase costs, and this is just a general discussion of some of the factors that are involved. It's interesting that, in health care, technology has a reputation of increasing cost, whereas in other arenas new technology is welcomed as a way to increase productivity and stimulate economic growth and in general lower cost. I think our following two speakers will address how technology may lower cost, but I'm going to look at the factors where it might increase cost.

The first thing is to determine what percentage of the rising costs of health care can be attributable to new technologies. There's no easy way of doing this and any kind of number you'll come up with is very controversial, but the most common approach is to talk about the residual. What this means is that you measure what you can measure, which are the costs associated with the aging population and with inflation in general, and subtract that from the overall costs of medical care; what you have left is the residual. Many people had thought that the residual is primarily related to the impact of new technologies. Using this method, it's estimated that new technology may be responsible for 15–50% of the increase in health care spending. As you can see, that's a very broad range, and it's really debatable what side of the equation you're arguing.

There are obviously some limitations of looking at the residual as the prime reflection of new technology. First, it's an indirect measure. You're only measuring what it isn't, so it's not really known exactly what the residual is measuring. There could be other factors such as more complex diseases in aging populations, and this overlaps with the new technologies that address aging populations. You have the increased growth in the elderly in this country, and the two interact. You have emergence of new health care issues; AIDS is the best example. Also, the residual doesn't measure how new technology may be affecting health care costs. It could be increased use of an existing technology, the introduction of new or modified technologies, or expanded

indications for existing or new technologies. We'll talk a little bit about all three of those. But the bottom line is no matter how you calculate the residual or what you think the contribution of new technology is basically, of all the factors, the costs of new medical technology is perceived to be the one that's the most controllable.

There's been a lot of effort by payers on identifying and managing new technologies as they enter the system. This is really the focus of my work in medical policy and technology assessment at Blue Cross/Blue Shield Association, where we try to understand how a new technology is used and try to validate the benefit before it enters the system. I think payers in general have a very difficult time in changing coverage policy on existing technologies. Precedents are set very quickly. Once you start paying for a technology, it's very difficult to go back and say, "No, we made a mistake. We really think that this is something that's not medically necessary or is investigational." Thus, there's a natural focus on technologies entering the system. I think there's an agreement that a lot of what goes on in medical practice has not been validated through controlled studies. I think what we're saying is we're in the era of accountability. The slate is wiped clean. Everything that's entering the system now should have an evidence base to it to validate its effectiveness. We're going to grandfather in everything that's been existing for many years even though we may not have the same level of evidence. It's a little bit of a double standard, but it's a way of saying that from this point forward we are going to be looking at the evidence to validate a technology before we cover it.

Here are just some of the ways that new technologies could affect health care costs. One, they could expand or decrease the population of patients being treated. I will focus my comments on two trends that I think have really contributed to the increased costs associated with new technology: minimally invasive procedures and treating patients earlier in the course of their disease. Both of them are going to expand the population of patients being treated. I was trying to think of a new technology that actually decreased the population being treated, and the only thing I could think of is a technology or a procedure that would provide a cure for a chronic disease. We really haven't been very good at that. There may be a few surgical approaches that we'll talk about that actually replace chronic pharmacologic therapy, but in general a new technology probably will expand the population of patients being treated.

Two, they may reduce or increase the unit cost of treatment. Some of the minimally invasive procedures that we will talk about may decrease the unit cost of treatment, but typically you're going to expand the population of patients being treated. The total cost is greater.

Three, they can reduce or increase the risk of complications. This relates to minimally invasive surgeries when you reduce the risk of complications. You're changing the risk-benefit ratio; once you lower the risk, you're more willing to undergo a procedure or it broadens the appropriate range of a procedure.

Four, they require repetitive use or eliminate the need for further treatment. I think with a lot of the imaging technologies that are now minimally invasive you have multiple different imaging choices for a single disease, which inevitably leads to some duplication.

And, five, they improve or complicate the patient's quality of life. Many of the new technologies truly do increase the quality of life, but this benefit is typically not measured in the health care budget. If you're talking about return to work or increased productivity from a societal perspective, it may be very advantageous, but its not reflected in the health care budget. It appears that your health costs are increasing.

Let me give you some examples. I want to start with some minimally invasive diagnostic technologies—first, the advent of the MRI for evaluation of musculoskeletal and neurologic disorders and, second, the overlapping imaging technologies that lead to duplication of services.

All three indications for an MRI—the evaluation of the knee, the evaluation of low-back pain, and screening for patients at risk for intracerebral aneurysm—replace an invasive diagnostic procedure involving the injection of dye. An MRI of the knee replaces an arthrogram, where they actually inject a dye into the knee joint; an MRI in the evaluation of low-back pain replaces a myelogram, where they inject a dye into the spinal column; the MRI as a screening tool for patients at risk for an intracerebral aneurysm replaces an angiography. All three of these MRI applications represent minimally invasive alternatives to invasive procedure. We've seen the utilization of these go way up as a result. I think an MRI evaluation of the knee is a very routine procedure at this point. For anyone who has a traumatic injury to the knee or osteoarthritis, it's just a routinely performed procedure. With respect to an MRI in the evaluation of patients with low-back pain, according to some studies 25% of them can be asymptomatic patients if you do an MRI of a patient's spine; there will be a bulging or a herniated disk. Any time you increase the number of tests that you do you have the challenge of determining whether results you see are clinically significant because in 25% of the patients it's going to be asymptomatic. It's not going to be the cause of their pain. You really have to work hard to make sure that what you're seeing relates to the clinical picture that the patient is presenting, and with low-back pain that can be very difficult because sometimes the symptoms are somewhat nonspecific, and it's hard to know whether a herniated disk is causing their pain. Ultimately, it can lead to increased rates of surgery.

An MRI is a screening tool for patients at risk for an aneurysm, which is an abnormal configuration of blood vessels in the brain. Recently, the manager of the Houston Astros was in the news when he had a seizure in the dugout; they ultimately discovered that he had an aneurysm, and he underwent surgery. Clearly, aneurysms

represent a risk for rupture and bleeding, causing a stroke. This fellow was very lucky that he was able to be treated in time. Patients who have a family history of aneurysms or have polycystic disease are perceived to be at greater risk for aneurysms; therefore, now that there's a noninvasive test for looking for aneurysms they can be screened much more easily than through an angiogram. However, in autopsy studies they've discovered that between 1% and 8% of patients will have an asymptomatic aneurysm. Again, you have the issue. You're going to screen a lot of patients. You're going to find aneurysms, and you're not going to understand the natural history or whether they're clinically significant or what to do with the information that you're generating from these noninvasive tests. Presumably, the family of the Astros manager will now be a candidate for this type of screening, and they might find an aneurysm. And who knows what they should do with it?

This next bit of information is taken from an article that was recently published in the *Journal of the American Medical Association*, which showed the influence of diagnostic testing on disease prevalence. We'll look at one of these, the abdominal aortic aneurysm, which is similar to the intracerebral aneurysm but located in the abdominal aorta. It's more common in older patients. If this is present with a rupture, it's very difficult surgery with a high mortality rate. It would be nice to be able to identify patients early on so that it can be done as an elective procedure, but for the traditional test, which is an angiogram, the incidence is 2.5%; once you start doing ultrasound it raises to 9%. You're going to have an increased diagnosis presumably of more mild to moderate disease. What do you do with that? How do you treat it? We know the natural history of these aneurysms. And coupled with this, interestingly enough, there's now a minimally invasive procedure that can be used, a stent graft, where they put in a stent, which is like a wire mesh, to prop the vessel open and graft material around it, which excludes the bulging part of the vessel. You have coupled a minimally invasive diagnostic technique with a minimally invasive therapy, and I think that would certainly drive utilization for more mild disease.

I was impressed when I thought about multiple-imaging techniques for a single disease. There is nothing like the heart. There are probably 20 ways to evaluate the heart. You can look at the cardiac anatomy, which is your basic chest film, but by using transthoracic echocardiography you can place the ultrasound transducer down the throat so that it's next to the heart. You get a better picture. You can do an MRI. You can look at the electrical activity of the heart. The electrocardiogram (EKG) is a standard way of doing that. A fancy way of doing an EKG is a signal average EKG, which gives you a risk of arrhythmia after a heart attack. You can have exercise/stress EKG. You can have ambulatory EKG, which you can use to detect arrhythmias. And the list just goes on and on. When you look at the coronary artery anatomy you can do angiography, which is the basic test. You can do angioscopy, which is putting an endoscope into the artery so that you can look at the interior surface of the vessel. You can do intravascular ultrasound in which you put a transducer into the vessel and look at the three-dimensional composition of the wall of the vessel to get an idea of

what kind of plaque is there. You can do Ultrafast CT, which is a noninvasive method to detect the amount of calcium in a vessel as a risk factor for future heart disease.

In the Chicago area there are actually ads on the radio encouraging asymptomatic patients in the 40- to 50-year-old range to come in for a screening test. And if they find a certain amount of coronary artery calcium, they may recommend that the patient then undergo an angiogram or some additional studies. This one is quite controversial in terms of whether the information that you get from this test can be used in the management of the patient. Yet, there's a lot of interest in it, and, as I said, it's advertised on the radio.

There are various ways to look at the myocardial profusion and viability of the heart. This really relates to whether or not it's worthwhile to undergo a revascularization procedure such as a coronary artery bypass graft (CABG) or an angioplasty. Thallium and stress echo are probably the most common, but positron emission tomography and single-photon-emission-computed tomography are also popular and increasingly used.

Finally, you can look at the way the heart is functioning as a pump and its cardiac hemodynamics. Doppler echocardiography is pretty standard. This thermodilution to measure cardiac output is a technique that's really only used in the intensive care unit for acutely ill patients, but thoracic bioimpedance also measures cardiac output, and it can be done on an outpatient basis. They have the opportunity to use this device in the clinics or in the emergency room. I think you might see increasing use of that. We have intracoronary Doppler echo cardiography, which looks at the functional significance of stenosis in the coronary artery. There is also Ultrafast CT and cardiac MRI. It's very difficult to image a moving heart with these techniques, but they figured out a way to do it using Ultrafast CT. That's a portion of the menu that a cardiologist can choose from when he or she's evaluating a patient with heart disease. As you can imagine, there will be some duplication of tests.

I just want to quickly look at the evolution of percutaneous transluminal coronary angioplasty, which we just call angioplasty. This started in 1977 with 32,000 cases, and it rose to 200,000 in 1982. With such a rapid growth you'd think, "Well, we're substituting an angioplasty for the open procedure, which is the CABG**,** so we shouldn't see an overall increase in the number of revascularization procedures as a whole," but, no, that's not the case. During this period of time there was no impact on the total number of revascularization procedures, and, in fact, the number of CABGs doubled during the same period. What you see again is an expansion of patient indications and patients being treated earlier in the course of their disease, particularly with angioplasty where you can treat single vessel disease and levels of stenosis that may not have been thought to warrant an open procedure.

Another feature of angioplasty is that it started out as a very straightforward procedure. You go in and you basically mechanically expand the artery. The concept is fairly simple. But it was limited by an incidence of restenosis occurring in 30–50% of patients after 6 months; these patients would have to undergo repeat angioplasty or occasionally undergo a CABG procedure. Attention was directed at trying to reduce this restenosis procedure, so now the relatively simple angioplasty has these additional technologies tacked onto it to reduce the restenosis rate. Remember, restenosis occurs in only 30–50% of the people. As a preventive technology for 50–70% of the people it's not going to be necessary to do this. They're not going to benefit from these add-ons to the technology. But here's what's common in 1999. Stents are placed in 80–90% of patients. Stents are these wire-mesh things that prop open the arteries to decrease the restenosis. You use intracoronary ultrasound to determine the adequacy of angioplasty and stent placement, and you use a monoclonal antibody called Reopro (Abciximab) to reduce early restenosis. And, finally, there's a lot of interest in intracoronary radiation. This is going to be a big market for those radiation therapists. They're going to get into the coronary artery disease business. What they can do is either implant a stent that is radioactive or expose the vessel to radioactive material at the time of angioplasty. It is anticipated that it'll be FDA-approved probably in a couple years. That will be another add-on to coronary artery disease.

Let's just look at a couple other minimally invasive therapies and how they can expand the patient selection criteria. Laparoscopic cholecystectomy burst on the scene in 1989, and it is really remarkable that within 18 months more than half of all the surgeons had undergone training. Laparoscopic means that it's a minimally invasive procedure. A small endoscope is put through a puncture incision in the abdomen, and the surgeons can basically do the surgery using video guidance. They can remove it without having to do a big incision in the patient. It was really a tremendous advance for a variety of surgical approaches in that they didn't have to use big incisions, which really delay the recovery and require several days of hospitalization. It was a major advance. But also I should say during 1989 there was a lot of interest in developing other alternatives such as biliary lithotripsy and some drug therapy for gallstones. Cholecystectomy is a basic part of a general surgeon's business. I think they were very interested in finding an alternative that could compete with some of these other things that were emerging. Because of the success of laparoscopic cholecystectomy the interest in biliary lithotripsy really waned, and although it's been FDA-approved right now I don't think it's routinely used.

There have been a couple studies that have documented the increasing rates of cholecystectomy. In 1992 an HMO reported that the rate of cholecystectomy increased from 1.35 cholecystectomies per 1,000 enrollees to 2.15. It didn't quite double but it certainly went up. And some people at the time said, "What we're looking at here is a reservoir effect." There are a lot of patients out there who are candidates for a cholecystectomy, but they've deferred it because they're too ill or

they're afraid of surgery. These patients are now presenting themselves for a cholecystectomy. This has been referred to as the woodworking effect. Basically, patients are coming out of the woodwork and undergoing the procedure. Part of the reason is that the risk-benefit ratio has changed such that, whereas in the past some of those patients would have deferred undergoing a cholecystectomy and 30% of patients would have only 1 episode of biliary pain and won't experience it again, patients who have an initial episode of biliary pain might go on to a surgical procedure.

Biliary pain can be very typical of gallstones, but in some patients the pain isn't quite as typical. You don't know whether the abdominal pain they're experiencing is indeed related to their gallstones. However, since the risk-benefit ratio has changed they may be candidates for this procedure. Additionally, there's another population of patients who may have typical pain that looks like it's related to gallstones but they don't have gallstones when you do an ultrasound. This is called acalculus cholecystitis, and some of these patients now also will be candidates for the procedure.

Just briefly, here are some other minimally invasive therapies. There are 35 laparoscopic procedures now in the *Common Procedural Technology* book. Over nine years it has expanded to involve all different areas of the body, different body cavities, and different ways of doing the procedure. Most of them offer decreased pain and convalescence and a decreased hospital stay. There really is a significant benefit in terms of quality of life for the patient, but, again, it's not reflected in the health care budget because for many of these procedures it is more costly to do a laparoscopic approach. The operating room time is lengthier, and there are instrument costs that are more expensive.

There are a few of these technologies that represent an alternative to drug therapy, which I was talking about earlier as a surgical, curative approach to a chronic disease. One of them may be radio frequency ablation of arrhythmias in the heart. In the past patients with heart arrhythmias may have been required to take lifelong drug therapy, but now they've been able to find the abnormal electrical circuitry in the heart and go in with a minimally invasive procedure, zap it, burn it away, and interrupt that electrical circuit so it provides a true cure. Certainly in that situation you're going to have a large reservoir of patients who have been on lifelong drug therapy who are going to present themselves for this technology.

I just briefly want to talk about patients treated earlier in the course of their disease in regard to drugs. Certainly the increasing drug costs are a great concern to payers because they are outpacing other increases. Essentially, a lower diagnostic threshold will detect milder disease as we've discussed earlier. The example I want to give is hypercholesterolemia. Basically, hypercholesterolemia is not a disease in and of itself. It's a risk factor. Treating patients earlier in the course of their disease would make perfect sense if the natural history of the disease was completely understood and we had available therapies to treat it. And that's really the case with AIDS. Over the

last seven years or so they've really determined that by looking at the amount of HIV in the body you can predict the natural history of the disease. You can tailor the drug therapy you give according to the amount of HIV in the body. It's been a tremendous success. The morbidity and mortality of AIDS has really dropped significantly, as have the medical costs. But in other situations the natural history is not that well understood and the available therapies are not that effective. Any time you treat patients earlier in the course of the disease you're going to introduce some inefficiency in treatment. There are going to be a lot of patients who are treated that really don't benefit, and hypercholesterolemia is an example.

There have been a number of randomized studies looking at the various drugs, the statin drugs, that are used to treat hypercholesterolemia. Generally, they report a significant effect, but when you look behind the numbers you can see that the effect is really not as great as you might think. For example, one of the lipid-lowering trials treated 4,000 people who had a myocardial infarcation (MI) and average cholesterol levels. About 80% of the people who have a coronary event will not have elevated cholesterol levels. This study looked at lipid-lowering therapy in this population of patients, and it reported a 24% reduction in coronary events after 4 years of treatment. This seems fairly significant. A look at the absolute numbers, however, shows that 13% of patients in the control group had an MI versus 10.2% in the treatment group. Although that's a 24% reduction, you can see that the absolute reduction is only 3 percentage points, which is not as impressive. It's really only those 3 % of patients who are benefiting from the treatment.

Chart 1 is an example of how changing the diagnostic thresholds can change the prevalence of disease. The National Cholesterol Education Program identified a cholesterol level of 240 as representing high cholesterol, and this is developing as identifying mildly elevated cholesterol. You can see the percentage of patients this represents. About 8 million patients could be candidates for drug therapy. Not all of them are. It really depends on other factors. By lowering the threshold you obviously expand the population of patients.

The drug companies are looking at the prevalence versus treatment. There's quite a gap on a number of these where there are a large percentage of patients who aren't being treated. We look at hypertension, high cholesterol, and osteoporosis. Those are all risk factors, not diseases. Although it's been considered appropriate therapy to treat all these patients, many of them ultimately will not benefit from them. Direct-to-consumer advertising is increasing. It's somewhat unfair to put these side-by-side, but there probably is a correlation. I should also point out that hypertension, high cholesterol, and osteoporosis programs are federally funded. There are public health initiatives that are trying to raise patient awareness and get these patients to come out of the woodwork and be treated. Over the next several years maybe we'll see these gaps decrease. Osteoporosis is a relatively new one. I've been told that both Hillary

Clinton and Tipper Gore are preparing public service announcements urging women to undergo bone mineral density testing.

We'll just briefly talk about more preventive therapy. This is primary prevention where you're trying to prevent the disease altogether. There have been a number of immunizations that have been FDA-approved in the last ten years. Rotavirus is the newest one. This is a cause of childhood diarrhea, which is rarely fatal in this country. It's a significant cause of mortality in developing countries where there are not as good hospital and rehydration services. For rotavirus, chicken pox, and Hepatitis A, the rationale for these vaccines is not so much that they're life-threatening but the morbidity and the indirect societal costs of caring for these kids when they have to stay home from school. Those concerns have really been the drivers behind these vaccines, rather than mortality. The Lyme disease vaccine is interesting in that it's not really the disease itself—it's the threat of the disease. Patients are a little anxious about tick bites in endemic areas; by having the vaccine you might reduce that anxiety.

I want to conclude with a concept of cost-effectiveness. A lot of the technologies that I'm presented with say they're cost-effective. The first point is that you have to remember that cost-effective doesn't mean cost savings. What cost-effective means is that somewhere someone has decided that the cost associated with this technology is something that our society wants to pay. There have been a lot of discussions on how to do a cost-effective analysis and what the methodology is, but there's very little discussion on what to do with that final number you get. You're going to get a number, say, $50,000 per quality-adjusted life year. That's the number you're going to come up with. The methodology may be absolutely exquisite, but you're still going to have to make a decision: Is this $50,000 something that we want to pay for? And there's been very little discussion about where that bar should be set. Different studies have done different things. One of the most common things that has been done is to say that this cost-effectiveness is similar to things that we already pay for. It's a relationship definition. The problem with that is that there's never been an explicit way to determine whether that first thing that set the precedent is cost-effective, so if you group everything together it really doesn't solve that problem.

Another common thing is that people say if it's between $20,000 and $40,000 per quality-adjusted life year, we're going to call that cost-effective. I've talked to a number of people, and I can't find anyone who knows how that number was picked. Where does it come out of the air? I don't know. The National Osteoporosis Foundation approached this from an interesting angle. They recently published a cost-effective analysis that was part of this campaign for treatment of osteoporosis, and what they decided is, "Well, we don't know what would be cost-effective, but let's figure out what is the absolute limit that we can spend." They took the total gross domestic product (GDP) and divided it by the number of people and came up with a figure of $30,000, which represents the mean maximum cost-effectiveness. In other

words, if you wanted to spend every last dime of the country's GDP on health care, you could spend $30,000 per quality-adjusted life year. Oddly enough, that comes in within the range that's been seemingly picked out of the air. But no society could do that; that's clear. It just serves as an interesting point of discussion because there are many technologies that are more cost-effective than that and many that are less. Not everyone is treated every year.

Ms. Joan Ogden: I'm going to give you one way that I looked at the cost of a particular technology on behalf of a client. I worked with colleagues Michael Costa and Dr. Howard McQuarrie in Washington, D.C. and in Utah. What we looked at was the cost for prescreening of Pap smears by a technology called AutoPap. It's an automatic screening technology that can screen Pap smears up-front, not a rescreening as many of the other technologies are. For AutoPaps 25% of the slides are set aside; no human has to look at those. We'll have a human look at the remaining 75%. It was approved by the FDA in 1998 for initial screening.

It can only be used on conventionally prepared Pap smears. It is intended for detection of the usual sorts of things, but it is not designed for use on high-risk cases. A question was, "What would it cost for an insurance carrier to extend benefits to cover this prescreening technique?" Pharmacy and therapeutic committees and medical directors rely on a lot of data sources to make decisions on new technology. It's often in a situation where you have a commentary about trials but no information on what it does to an actual insured population's cost per member per month (PMPM). And so what we tried to do was the typical kind of thing an actuary does: Go after the data, apply the clinical information on top of the data, and see what results you come up with.

First of all, we have the clinical pathway that gets followed. We're working with managed care organization data, incorporating the clinical trial data and laying it on top of historical data consistent with treatment guidelines. We then end up with an actuarial cost PMPM. I said to my clients, "Let's use your data to model this," and I started off with two separate sets of scenarios. One was a four-year consecutive block of data where each woman in that block, typically with no children, was covered for at least two consecutive years within any four-year time period. Claims data was examined from a 500,000-member HMO and a 100,000-member PPO, for consecutive 4- (HMO) or 2- (PPO) year periods, to establish baseline clinical and cost scenarios. My clinical data from the clinical trials told me that I had improvements in two of the errors. When you consider a Pap smear you either get a true positive or a true negative or, much less desirable, you get a false positive or a false negative. What we're looking at are the two errors, the false positive and the false negative, and in this case the AutoPap was determined through clinical trials to reduce the incidence of false positives by 15% and the incidence of false negatives by 32%. Now, those sound great, but what does it come down to in terms of a PMPM? Obviously, there is an additional cost for new technology. Sensitivity analyses were run at 95%, 90%,

and 85% of clinical trial levels to approximate "real-world" lab performance. We looked at it based on a PMPM ranging from $80 to $160 to determine what our range of cost PMPM might be.

The frequency tree or sequelae in Chart 2 came specifically from the data. We started off with a scenario where in order to be counted we had to have a woman with two Pap smears in the time frame that we were looking at, either the four years in the HMO data or the two years in the PPO data. We started off with a routine Pap. If they didn't have an initial routine Pap, they got dropped out of the data. Then we looked at a subsequent Pap. We either had a normal Pap result initially or an abnormal Pap. And it breaks out based on what the actual claims and diagnosis data told us. If we had a routine Pap followed by a Pap within six months or a procedure within six months, it was deemed to be an initial reading of abnormal. Then we had a procedure that had a positive diagnosis on it in the claim record or a procedure that had a negative diagnosis associated with it. Or we got another follow-up Pap. This is the pathway that requires watchful waiting. We'll just have the woman come in every six months and do another Pap smear. It tracks on down. Over the course of the two or four years, this sequelae covered the full spectrum of results that we saw in the actual claims data.

The data was different between the HMO and the PPO. Chart 3 shows the percentages in the HMO scenario where we found the events occurring. We had a 3.4% true positive underlying rate over the course of the four-year HMO experience. Notice that 7% of the slides showed up abnormal in the initial routine Pap scenario. That is, they were followed by another Pap within six months or a procedure. We only had, of the normal slides that showed up, a 1% false negative rate.

For the PPO the numbers were very different in terms of the framework. In Chart 4 we have a very different breakout initially. Instead of 7% we have 13.9% abnormal. As you track through the entire data, let me remind you that under the HMO we had 3.4% true abnormals. With the PPO environment we have 3.2% true abnormals, yet we have a very different split and a very different pattern of treatment. Here you get 24% of the abnormal with a procedure. Under the HMO environment you have 52% of the true abnormals with an immediate procedure. This has cost implications.

The cost of an AutoPap ranges somewhere, to add it on, between $10 and $20 for the initial prescreening. After going through all of the data your incremental cost at $20 (the upper end of the cost of the AutoPap screening) adds somewhere in the neighborhood of 7–9 cents PMPM. This is not per female member. This is per man, woman, and child. This is the additional cost just to the health claims in terms of reduction of false positives and reduction of false negatives.

From the Floor: Why is it different at different PMPM levels?

Ms. Ogden: Because of varying assortments of administrative cost. What we're doing is modeling it as a percentage of the total cost. We're presuming contractual arrangements.
We're looking here solely at the cost of this additional technology. We have not valued the other issues, such as the productivity loss and the sleepless night factor, which are very real for these women who are going in every six months to get another Pap smear to see if they have cancer. And so the bottom line: Is the coverage somewhere in the neighborhood of 10 cents PMPM worth it? There's not a "yes" or a "no" answer, but it does give a real number so that you can make the decision as to whether this is something you'll add to deal with these other nonquantified issues.

Questions? Have any of you done this sort of testing? Let me comment about one other thing. I think there's a lot more data here to look at because over the course of the four years when I saw a Pap that had an initial abnormal result and a subsequent Pap with no further procedure, meaning it really was a false positive, over the course of the 4 years at least 17% of those were initially deemed false positive by initial Pap. The subsequent Pap ended up having a major procedure involving the cervix with a diagnosis that would suggest that the original positive Pap was accurate. The follow-up Pap was the incorrect one. I think that has a lot of implications for the commentary that we tend to disseminate when we're trying to reduce costs. Typically, once you've had three successive normal Paps you then move to a three-year cycle. Those three successive normal Paps may actually have been wrong based on what I'm seeing in the data, and I think that bears further study.

Dr. David Snell: I'm going to change gears a little bit here. I'm not going to talk about pure technology, but a subject that's near and dear to my heart that's getting a lot of press these days. It's information technology and how it's going to perhaps change how both you and I will deal with the medical system. Let me give you a little bit of background about myself. I know you're all aware of M&R, obviously, but I didn't really know until I got there that the vast majority of what we did was actuarial. I knew them primarily through the HMGs that I utilized as the medical director for Blue Cross. I'm assuming that most of you know about HMGs. We'll get more into that.

I basically bounced around clinical medicine for a number of years until I figured out maybe there was something better than being up at three in the morning doing appendectomies. I went back and got an MBA at UCLA and, after being in private practice and clinical attending for a while, I went to Blue Cross. I've also been involved in the International Guard as a senior flight surgeon. The reason I say that is because it gives us a little bit more credibility in threatening doctors to perform in certain ways.

As something that I'm sure you are very aware of and that we're finally finding out in the medical field, and as I'm sure Dr. Brown can tell you from her experience at Blue

Cross, is that the sands of medical information and the role of information technology are shifting. I don't necessarily mean looking at the number of 25-year-old millionaires that are in Seattle building houses and driving Porsches while the doctors are sitting there watching their incomes go down. I'm talking about how doctors and people in the medical profession have traditionally obtained their information.

I ran across it just a week or so ago in a medical journal. Doctors tend to depend on experts when they need information. They do that before they go to computers. Most of the experience that physicians and medical personnel have with information technology is a billing system, and it has been an unsuccessful billing system. I can't tell you how many doctors I've talked to who say, "Yeah, those blankety-blank computers. I spent $10,000 to get the computers in here, and I can't get anything right; we try to do electronic claim submissions and it doesn't work, and I can't get any data." Physicians and other medical personnel are attuned to the idea that you really can't use a machine to get your information. It's much better to call somebody else up, especially with physicians. They can just call the medical librarian and say, "I want this, this, and this," and the librarians say, "Yes doctor, yes doctor, yes doctor."

There has been a lot of push towards guidelines. Most physicians, at least if they're reading *The Wall Street Journal* or if they've had some sort of interaction with Blue Cross or many other health care plans, know about the HMGs. Currently we cover about 50–60 million people.

In essence, the way technology has worked now is in spite of all that promise about having electronic medical records and the Newton. Anybody remember the Newton that didn't work and led to the expulsion of John Scully at Apple? There's nothing really that's in widespread use now, except for a few technologically advanced practices, where a physician can just punch a finger on a screen or do something with his or her hands on a handheld and get the information that he or she needs. We were having this discussion before we even started this meeting about where you go to find a guideline. How are you going to do it? There aren't that many guidelines in the literature.

Something that actuaries know and that physicians and health care providers are just beginning to understand is that data is key. Blue Cross and Blue Shield knows that. When I was in Tennessee, at the Blue Cross system there, we had huge amounts of claims data. We'd go to the physician and say this is the way we do that. Then they'd say, "You can't tell us what to do because these are just claims data." It doesn't talk about quality and everything else. We could give them at least the beginning of the information they needed to influence the quality of care. That would be the PMPM stuff, the bed days per thousand. There is almost any number of permutations and combinations of data that you can get out of the claims that you can deliver to medical groups or even patients at this point in time who are searching the

Internet for much more information about their diseases. Reflecting off of this data is the idea of disease management and that 15% of the patient population will probably give you about 60% of the cost for your health plan. How do you get the information to the people who are taking care of this chronically ill population? How do you get the information to the people who have the chronic diseases?

Here we are, and that's probably no different than it was 20 years ago. What's different now? This is where we come to the focus of this meeting in that there's the information technology to be able to make this kind of stuff available. There isn't a physician alive hopefully in this country who hasn't heard of the Internet and the founder of Web MD, who's worth $1.5 billion. All the physicians are saying, "I could have thought of that." Well, they didn't, and he did. There's the use of the Mac and Windows. Finally, Palm Pilots, which are probably the first widespread use of a simple device that even physicians can figure out how to use. I've seen them using it, although not as often as in business. Then we get down to something that I'm going to patent because I think it's such a neat phrase, the four D's: dumbing down of data to doctors. Essentially, what we have to do is get stuff, as I mentioned, that's presentable to both patients and doctors.

The question then becomes, well, if you're going to do the four D's, what are you going to do it with? What is out there to present in terms of health care finance, health care treatment, and health care guidelines? Everything's out there. If you do a data dump on physicians or health care providers, they're going to say, "Thank you very much; let me find the round file for this one next." At this point in time it's difficult to separate the wheat from the chaff. There's a phenomenal number of software companies. As a matter of fact, I get this interesting little thing called Computer Talk, and it's with the Directory of Medical Computer Systems. It is chock-full of ads, companies, and things that you can get. But the question is when you install this, it isn't something that's going to cover a national data bank because the medical records aren't available right now. It isn't something that's going to cover the office next door. It's just something that you have to generate a lot of data to put into; you may get a little bit of reward out of that. At this point in time it's not easy to figure out what the data are.

Let me give you an example. This is something that came across my desk that's actually a fairly good idea from a health care software company about physician profiling. They talk about using this as a profiling tool that looks at inpatient, outpatient, referred care, procedure, uses, and all the stuff that we talk about that's out there. This is what you get. Here's a physician who's working his typical 60-hour week. He buys this software program for a couple thousand dollars or the health plan tells him we're going to give you this information because you're going to need it. He's going to look at this, and first of all, he won't be able to read it. Secondly, he won't know what it means because when you talk about performance ratios or actual cost or something like that, he kind of gets lost in the program. You've lost your big

chance to make any difference to that physician's influence and practice. I don't know if this is as complex as it gets or as simple as it gets, but I just thought it was a good example of what not to do. This is a specialty group detail for professional fee-for-service expenses. I'm not real sure what this all means. I think this would be, for example, one physician's referrals to different types of specialties and what they cost and PMPM stuff. But, again, you've lost the battle already when you're trying to present data like this to physicians or health care providers who don't have a real appreciation for what you can do and haven't taken the actuarial exams to be able to understand it.

I know I'm not supposed to be politicizing this, but this is something that some of our information technology people have come up with in terms of a software program that utilizes the guidelines. We had some clinical input on this because they saw this kind of stuff and said, "We don't want our program to do this." This is, I think, where the technology will need to be going. A physician can look at this and say, "This is great. It has a pie chart. I recognize that. It has different colors. And it has like four or five different numbers. Just tell me what I need to know, inpatient utilization summary. OK. Got it. Good idea." The next thing they want to see is they're right in the middle of the bell-shaped curve because nobody likes to stand out these days. This is basically how this thing works. It does take the data from the health plan or the physician office, puts it in what the information technology people call a relational database, and then calls back and forth for information from either a vendor application or the HMGs that we have.

There are also other things that are provided for physicians. What I think will be necessary is another program that our information technology people devised, which is a data warehouse. That takes information that the health plan has, such as a long list of numbers, and then just translates it into a relatively straightforward thing. This, again, is something that physicians will be able to understand when you just put up a small bar graph, a few dates, and some percentages. All they want to see is a big red x where they are.

What's coming down the pike? Again, this is something that deals with an office-based PC, drug information thing. How many people have heard about Planet Rx or drugstore.com? Drugstore.com was started by a second-year medical student in Pittsburgh who got angry at the way that his professors were trying to teach him and moved out to Silicon Valley. He's probably worth $1.5 billion. He didn't even get his degree. But, again, there's a phenomenal amount of morbidity and mortality secondary to drug interactions or the wrong prescriptions given. At some point in time, and correct me, you would know more than I, Elizabeth, 8–15% of all medications given in a hospital with an IV or orally have some sort of inadvertent side effect. Or they were given inappropriately or the wrong medication was given to the wrong patient.

Dr. Brown: It's a lot higher. Actually 25%.

Dr. Sneer: There you go. I was trying to make us look a little bit better. But it's phenomenal. And that's the kind of thing that software can do very easily. It can check for allergies, check for the appropriate medication, check for side effects, or check for contraindications with other medications. That stuff is somewhat available in hospitals but not at all available to physicians. This is the first stab at doing that.

Getting back to the Newton, this example is a little electronic medical record that this company thinks is going to make them the next $1.5 billion. They want the physician to carry around this little tablet and transcribe all the information on it. I can tell you probably right now that it ain't gonna work. All that you need to have is something that the physician can poke, poke, poke. Something then comes out; it prints out a bill, like the guy who comes and checks you in at Avis. I mean that's technology at its best, so why doesn't it have something like that when you go into the room? Boom, boom, boom. Your prescription prints out. You give it to the patient. That's probably what the first stab is, but the unfortunate thing is because medicine is so complex, they think the software and the hardware that needs to deal with it has to be complex, too. They ought to hire me, and I come a lot cheaper than $1.5 billion. I could have just told them about the four D's.

Where does this all get us? We're at a point now where there may be the potential for an incredible paradigm shift that hasn't happened since the telephone's contribution to medicine. Formerly we were talking about pony express; then you got the telephone and the telegraph so that you could at least share information. There is something that's called the standard of care in a community that has been used in lawsuits. That goes to the idea that you need to practice your brand of medicine, even though it's an art, in comparison to the standard of care in a community. Now the standard of care in a community in Knoxville, Tennessee is the same as in Seattle because of the influence of technology. You should be aware of what's going on in medical practice all over the country as opposed to just in your small rural area.

If there's going to be widespread adaptation of new information technology that will give doctors useful clinical information at the patient group or population level, the way in which health care is delivered in this country will change phenomenally. Let me say that again. If we can figure out how to get the Avis rent-a-car system of delivering care at the patient's bedside into a little bar coder, a point-and-shoot type of thing, a laser pointer, or whatever it's going to be doing so that even doctors can utilize it, and that sorts the claims data and the patient care data that that physician is using and puts it into a database and gets that available at a group and a population level, the way in which we're going to be able to deliver care to Americans is going to change phenomenally. Whoever those people are who are moving or will move to Silicon Valley and figure this out will be worth $1.5 billion the week after they do

that. Let me state that again, $1.5 billion. We won't be having this conversation if you or I can do that.

This is how doctors can do it. This is courtesy of Vasona Systems, which is designing some software that is case-management-oriented to help them do that. How many of you have worked with groups of doctors? Do you know the term herding cats or herding piranhas? Does that come to mind? It's not an easy task. We can do this if we can agree to standards of information technology and what kind of hardware we're going to use for that. That's if we can build a database, either at a health care plan level or at a physician level in terms of a specialty group or nationally, and if we can bring the database technology to the point-of-care. That's just a more complex way of saying if we can bring the Avis technology to the bedside and integrate the data with physician expertise. Those are the people who have the best outcomes and the ability to take care of patients best and make it easy to use and treat. There's your $1.5 billion.

What are the questions? When? Where? And how? Well, Healtheon launched their beta test with Brown & Toland Medical Group, involving 1,500 physicians in the San Francisco Bay area. It didn't do very well. They were something like eight months behind their initial public offering because their beta test went so poorly. The doctors had tremendous difficulty utilizing the data and the browser. The main reason, at least according to *The Wall Street Journal*, was because the people who write software are not the people who take care of patients. There was no interaction.

I have to tell you this story because this deals with engineers. I went to NASA, and I worked on the Mir project for a while in Houston. I was going to go to Russia. We were going to fly a defibrillator to the Mir station just in case somebody went into defib. Part of my assignment was to teach the astronauts how to use this defibrillator. They bring out this huge defibrillator, and it had words in Russian on it, words in English, cables, and paper so you could get an EKG tracing and stuff like that. And I said, "You know, they have automated external defibrillators (AEDs), which the airlines are carrying now. This was just three years ago. And it's about the size of a paperback." It costs about $100,000 a pound to lift something in orbit. You take this 20-pound defibrillator versus a 2.5-pound AED. Even I can do the math on that one. And I said, "We could just use this AED," and the engineer who's doing the project with me looks at me. It must have been like what passes for pity on an engineer's face. He says, "You haven't been around here long enough, but you'll understand. We at NASA do things differently here than you do in the real world, and this is what we're going to be going with." I understand. Got the message.

Anyway, when? Who knows? Where? It's not going to be at Brown & Toland, because they've already had the beta test. How? We don't know because the technology hasn't caught up with the information and the needs that we have. People are familiar with Moore's law (popularized by the founder of Intel

Corporation)—how the processing power of the chip is going to double every 18 months? The Internet moves in dog years. One paper-info year is equal to seven-Internet years. The answer is it depends basically on the doctors and the dollars, the Health Care Financing Administration, Blue Cross and Aetna, and all the stuff that goes into this incredible, massively intricate health care system that we have. But remember, that person or persons who figure it out will be worth $1.5 billion. And as Chuck Yeager, my favorite pilot, once said, “If you haven’t got an answer to the solution, hey, let’s go fly."

CHART 1
EFFECT OF CHANGING DIAGNOSTIC
THRESHOLDS ON PREVALENCE
OF HYPERCHOLESTEROLEMIA